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TOOLKIT GUIDE

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

* A resource CD that contains the workshop materials, presentation slides, trainer's guides, and technical content papers is located on the inside back cover.

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MODULE A: TOOLKIT GUIDE

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1 WELCOME

Welcome to the Green Recovery and Reconstruction Toolkit (GRRT). Through this toolkit and training program, participants will learn about the intersection of the environment and post-disaster recovery and reconstruction. Actively addressing environmental issues will help to protect people and communities in the long-term. We hope that the solutions, strategies, tools, and techniques presented in this toolkit will help you and others respond to the global challenges of sustainable recovery and reconstruction.

Two leading organizations in their fields, World Wildlife Fund (WWF) and the American Red Cross, developed the GRRT together during an innovative five year partnership (2005-2010). The partnership was created after the 2004 Indian Ocean tsunami for the purpose of incorporating environmental sustainability into recovery and reconstruction projects. They developed considerable skills, strategies, tools and trainings designed to enhance communities' resilience and reduce risk and vulnerability to future hazards. Particular areas of focus were water and sanitation, shelter, livelihoods and disaster risk reduction. Together, their work improved project outcomes in Sri Lanka, Indonesia, Thailand and the Maldives.

The GRRT was developed by over 30 international subject matter experts and humanitarian specialists from over 18 organizations. Through a collaborative development process, the GRRT was able to capture a cross-section of disaster scenarios, and diverse geographic and cultural contexts. Participating organizations include the International Federation of Red Cross and Red Crescent Societies, Oxfam, CARE, Save the Children, Mercy Corps, Tearfund, United Nations Environment Programme, ProAct, World Conservation Union (IUCN), World Vision, RedR UK, the U.S. Agency for International Development, the International Strategy for Disaster Reduction, ProAct, the Danish Refugee Council, the Asian Disaster Preparedness Center, Shelter Centre, and Environment Foundation Limited.

Although disasters (natural, man-made or conflict related) wreak havoc, the rebuilding effort that follows represents a significant and important opportunity to rebuild communities that are more environmentally and socially sustainable than before the disaster. Humanitarian professionals, conservation practitioners, local communities, government organizations, donor organizations, and private citizens can all take specific steps to ensure that reconstructed communities are built back safer by actively addressing environmental sustainability to reduce risk and vulnerability to future disasters. These activities include incorporating sustainable spatial planning; procuring and using sustainable building materials and practices; improving natural resource management to reestablish sustainable livelihoods; and adopting environmentally sound water and sanitation approaches.

2 WHAT IS THE GREEN RECOVERY AND RECONSTRUCTION TOOLKIT?

The Green Recovery and Reconstruction Toolkit (GRRT) is a series of 10 standalone modules that address a wide range of topics and sectors vital to disaster response. Each module consists of the following:

1. A content paper, presenting the key information about the topic
2. Trainer's guide for training planners and facilitators on a proposed workshop agenda, participant learning objectives, key points for presentations, interactive learning activities, and PowerPoint slides to support the workshop
3. All the materials necessary for a one-day workshop on the topic (except for Module 1, which is limited to a 60-minute overview session.)

Each topic presents a range of green recovery and reconstruction principles and practices. In addition, several modules combine to form a "suite" of workshops with a focus on a broader application. Most participants in a GRRT workshop would benefit from a combination of the introductory module, which presents the context of green recovery and reconstruction, and one or more sectoral modules, e.g., construction, water/sanitation, and livelihoods. A menu of workshop suites is described below. For senior managers, project managers, and others involved in project design in any sector, the workshop on Module 2 is recommended. This workshop provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector.

3 WHO IS THE GRRT FOR?

The core audience for the GRRT is individuals involved in the conception, design, implementation, monitoring, or evaluation of a humanitarian project. It applies as well to those involved in the various planning and implementation stages of temporary camps, permanent housing, water supply projects, livelihoods interventions, or any other activity designed to support communities recovering from disaster. Specific audiences may include project managers in the field or at headquarters, project designers, shelter and other construction professionals, monitoring and evaluation specialists, physical planners, logistics and procurement officers, donors, livelihood specialists, water and sanitation project designers and managers, and disaster risk reduction planners.

The staff of local and national government agencies, as well as environmental specialists involved in the design, review, and implementation of recovery and reconstruction projects, would also benefit from the training. The GRRT modules may also be used by consultants working for humanitarian agencies or specialist staff responsible for ensuring that the environmental aspects of humanitarian projects are addressed. It is for national as well as expatriate staff.

Target staff includes shelter specialists, water and sanitation specialists, field engineers, program and country directors, disaster management staff, livelihoods specialists, spatial planners, environmental managers, and procurement staff. The audience should also include national headquarters staff, since in disasters they are often in-country and/or designing projects when there are still no in-country staff. These staff have wider program portfolios that can incorporate GRRT learning across many projects and countries. National headquarters staff may also provide buy-in and proactive support for environmental concerns, especially at decision-making levels.

Other important stakeholders who may be interested include the local community, local and national government officials, and private-sector representatives (e.g., construction contractors, suppliers, and estimators). Staff from donors and multilateral agencies can also promote and apply GRRT principles to help grantees and fund recipients meet donor-mandated requirements for addressing sustainability issues in their projects.

In terms of the audience size for workshops, the modules have been designed with exercises and other interactive activities for groups of 15–25. As a consequence, if a training planner is expecting a smaller or larger group, then they will need to modify the exercises or the training plan accordingly.

4 WHAT DOES THE GRRT TRY TO ACHIEVE?

The goal of the GRRT is to equip humanitarian, environmental, and conservation field staff involved in post-disaster recovery and reconstruction with the practical information and strategies necessary to improve project outcomes for the affected population, build back communities that are more environmentally and socially sustainable, and reduce risk and vulnerability to future disasters.

The GRRT is available for use by organizations that want to train their own and partners' staff in the knowledge, skills, and, most important, attitudes of building back with a "green" approach.

5 HOW IS IT ORGANIZED?

The GRRT consists of 10 modules in addition to this Guide. The titles are listed in the following table as well as the modules' learning objectives and the intended audience.

TITLE	MODULE LEARNING OBJECTIVES By the end of the training, participants will be able to….	TARGET AUDIENCE
A. TOOLKIT GUIDE	This is not a training module but a brief summary guide of how the GRRT works and recommended training tools and methods.	All trainers
1. OPPORTUNITIES FOR GREEN RECOVERY AND RECONSTRUCTION: AN INTRODUCTION	1. Describe how addressing the environment in a humanitarian response a) is critical to saving lives and livelihoods, b) reduces risk and vulnerability, and c) contributes to successful recovery outcomes 2. Explain the purpose of the Green Recovery and Reconstruction Toolkit and its components. 3. Discuss key opportunities, misconceptions, and challenges for mainstreaming the environment into humanitarian action.	All participants
2. GREEN GUIDE TO PROJECT DESIGN, MONITORING, AND EVALUATION	1. Understand why it is important to incorporate environmental considerations into project design, monitoring, and evaluation in order to improve outcomes for people and communities recovering from disaster. 2. Integrate environmental indicators into the project strategy and the key steps of the project cycle's development and implementation. 3. Select and measure environmental indicators using the same criteria as other indicators (e.g., SMART indicators). 4. Demonstrate that integrating environmental monitoring into a project does not have to be difficult, costly, or time consuming.	M&E Specialists, Program and Country Directors, Delegates Across Sectors, Environmental Managers
3. GREEN GUIDE TO ENVIRONMENTAL IMPACT ASSESSMENT TOOLS AND TECHNIQUES	1. Describe the value and role of environmental impact assessment tools in post-disaster recovery and reconstruction project planning. 2. List the five elements of the Environmental Impact Assessment (EIA) process. 3. Use the ESR tool with a sample project to identify and assess the adverse environmental impacts and propose mitigation measures to prevent, reduce, and compensate for the impacts. 4. Describe several tools that are used for environmental assessments in post-disaster settings.	Delegates across sectors (Water and Sanitation, Livelihoods, Shelter, Disaster Risk Reduction), Field Engineers, Program and Country Directors, Environmental Managers
4. GREEN GUIDE TO STRATEGIC SITE PLANNING AND DEVELOPMENT	1. Understand the principles of environmentally sustainable site selection and development. 2. Conduct an assessment of post-disaster site selection, design, and adaptation to address environmental conditions in order to protect people and communities. 3. Identify strategic points of entry in the post-disaster recovery and reconstruction cycle to promote environmentally sustainable site selection and development.	Country Office Directors, Government Officials, Senior Program Managers, and Site Planners who make site planning decisions.
5. GREEN GUIDE TO MATERIALS AND THE SUPPLY CHAIN	1. Identify the typical environmental impacts of building material choices in order to minimize impacts to people and communities recovering from disaster. 2. Use environmentally aware approaches in the design of buildings and selection of materials for post-disaster housing reconstruction. 3. Identify the typical environmental impacts of material procurement options. 4. Describe strategies for procuring materials for post-disaster housing reconstruction that have the least negative impact on human welfare and the environment. 5. Explain the benefits and limits of environmentally conscious decision making in the selection and procurement of building materials after disasters.	Procurement Specialists, Shelter Delegates
6. GREEN GUIDE TO CONSTRUCTION	1. Describe the key principles of environmentally sustainable building design and architecture to protect people and communities recovering from disaster. 2. Describe the key principles of environmentally sustainable on-site construction management. 3. Demonstrate how to apply the key principles of sustainable building design and construction management to a community-based project.	Shelter Delegates, Field Engineers, Spatial Planners
7. GREEN GUIDE TO WATER AND SANITATION	1. Promote and implement water and sanitation systems that improve community well-being by enhancing environmental sustainability. 2. Explain to stakeholders why water supply project infrastructure should include watershed protection to ensure sustainability, and identify examples of ways to achieve sustainability. 3. Demonstrate how water and sanitation projects can be made more sustainable for communities through initial technology choice, project design, and community consultation.	Water and Sanitation Delegates, Field Engineers, Hygiene Specialists.
8. GREEN GUIDE TO LIVELIHOODS	1. Explain how livelihoods, disaster recovery, risk reduction, and ecosystems are linked. 2. Identify the recurring environmental impacts of typical livelihoods interventions. 3. Understand and address solutions for sector-specific livelihoods challenges, and be able to identify sources of expertise to improve livelihoods project outcomes.	Livelihoods Delegates, Environmental Managers

TITLE	MODULE LEARNING OBJECTIVES By the end of the training, participants will be able to….	TARGET AUDIENCE
9. GREEN GUIDE TO DISASTER RISK REDUCTION	1. Describe the ways in which disaster risk and environmental conditions are linked. 2. Integrate environmental issues into typical disaster risk reduction assessments. 3. Identify a set of ecosystem-based activities that can reduce risk and enhance disaster risk reduction programs. 4. Describe how disaster risk reduction activities can have negative impacts on the environment and how these impacts can be mitigated.	Disaster Risk Reduction Delegates, Environmental Managers
10. GREEN GUIDE TO ORGANIZATIONAL OPERATIONS	1. Describe the three core strategies of Green Organizational Operations and how they can be used to implement a plan for reaching greening goals and targets. 2. Assess opportunities for improving the environmental performance of the operational aspects of organizations and identify specific areas to address. 3. Describe three examples of "action items" for greening and discuss how they can be instituted within each of the core strategies. 4. Assign responsibility, motivate staff, and develop a green team to participate in greening efforts.	Facility managers, and other headquarters and field offices staff who have decided to apply the principles of sustainability to their own work environment

5.1 Choosing Applicable Modules for Your Participants

Each of the above modules is designed to support a one-day workshop, except *Module 1: Opportunities for Green Recovery and Reconstruction: An Introduction,* which can be presented in one 90- to 120-minute session. Users (training planners) of the GRRT are encouraged to combine modules, using two or more of them to provide a broader coverage of the topic of green recovery and reconstruction. For example, a training audience interested in exploring the full range of issues surrounding the reconstruction of housing would benefit from the modules that address site selection, construction techniques, and building materials and their procurement.

Another way of determining which modules to combine for a GRRT workshop is to send participants a pretraining survey to inform the training planners of the audience's level of knowledge and skills regarding green recovery and reconstruction. A model Pre-workshop Survey is provided as Annex A. This model survey may need to be modified to be appropriate to the recipients when it is apparent that some questions do not apply to the audience, or if there are information requirements that the survey does not cover.

A well designed-survey will not only enable training planners to assess the training needs of the target audience, but also will provide guidelines on how the workshop should be tailored to meet the specific needs of the audience.

Section 7 below includes suggestions for multimodule workshops.

6 WHEN SHOULD THE GRRT BE USED?

The time frame for the target audience to apply the principles of the GRRT is immediately following the disaster, when recovery and reconstruction strategies are first being formed, and then throughout the recovery and reconstruction phase, which may last from six months to several years after a disaster strikes. Training on the GRRT should ideally occur before a disaster happens so that you can equip responders with the knowledge and strategies necessary to begin immediate implementation. However, the concepts can be applied after immediate, life-saving relief activities have taken place and alongside the recovery and reconstruction planning. While it is best to address environmental issues during the recovery planning phase early on after a disaster, it is never too late to take some action to improve outcomes for people and communities.

7 SUGGESTED TRAINING SERIES

Modules 2–10 are designed to support a standalone one-day workshop on its topic. However, if the audience is relatively uninformed about the basics of green recovery and reconstruction, they would also benefit from starting with an introductory session of *Module 1: Opportunities for Green Recovery and Reconstruction: An Introduction*. The following outlines a range of suggested combinations of modules to provide a more comprehensive training on related topics. The trainer's guides for these modules suggest how some workshop sessions might be modified or combined to create a multimodule workshop.

7.1 The Basics: Modules 1, 2

Module 1: *Opportunities for Green Recovery and Reconstruction: An Introduction*
Module 2: *Project Design, Monitoring, and Evaluation*

These are the introductory modules. They are intended to be taken by individuals who have not previously been engaged with the concept or practice of integrating environmental sustainability to their disaster/conflict response programming. Module 1 provides the theoretical underpinnings and practical examples for this approach. Module 2 describes why it is important to incorporate environmental considerations into project design, monitoring, and evaluation in order to improve outcomes for people and communities recovering from disaster. It demonstrates how to integrate environmental indicators into the project strategy and every step of the project cycle's development and implementation.

7.2 Environmental Impact Assessment Tools and Techniques: Modules 1, 2, 3

Module 1: *Opportunities for Green Recovery and Reconstruction: An Introduction*
Module 2: *Project Design, Monitoring, and Evaluation*
Module 3: *Environmental Impact Assessment Tools and Techniques*

The discussion above regarding combining Modules 1 and 2 applies here as well, but is enhanced through the additional information about how to better inform project design through incorporation of environmental assessments from the earliest stages of the project cycle. Post disaster/conflict assessments are always necessary, but these assessments need to include environmental observations and information gleaned from environmental impact assessments so that the project design can include appropriate environmental actions.

7.3 Essentials for Construction: Modules 1, 2, 4, 5, 6

Module 1: *Opportunities for Green Recovery and Reconstruction: An Introduction*
Module 2: *Project Design, Monitoring, and Evaluation*
Module 4: *Strategic Site Planning and Development*
Module 5: *Materials and the Supply Chain*
Module 6: *Construction*

The natural and human-built environments often sustain heavy damage from disasters and conflict, and they may also sustain damage from some humanitarian action during the recovery and reconstruction. After the introduction to GRRT, this set of modules begins with Module 4, with guidelines on environmentally sound site selection and planning of buildings and infrastructure. The principle is that even well-designed structures, if built in the wrong location, can contribute to future risk. Closely linked to this is Module 5, with its discussion of the principles of selecting building materials from environmentally sustainable sources and employing procurement practices that reinforce these principles and minimize energy usage. Module 6 examines the principles of construction, especially in terms of environmentally sustainable architectural design and construction techniques.

7.4 Essentials for Water and Sanitation: Modules 1, 2, 7, 5

Module 1: *Opportunities for Green Recovery and Reconstruction: An Introduction*
Module 7: *Water and Sanitation*
Module 5: *Materials and the Supply Chain*

Module 7 focuses on the related priorities managing water sources, wastewater, and solid waste in sustainable ways. During post-disaster/conflict recovery and reconstruction, we have an opportunity to minimize negative environmental impact on the watershed and install water systems that provide high-quality water utilizing sustainable sources. Similarly, sanitation systems can be installed that safeguard against pollution and even promote practices that convert waste into a resource. The addition of Module 5 to Module 7 would allow for further exploration of the interrelationship between acquisition of building materials and their impacts on watershed management, and would allow more discussion of environmentally sustainable building materials for water and sanitation projects.

7.5 Essentials for Sustainable Livelihoods: Modules 1, 2, 8, 5

Module 1: *Opportunities for Green Recovery and Reconstruction: An Introduction*
Module 2: *Project Design, Monitoring, and Evaluation*
Module 8: *Livelihoods*
Module 5: *Materials and the Supply Chain*

The support to livelihoods after disasters and conflict, whether by creating new jobs or restarting previously existing jobs, is key to disaster recovery and reconstruction. Linking a workshop on Module 8 with Module 5 allows for the opportunity to promote environmentally sustainable jobs that are based in the potentially booming sectors related to construction. The study of these modules together requires thinking about balancing the competing demands of job creation while protecting the environmental resources upon which many of the jobs depend.

7.6 Essentials for Sustainable Disaster Risk Reduction: Modules 1, 2, 9, 4

Module 1: *Opportunities for Green Recovery and Reconstruction: An Introduction*
Module 2: *Project Design, Monitoring, and Evaluation*
Module 9: *Disaster Risk Reduction*
Module 4: *Strategic Site Planning and Development*

Active environmental management and protection can reduce disaster risk and compliment more conventional DRR strategies. Module 4 can be considered as a subset of DRR, that is, good site selection, planning, and development will result in minimized environmental impact. Many of the principles of DRR correspond with and reinforce strategic site planning and development. Putting these workshops together creates an opportunity for participants to explore this synergy.

8 GRRT WORKSHOP PLANNING CHECKLIST

It is necessary to ensure that arrangements are in place several days before the workshop begins for all of the following items.

DONE	NO. REQ.	ITEM
❑	1	**Data projector** for showing PowerPoints. Ensure that the projector includes cable for connection to computer and that it is operating properly. Conduct a test setup with the computer to be used during the workshop at least **the day before the workshop begins**. Ensure that the projector light is bright enough for slides to be seen clearly.
❑	1	**Projection screen**, as large as possible so that the image can be large enough for people to read PowerPoint slides from the back of the room.
❑	1	**Office equipment**: computer, laser printer and copier, uninterrupted power supply
❑	1	Arrange for **secretarial and administrative support** throughout the workshop
❑	2	**Extension cords**, one for the data projector and another for the office equipment
❑	1	**Carton of paper**
❑	1	Set of **office supplies**: stapler, scissors, masking tape, hole punch
❑	4	**Flip-chart stands**
❑	4	**Flip-chart paper** tablets, minimum 50 sheets each
❑	4	Boxes of **markers** for flip-chart paper
❑	1 ea	**Ball point** pens (one for each participant)
❑	1 ea	**Writing tablet** (one for each participant)
❑	1 ea	**Name tags** (include enough for all facilitators)
❑	1 ea	**Table name cards** (heavy-stock paper)
❑	1 ea + 5	**Participant workbook binders** (if ring binders are used)
❑	1 ea + 5	Printed copies of **Participant Workbook** = the number of participants and facilitators plus about five extra
❑	1 ea + 5	**Certificate blanks** (with extras copies in case of mistakes)

8.1 Arrangements with Conference Facility

The following criteria for the workshop venue must be met:

1. The conference room should be large enough to accommodate participants, facilitators, and resource materials, at least 2 m^2 per person. The room should have adequate electrical outlets and minimal noise intrusions from highway traffic, kitchen, or other noise in the facility, such as a generator or construction. The air-conditioning unit should be adequate and not noisy.
2. The facility must have enough appropriately sized tables to meet workshop needs and is able to arrange them in a café-style layout. Appropriate size means that four to six people can sit **comfortably** around a rectangular or round table in such a way that nobody has his or her back to the front of the room. For rectangular tables this often requires the combination of two medium-sized or three small tables.
3. The conference room must be able to be darkened enough for the showing of PowerPoint slides but should have adequate lighting for comfortable note taking and discussions.
4. The conference facility should provide a room where the secretariat can be set up, near the conference room. Leaders must be able to secure/lock that room. (Sometimes the main room is large enough to accommodate the secretariat, but the activities may be a source of distractions.)
5. The coffee/tea break arrangements should be satisfactory in terms of food and beverages served in a pleasant location convenient to the conference room. Water needs to be provided for participants throughout the day.
6. The lunch should be served quickly and on time, generally requiring a buffet arrangement. All food selections should be culturally appropriate.
7. Sleeping accommodations for participants and facilitators should be satisfactory and comfortable.

8.2 Arrangements for Secretariat Support

Tasks for the one or two individuals who will staff the secretariat:

1. Make sure the secretariat room is equipped and working.
2. Make sure the conference room equipment is complete and working.
3. Be responsible for printing and copying workshop materials.
4. Ensure that there are adequate flip-chart paper, markers, and writing materials for participants.
5. Provide conference venue management and food caterers with workshop agenda.
6. Ensure that the workshop materials for participants are ready, complete, and handed out to the participants upon arrival.
7. Make arrangements for water in the conference room and coffee/tea breaks in the breakout room.

9 TRAINING TOOLS AND METHODS

9.1 Training Tips

Pretraining survey

The more training planners know about their prospective training audience the better they will be able to plan and prepare for their workshops. One technique for learning about the potential trainees is to undertake a training needs assessment by sending participants a brief survey two to four weeks before the planned workshop. The survey should seek to develop a profile of the audience, such as job descriptions and current skills and experience related to the workshop, as well as the participants' descriptions of what they want to get out of a workshop.

Annex A is a draft pre-workshop survey that training planners can consider adapting and sending to their training audience. The attendees list, therefore, needs to be made available to the trainer beforehand with enough time for the survey to be implemented.

Post-training survey

The real value in the GRRT training will be in the information that the participants learned and put into practice. How successful the training was and how useful it was in on-the-job applications is also information that training planners should know. Follow-up surveys or interviews will provide important feedback that may inform future training and help improve the GRRT content and training approach. The post-training survey can also include a training impact assessment that can be used to monitor specific changes in a participant's knowledge, skills, and perceptions.

9.2 Principles of Adult Learning

The following section (Sections 9.2.1 – 9.2.9) is excerpted from www.library.yale.edu/training/stod/onthejob/principles.html (as of May 22, 2010).

See copyright statement at the end of this article.

The following learning principles are important to keep in mind when you are planning and conducting training activities for adults. They are adopted from Xavier University Train the Trainer Workshop, delivered by Edward E. Jones, Ed.D.

Motivation Utilization Interest Stimulus Transfer
Logic Immediate Application Participation Repetition

9.2.1 Motivation

Learners must be motivated before they will learn.

Learning requires action on the part of your student. Often this action is internal and is initiated by the student. He/she freely chooses to act or not to act – to do something to acquire the knowledge, attitude, or skill you are teaching, or to do nothing. You cannot motivate your learners; they must motivate themselves.

"If I can't motivate my learners, then what can I do?" A motive is a desire in response to a need, which causes a person to act. A study by the American Productivity Center (1980) says, "Since motivation comes from within, a worker (student) is more motivated to perform well if he or she understands what is going on. The more I understand what is going on, why it is going on, how it affects me, and what's in it for me, the more I will tend to support...its goals."

How do I help my learners become motivated?

Show your learners what's in it for them. Don't assume that they feel that your class or subject is useful and valuable to them.

Show them the value or use of the subject. It's good to keep in mind that what's valuable for one person may not be valuable for another. It then becomes your job to show the whole class how every experience can be a beneficial learning experience.

Use the learning itself as a motivator. When your learning sessions are rich and rewarding, when learners feel they have enlarged the limits of their minds, when they can see useful application for the things they've just learned, then they'll be motivated to continue to learn more. Motivation is internal but you have the responsibility of providing a positive learning climate.

Use praise liberally. Call it positive reinforcement, a pat on the back, encouragement, and support for a job well done. Praise your learners for the little things they do well. Don't wait for the "big success." The key here is to praise often but be natural and above all sincere! Don't make things up because you'll be discovered as a phony. Learners want praise, but they want genuine praise.

Make course objectives clear when setting expectations. Then challenge learners to achieve them. For some, having a goal to attain is the motivation to attain it. Make sure that class work is clearly relevant to the objectives. This will help maintain the motivating challenge of striving to attain the goal.

This is not a complete listing of motivators and motivating techniques. Such a list does not, and cannot, exist. Because each person is different, with unique qualities, experience, needs, and desires, each will be motivated differently. Some will be motivated entirely by knowing "what's in it for me?" Others need a complex array of motivators.

9.2.2 Utilization

The student must see a use for the material being learned.

Your instructor role is specifically geared toward helping people (the employees of your company or organization) do their jobs better. These employees/learners are looking for help with their jobs. Remember that adult learners are problem centered. If they cannot see how the subject matter will help them (be useful), they won't be inclined to try very hard to learn it.

Often you present material that is "background" or "foundation" material. Well and good, but do make certain they realize that the material is relevant and that you intend to build on it. Learners must see the connection between your "background" material and solid, usable job applications.

Show your learners how the material can be used.

First, paint the "big picture." They need to see how the material you're teaching is relevant to their job. Show how all the material has application to them. Let them know that it's not just interesting but useful.

Watch out for too many "war stories." These may be interesting to you and fun to tell but are they practical for the learners? Remember, these are adult learners and are problem-solution centered. Being entertained by too many stories may well turn them off. If the story brings perspective, then by all means use it. But don't use it just because it's your favorite.

Much of the material in your class will fall into two categories: "nice to know" and "need to know." Many times your learners won't be able to discriminate between the two. You will have to point out what's background and what's critical to their performance.

The "How can I use this back on the job?" and "What will you teach that will help me with my problem?" questions are going to be on the minds of your learners throughout the class. The answers should be on your mind and a part of your presentation.

9.2.3 Stimulus

Learning is stimulated through the five senses.

Your mind, like your muscles, becomes active when the bodily senses are stimulated. The learners who come to your classes are no different. Their sensory equipment must be activated before their minds will realize and accept the facts, concepts, and skills you wish them to learn.

There are few stimuli that will activate all five senses simultaneously. Since you'll have to select among these senses, it will be useful for you to know that some are much more vital to the learning process than others. Here's a breakdown of how we learn what we know today:

- 75% through the sense of sight
- 13% through the sense of hearing
- 6% through the sense of touch
- 3% through the sense of smell
- 3% through the sense of taste

Clearly, visual stimuli should have a large part in the learning process. But you must also realize that the more senses a student uses while learning, the faster and more efficiently he or she will learn.

When an instructor uses words alone, learners retain only a portion of the facts. They will retain 3-1/4 times more information if the instructor uses pictures alone. But they retain 6-1/2 times more if the instructor uses both words and pictures.

To stimulate learning through the senses:

- Use visual stimuli whenever possible to get your point across. Learners remember more of what they see.
- Appeal to several senses simultaneously for the most efficient learning.
- Use strong stimuli for greater response: vivid pictures, loud noises, and bright colors.
- Vary the stimuli. Repetition of even a strong stimulus becomes monotonous and may weaken the desired response.

A stimulating presentation requires more preparation, but if a subject is worth remembering, it's worth presenting so it will be remembered.

9.2.4 Interest

The student must be interested in the learning.

You can't assume your students are interested in learning just because they're in the class. We do know students will be thinking about something that interests them. Your job is to generate interest in the course materials.

The difference between interest and motivation is subtle, for the two often work in a cause-and-effect relationship. If interest is high, there will be little need for you to motivate a class. If motivation is applied throughout training, the interest problem is solved. We treat them here as separate to emphasize the necessity for including both in your classes: hold the learners' attention and make them want to learn.

How can you keep learners interested?

First, you, as the instructor, must be interested. Learners quickly turn off to an instructor who appears to be disinterested in the subject, is listless, or seems tired or bored. Build interest throughout the session. The interest that learners bring to class can quickly be lost. Arouse curiosity and increase enthusiasm as new material is introduced. Vary your methods.

Hold interest once you've gotten it. Some tools you can use are visual aids, student participation, and humor. Perhaps a change of pace in the presentation or in the physical surroundings will be necessary.

You must also be interested in the learners. They'll respond to genuine interest and enthusiasm that involves them personally.

Get your students' interest aroused early in your session. You may want to consider some variety in your class opening. Instead of handling all the administrative material and then student introductions, start with an exercise that will have them interacting right from the start (team questions for you about the course, or "why I'm here and what I want to get out of this class" are a couple of examples). This approach gets them involved quickly, covers the introduction dilemma, and starts your class with student interest high.

If your trainees aren't interested, check yourself, not them. After all, they're your trainees, in your class, learning your subject, and it's your job to keep them interested. Remember the materials and training approaches, which keep adults interested and problem centered. And remember that involvement creates interest.

9.2.5 Transfer

Learners learn easily when they can make transfers.

Learners always arrive in your class with some prior knowledge. They may already understand the basics of the subject; they may possess considerable misinformation; they may know nothing about the subject. They will have some knowledge or understanding about something, and it is your job to use that knowledge to enhance the learning process. We call this the principle of transfer.

Building on what a class knows, working from the known to the unknown, is termed “positive transfer.” When prior knowledge interferes with the new learning, “negative transfer” is taking place. Negative transfer can be avoided by emphasizing new learning as something to build upon. People resist changing ideas that they have long accepted. Instructing them in new ideas will be easier if they are not confronted with the necessity of unlearning the old ways.

Relating new ideas to known facts can affect a positive transfer. Some of the mystery is removed when a student can relate new information to something that is familiar to the student. This allows him or her to grasp the new concept by having a mental picture to which the new facts can be tied.

To use the principle of transfer:

- Always proceed from the known to the unknown.
- Relate new ideas to familiar facts by analogies and comparisons.
- Emphasize new ideas, concepts, or methods as better, not different from, the old ways.

9.2.6 Logic

The learner must see the logic of the material.

Our thought processes may begin with our sensory equipment, but we do have such a thing as “think power,” which is rooted in the mind and which utilizes logical reasoning processes. All information entering the mind is screened by an analytical procedure that rejects, or at least questions, ideas that don’t make sense. Use the principle of logic to prepare your lesson so it will be logical to this reasoning mechanism of the mind.

The principle of logic involves two things:

Each point must make sense by itself. The ideas or concepts you present must appear inherently logical. To help accomplish this, try these methods:

1. Give the “why” behind your point. People want to know the reason behind a procedure, method, or principle. They want to know what caused it and/or what effects will result.
2. Lead up to the point by presenting several facts from varying situations that all point to the desired conclusion. Your learners may draw the conclusions themselves, in which case their learning is improved.

State your point, and then ask the learners to apply it to specific instances. This reasoning will help them see what makes a general point true. The points must come in a logical sequence. Put your ideas in an order that establishes the clear relationship between points and that will be understood by the student.

Here are some logical sequences that can be employed:

- Whole-to-part: Give the big picture first, then the specific parts.
- Magnitude: Large to small, or vice versa.
- Importance: Start with the most important item, and work to the least.
- Geographical: Take things in the order of their physical relationship, whether they are store locations or equipment in restaurants.
- Difficulty: From the easier or known to the more difficult or unknown.
- Performance: Present a procedure in the order it is performed.

9.2.7 Immediate Application

Immediate application improves the learning

This principle directs you to try out the skills or verbalize the facts just acquired. In effect, tell your learners, “You’ve just leaned it; now do it here in the classroom.” As they begin actually applying what they’ve just heard or seen, they will do the following:

- Establish more relationships between the parts of the course
- Perfect or test their understanding of the subject
- Get involved
- Develop still stronger motives for learning

The methods and techniques used for class participation can be used to apply the principle of application. The point here is this: have learners do and verbalize as soon as possible after their exposure to new facts.

An effective way to use this principle is to have your learners give (write-present-discuss) an application of the concepts to their own situations “back home.” This could be done individually or in teams. The key is to “do it now.” Thus, the principle of immediate application is activated.

9.2.8 Participation

Learners learn better when they are actively involved in the training.

If a student doesn’t participate in the class, that is, doesn’t say anything or get involved other than sitting there, what does that tell you?

Such behavior can indicate how much the person is getting from the class. Sometimes these individuals do learn, but usually it is an indication of less learning. A good rule to follow is the more participation, the more learning. Without active participation, your learners won’t be doing the thinking and applying – two essential elements that lead to increased learning. This is particularly true with adult learners who, for the most part, aren’t used to long periods of uninterrupted sitting.

As an instructor you must plan participative activities for everyone in the class. Give them things to do. This gives them a chance to ask questions and comment on the materials being taught. They feel they are a part of the learning situation and not just passive receivers. A word of caution is also in order. Participation just for participation’s sake is a waste of time for you and the learners. To have them “break into small groups” just because you like small groups isn’t going to be effective. Make sure you have a planned purpose to your activity.

Active participation includes:

- Oral: Asking questions of the whole class, assigning some learners to explain various sub-points or having them conduct a demonstration. Encourage voluntary contributions, challenges, or questions.
- Written: Working on group problems or exercises, individual tasks, pop quizzes, flip-chart summaries, or case solutions.
- Group work: Group discussions, small-team exercises, role-plays, case studies, projects for later presentation.
- Physical assembly of components: machines, instruments, or layouts; performing or demonstrating an activity.

This principle operates for the benefit not only of the student but of the instructor as well. With properly planned participation, you are now free to work with individual learners, observe student groups, and prepare yourself for the next session. Learners don't want to see and hear only you all day. You will quickly tire if you have to be the focus of attention all day.

Remember the principle of stimulus – involving many of the senses. Participation is an effective way to get more of the senses involved and increase the learning. When we discussed stimulus, we said that words alone are not very effective. We remember more of what we do and say than of what somebody else does or says – because we're involved. Don't use involvement for its own sake, but to increase learning. So get 'em involved!

9.2.9 Repetition

Repetition, repetition, repetition assists learning.

The world of advertising recognizes the effect of a repeated message. Stop and think how many times you've seen the same ad on TV or in print. They want to imprint the product on your mind and constant repetition does just that. Let's see how this works in training.

Notice that each time you have a "refresher" session, the Desirable Learning Curve holds constant (because your desired student progress hasn't changed) but the Forgetting curve shows less and less falloff. In other words, your learners are remembering more and getting closer to your desired learning level.

In his many cassette tape programs, Earl Nightingale tells his listeners, "a message read or heard several times a day for eight days is virtually memorized; at the end of 30 days the memory retains 90% of the message."

No, you should not repeat your message like a tape recorder in your classes, but you should be aware of how the mind works in retaining material and the importance of repetition in your learning situation.

9.3 Review of Training Methods and Techniques[1]

In this section we briefly discuss several training methods and the advantages and disadvantages associated with each of them.

	BRAINSTORMING	CASE STUDIES
DESCRIPTION OF METHOD	Creative thinking is more important than practical thinking. Participants spontaneously offer ideas on the given theme.	Case studies involve discussion of details about actual or hypothetical situations that participants could face in their work. The event or case is analyzed and discussed, and a plan of action is developed to address the given situation.
PROCEDURES/ HOW TO USE	Participants spontaneously offer ideas on the given theme. During the idea-generating stage, no idea is rejected or criticized, all ideas are written down, and all participants are given a turn to share their ideas. Participant ideas should be quick and brief. Participants should be encouraged to feel at ease suggesting any ideas – even the most absurd (wild) ideas should be welcomed. When all ideas have been mentioned, the group should discuss the ideas generated, asking for clarification, combination, or refinement of ideas. The most valuable ideas should be chosen and developed.	Either the trainer or the participants prepare a case study in advance of the session. The trainer should provide a structure for the case studies to follow. For example, case studies could consist of a description of the problem, an analysis of the problem, the actions that were taken, results, and lessons learned. The value of case studies must correspond to the time spent developing and analyzing them. Examples should not be too long, complicated, or detailed.
WHEN TO USE	The aim of this method is to generate as many ideas as possible and to stimulate creative thinking. It is a good technique to use for problem-solving sessions, when you want to reframe an issue, or when you want to generate new ideas (e.g., identification of project ideas).	Very good method for applying theory to a real case. Case studies allow participants to suggest alternative solutions and promote the development of problem-solving skills. For example, following a discussion of coordination of an international response to a large-scale disaster, it may be useful to analyze a case study for a specific example.
ADVANTAGES	• Freedom of expression is encouraged. • This is a fast way to gather many opinions. • New and innovative solutions are often suggested.	Case studies promote the development of problem-solving skills and allow participants to learn from each other's experiences and suggest alternative solutions.
DISADVAN-TAGES	Requires a skilled trainer to encourage full participation and to suspend criticism and judgment of ideas.	• Case studies must be developed ahead of time. • May take much time to prepare and complete. • Participants may lack the knowledge or experience to analyze adequately the case study.

1 Source: *REA Training of Trainers, Trainer's Reference Reader*. 2006. Rapid Environmental Impact Assessment for Disasters Workshop Materials. Designed and developed by InterWorks LLC for CARE International. Funded by United States Agency for International Development (USAID). Version: 4.4.1. *Revised* January 2006

	SIMULATION/ROLE PLAYING	GROUP DISCUSSIONS
DESCRIPTION OF METHOD	Modeling, simulations, and role-plays involve participants in situations that mirror or simulate reality. The purpose is to get participants to think, feel, and act in these simulated situations and then to reflect on their experience. Simulations recreate the environment that participants are likely to encounter in a real situation.	In group discussions, the trainer serves as a facilitator, enabling all members of the group to participate and ensuring that a vocal minority does not dominate the discussion.
PROCEDURES/ HOW TO USE	To conduct a simulation or role-play, at a minimum the trainer needs to develop the scenario for the role-play and several roles that participants will take on. The trainer must also consider what the objectives of the role-play are and make sure that the role-play/simulation illustrates relevant points.	Additional guidelines are offered in Part II, in the section "Facilitation of group discussions."
WHEN TO USE	This method serves as a type of "experimental laboratory" where participants are allowed to try out different roles, make mistakes, and learn from the whole experience. One example of a simulation is a situation that requires participants to plan, prepare for, and respond to a large refugee influx, chemical spill, or earthquake.	Use when you want: • Trainees to share their opinions and experience • Conflicting viewpoints to emerge and be debated • To encourage examples and anecdotes from trainees' experience • To raise issues that you will address in a case study or presentation
ADVANTAGES	Practical exercises that stimulate adult learning	• Shows respect for trainees' opinions and experience • Involves trainees in the teaching and learning process • Relies on the real opinions and experience of trainees • Helps highlight many important, complex, and interrelated issues
DISADVAN-TAGES	Often costly and time consuming to develop	• Requires someone with good facilitation skills • Good discussions require trust among participants • Some trainees may want the trainer to provide the "correct" or final viewpoint • New, tangential issues may arise that may require additional time to discuss

	DEMONSTRATION	PRESENTATIONS/LECTURES
DESCRIPTION OF METHOD	A demonstration is a way of showing how to perform an action, or how to follow a certain procedure.	Presentations or lectures may be used to present factual material in logical form, to describe one point of view on a debatable issue, to entertain or inspire the audience, to stimulate thinking and further study of a problem, or to initiate a general discussion. Some participants prefer to learn by listening rather than by having to read the same information.
PROCEDURES/ HOW TO USE	The trainer models the behavior or the action that he or she wants participants to copy. Trainer demonstrations should be followed by practical hands-on exercises that give participants an opportunity to practice what they have just observed.	Presentations should be brief, not longer than 20 minutes (lectures should be limited to an hour or less), should be thoroughly prepared in advance, and should be followed by some other training method. Try to involve participants by asking questions, and use visual materials to supplement your presentation.
WHEN TO USE	Use when your objective is to get participants to use and learn new technical skills. For example, how to create compost bins for use in household solid waste management.	Use with large groups, when participation is not required, and to summarize main points. Presentations are also useful for presenting new concepts, themes, or theories.
ADVANTAGES	• Participants have a chance to practice. • Trainers can see whether participants have mastered the skill.	• A lot of information can be presented quickly. • Useful for large groups. • Participants pose questions that may be of interest to the whole group. • Often preferred when the lecturer is a highly respected expert who is also engaging. • Participants who like traditional methods will like this.
DISADVAN-TAGES	Demonstrations are constrained by the amount of time and money that may be required to conduct them. If the materials used in a demonstration are small, some participants will have difficulty seeing what is being done.	• Relies on the speaker's experience • Participants are passive recipients of knowledge • Tiring after about 15 minutes • Easily forgotten • No feedback from audience

	PRACTICAL EXERCISES/GROUP WORK	INDEPENDENT READING
DESCRIPTION OF METHOD	Practical exercises involve participants in thinking about and/or using a technique or method.	Participants are asked to read some material independently and be able to discuss it later.
PROCEDURES/ HOW TO USE	Practical exercises are usually preceded with a presentation by the trainer that provides the necessary concepts, principles, questions, or formula for resolving the problem posed in the subsequent practical exercise. Participants then work on a problem or exercise in groups. Groups discuss the problem and come to a solution or make a recommendation, and then report their decision to the whole meeting. Reports are presented by a member of the group, with the use of flip-chart illustration, lists, or other visual aids. For example, an instructor may present the principles of storing relief supplies in a warehouse and then give participants a written practical exercise in which they have to calculate the use of warehouse space.	
WHEN TO USE	Participants learn best by actually practicing what they are learning.	This technique may be used at the beginning, at the end, and during the lesson. In many cases independent reading will save time.
ADVANTAGES	• Everyone participates. • Encourages discussions, exchange of experience and ideas. • Shy participants are more relaxed in small groups. • Incorporates the use of specific information and recommendations.	• Participants can proceed at their own pace. • Allows participants to delve into topics more deeply.
DISADVAN-TAGES	• Takes time and may require more space where separate rooms are required. • May turn out to be nonproductive, if instructions or set-up are confusing or incomplete or if not enough time is allotted for the groups to work. • Small-group work can be an overused method. • Requires effective group leadership. • Do not overload the amount of work the small groups need to produce. Allow enough time for group work or you will frustrate the participants.	• Can be time consuming. • Difficult to rely on this method because some participants will not do the reading.

	SKITS	ROUNDTABLE (PANEL) DISCUSSIONS
DESCRIPTION OF METHOD	Skits are short, rehearsed performances involving one or more participants.	Roundtable discussions offer listeners information on different sides of a problem and give them the opportunity to weigh all sides of an issue.
PROCEDURES/ HOW TO USE	Using prepared scenarios, participants perform a situation or event, dramatizing a real situation at work.	To organize a roundtable (also referred to as a panel discussion), the trainer invites a group of experts to discuss and debate an issue. Roundtable discussions require an effective discussion leader who maintains order, gives every expert equal time to express himself or herself, and organizes the discussion so that the theme is adequately covered. Discussions should be followed by an opportunity for participants to ask questions about what has been said.
WHEN TO USE	Skits may be used to present a new theme for discussion, highlight certain problems, or sensitize participants to the culture or lifestyle of a group or society.	When you want to allow multiple experts to speak in a semi-structured session.
ADVANTAGES	Skits allow participants to become personally and emotionally involved in the topic or problem. They also stimulate participants' interest and their involvement in the discussion.	• Allows multiple viewpoints to be expressed. • Good method for incorporating experts into a workshop.
DISADVAN-TAGES	While skits can include humor, it should not overshadow or blur the intended message.	The use of roundtables is limited when not all sides of an issue are discussed, as in the case when all roundtable experts share similar points of view. Also, roundtables depend on having a good, effective roundtable leader to make sure that all the experts have equal time to share their ideas.

	VIDEO FEEDBACK	VIDEO PLAYBACK
DESCRIPTION OF METHOD	Participants are videotaped while performing a specified activity.	A good collection of video materials may enliven the workshop, and is useful for stimulating discussion.
PROCEDURES/ HOW TO USE	The trainer must clearly define the purpose and objectives of the videotaping exercise. After participants are taped, the video is played back so each participant can review his or her own performance. The trainer offers helpful suggestions to each participant.	It is frequently useful to show short video segments and discuss their relevance to the topic being considered.
WHEN TO USE	Useful when participants are practicing a specific skill, as it allows them to see their own performance. For example, trainees in a training-of-trainers workshop can be videotaped making presentations.	Videos show real-life situations about which you are talking. They are also a good method for demonstrating a procedural or step-by-step skill.
ADVANTAGES	Participants can view and critique their own performances.	• Can show real situation. • Provides variety for participants.
DISADVAN-TAGES	Can be time consuming Need the proper equipment to conduct such an exercise.	Can be expensive to purchase or produce. May be difficult for all participants to see or hear the video without the proper equipment.

	IDEA CARDS
DESCRIPTION OF METHOD	Sometimes it is useful to record thoughts, lists, and ideas on small cards rather than on the static whiteboard or flip-chart paper.
PROCEDURES/ HOW TO USE	Distribute large cards (minimum size should be approximately 1/2 of an A4 sheet of paper) to participants. Ask them to write one idea/comment/procedure/etc. per card (depending on the topic you are discussing). Collect the cards from the participants. Organize and summarize them based on the group's discussion.
WHEN TO USE	Use when you want input from the entire group. For example, if the topic you are discussing is assessment information sources, you could ask participants to write down one source of information per card, and then discuss the list generated by the whole group.
ADVANTAGES	• Useful for soliciting ideas from everyone • Useful when you need to capture a lot of input from the group in a short amount of time. • Notes made on separate cards are easily classified, organized, and moved.
DISADVANTAGES	May be difficult for participants to read the cards during the debriefing session.

9.4 Facilitation Skills and Techniques

9.4.1 Responsibilities of the Discussion Facilitator

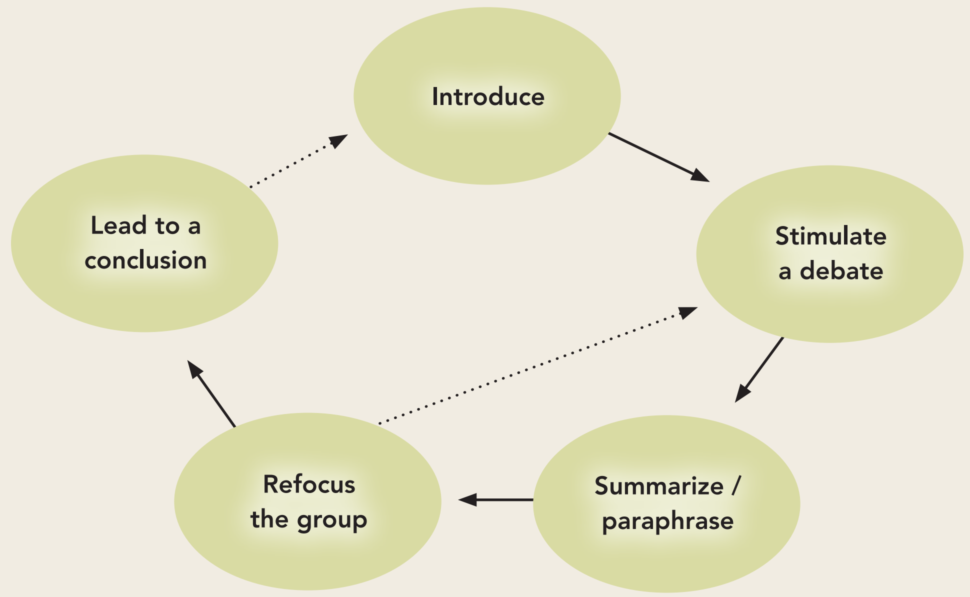
When leading a discussion, the workshop trainer has many responsibilities, including the following:

- Encouraging active, meaningful, and full participation
- Stimulating discussion
- Managing the discussion time and keeping the workshop on track
- Managing conflicts that may arise
- Allowing minority views to be expressed
- Summarizing and synthesizing main points, views, and conclusions
- Inviting quieter or shy participants to give their opinion or ideas

During participatory workshops, both structured and impromptu discussions will occur between participants, and between participants and the trainer. Thus, the trainer needs to be adept at managing and leading group discussions.

9.4.2 The Discussion Cycle

Trainers should know where they want to lead a discussion and what kind of discussion is to take place. It is helpful to envision beforehand how the discussion should proceed. Trainers should imagine the types of questions or concerns that will arise during the discussion and prepare a response to deal with those issues. A useful approach to organizing discussions is to follow the steps outlined in the "discussion cycle" illustration below.



The steps in the discussion cycle are:

Introduce: Introduce the topic and explain the purpose and procedures for this session.

Stimulate debate/discussion: The trainer will need to find a way to stimulate the group's interest and participation if he or she is to engage them in the discussion. There are various ways to do this.

1. Make a brief presentation that raises issues of concern to participants and sets the stage for the discussion questions that follow.
2. Ask the group to read a short excerpt from an article.
3. Distribute discussion papers or reports ahead of time.
4. Show a short thought-provoking video.
5. Ask the group to complete a quick exercise, questionnaire, or short problem.
6. Make a provocative statement or ask a provocative question.
7. Stage a brief role-play or skit.

After using any of these techniques, the trainer should have several follow-up discussion questions ready. "What did you think about … ?" "How do you feel about what you saw?" "What is your view about what you've read?"

Summarize key perspectives and main points: Discussions will be freewheeling and perspectives will be numerous, and participants may or may not express themselves clearly or succinctly. It is the responsibility of the discussion facilitator to summarize the key perspectives as well as the main points that have surfaced during the discussion.

Refocus the discussion: If the discussion wanders off course or if there is another level of analysis that is required, the facilitator will need to **refocus** the discussion by asking the group another question.

Lead to a conclusion: Trainers need to lead the discussions to a sense of closure. The trainer can do this by offering some final concluding remarks that capture the spirit and key points of the discussion or that offer some next steps.

While the discussion cycle tells us how to structure a discussion or sequence a group activity, it does not, by itself, guarantee success. Trainers must also use techniques that facilitate lively dialogue and communication. These techniques include:

1. Asking good questions
2. Handling participant questions
3. Listening actively

Each of these three techniques is now considered more fully.

9.4.3 Asking Good Questions

Not all questions will generate the response you want. Asking good questions is an important skill trainers must master. Trainers who ask good questions keep the discussion interesting, highlight critical issues, and keep participants engaged. Here are some guidelines for asking good questions.

1. Initially pose general questions to the whole group.
2. Make follow-up questions precise and direct.
3. Ask answerable questions (questions that seek information that is within the participants' knowledge or experience).
4. Formulate clear questions. If your question is not initially understood, reformulate it, or break it down into sub-questions.
5. Prepare your questions in advance and envision the responses you hope to receive. This will help you reformulate the question if the initial response takes the discussion on an unintended tangent.
6. Ask one question at a time. Allow enough time for participants to answer. If there is silence, count to five before asking your next question.
7. Avoid leading questions such as, "Don't you think that … ?"
8. Formulate reflective or hypothetical questions. "What would happen if… ?"
9. Use open-ended questions. Open-ended questions cannot be answered with a simple "yes" or "no." They require a more complex answer or opinion. Generally, questions that begin with "What," "How," or "Why" will generate more complete responses.

Even when trainers ask good questions, they do not always get in-depth, informative answers. Trainers must follow up with participants to go beyond superficial answers that are sometimes offered. For example, in a discussion about ensuring local participation in projects, trainers might ask the following questions:, "How specifically would you involve the local population?" "What specific activities would they be involved in?" "Who would you involve?" "Can you give me a specific example of what you have tried in the past?" These types of questions will invoke more thoughtful responses that will benefit other participants in the course.

9.4.4 Handling Participant Questions

Not only will the trainer be asking questions, but often he or she will have to respond to questions posed by participants. Here are some guidelines for handling participant questions:

1. Anticipate the types of questions participants might ask and prepare your response or strategy for handling them.
2. Redirect the question to someone else: the questioner, other participants, or other trainers.
3. If the question is critical, insulting, or confrontational, stay calm. Some ways to stay calm include counting to six and taking a deep breath before responding. You can also defuse a tense situation by taking a break, or by breaking a larger group into smaller groups and asking each group to identify four or five main problems or issues under contention and what they would

recommend to solve them. You might also ask if anyone can share a different perspective or opinion on the matter. Sometimes just thanking a person for his or her contribution, or suggesting that you can speak with him or her during the break, are good strategies for dealing with this challenging behavior.

4. Summarize or reformulate the question before answering.
5. Take several questions at a time.
6. Stimulate a general discussion if the question seems of general interest to other participants.
7. Admit it when you don't know the answer and redirect the question to someone who does know.

9.4.5 Listening Actively

The trainer will need to be an active listener if he or she is to encourage participants to share their opinions and respond meaningfully to questions. A trainer who listens actively is telling his or her participants that he or she cares about what they are saying. Active listening helps the trainer accurately interpret the meaning and purpose of the participant's question or comment. Active listening techniques include:

1. Allowing the participant to complete his or her question or comment before responding
2. Asking questions to clarify your understanding
3. Paraphrasing
4. Summarizing and reformulating what has been said
5. Asking open-ended questions
6. Including participant's words or concepts in your response
7. Asking a participant to elaborate on his or her answer: "Ali, why don't you tell us more about that."

9.5 Preparing, Organizing, and Planning Participatory Workshops

9.5.1 Understanding How Adults Learn

When conducting a training event, it is important to recognize that adult learners bring expertise, experience, and insights that, when tapped, can enhance the quality of a training session. Participants will learn from each other, not just from the official "trainer." Adults must be interested and engaged in a topic in order to learn the material. If they do not feel there is a reason to learn a particular skill or subject, it will be very difficult to engage them. One way to engage adults is to make workshops participatory.

Participants learn best when they are actively involved in the learning process. The old adage, "learn by doing," applies here. By actively involving adults in their own learning—drawing on their past experiences and allowing opportunities to learn by doing—trainers will facilitate the adult learning process.

In general, participants learn better and are more interested if the methods used are varied and if they are given opportunities to actively participate through practical exercises, small-group work, and group discussions. Participants should be challenged to think critically, use and develop planning skills, and solve problems creatively.

For additional information on how adults learn, see the article in Annex 3.

9.5.2 Understanding Participatory Workshops

Participatory or interactive training methods differ from instructor-centered teaching approaches. Ideally, the participatory approach grants a higher value to participant insight and experience and thus relies on increased participant involvement in the teaching and learning process. Participatory workshops also recognize that participants learn best when several of their senses are engaged in the learning process (seeing, hearing, and doing).

In participatory workshops, trainers still make presentations, but they do not rely primarily on this method. They will also plan, design, and facilitate group discussion, self-study, and group problem-solving exercises. The following chart presents some additional differences between instructor-centered approaches and participatory approaches.

COMPARISON	INSTRUCTOR CENTERED WORKSHOPS	PARTICIPATORY WORKSHOPS
EXPERTISE/KNOWLEDGE	Instructor is the sole expert and authority; instructor alone has the "correct" knowledge	Both the trainer and participants bring experience, expertise, and knowledge relevant to the topic
ROLE AND RESPONSIBILITY OF INSTRUCTOR	Lecturer, scholar, savant	• Plans and organizes seminar; provides structure for participant involvement • Stimulates group discussion • Facilitates discussion by participants • Summarizes group discussions and conclusions • Makes mini-presentations
ROLE OF THE LEARNER	Passive listener; listens and poses questions to instructor.	Active learners, involved in discussions and problem solving
PRIMARY METHODS	• Lecture or presentation by the instructor followed by question and answer period • Participants direct their questions to the instructor	• Group discussion and analysis • Practical exercises and activities • Mini-presentations to introduce a topic or to emphasize important points • Participants direct questions to each other and to the trainer
LEARNING	Participants must memorize theory, information, and facts. The insights, opinions, and experience of participants are seldom sought.	• Participants learn from instructor and from each other through discussions • Critical reflection; practical activities • A primary goal of participatory seminars and workshops is to develop participants' critical-thinking, problem-solving, and planning skills
SOLUTIONS/ACTION	Instructor proposes a set of "correct solutions" or expertise-based technical solutions that participants must learn and follow	Participants are involved in identifying and generating solutions, and proposing actions, based on technical information as well as their own experience, resources, and capacities

There are many different types and variations of training methods. Trainers have to choose the most suitable methods for each training situation. To choose suitable and effective training methods, it is necessary to take into account many factors including participant needs and characteristics; the training situation; trainer expertise and skills; amount and content of information; the timing and location of the event; and available equipment. Annex 1 provides a matrix that compares the uses, advantages, and disadvantages of various types of training methods.

9.5.3 Training Needs Assessment

Training needs assessment identifies the characteristics of the training audience: their specific job performance, competency, and/or information needs; their gaps in knowledge or skills; and the most cost-effective or optimal mode of delivering the training. Information collected during the needs assessment – whether obtained through informal conversations with key stakeholders or more formal interviews, observations, focus groups, performance data, questionnaires, or tests – can clarify issues and provide a focus on performance. It is also good practice to allow time at the beginning of a workshop to ask participants to share one thing that they hope to learn or acquire during the workshop.

9.5.4 Establishing Training And Learning Objectives

Whenever you conduct a training event – be it a presentation, workshop, demonstration, or similar activity – you must consider in advance what you would like participants to learn from the event. While the GRRT workshop learning objectives are outlined already in the course materials, keep in mind that each group of participants will have specific needs and expectations. A training needs assessment will help you establish priorities and clarify specific training and learning objectives particular to your training event.

It may be useful to consider two broad types of objectives for your event. First, what are your overarching or broad reasons for holding the training event? What do you hope it will accomplish? Your answers may relate strictly to learning or they may also relate to networking, team building, or increasing the visibility of your program or expertise.

Once you have developed your overarching course objectives, the focus should be on developing specific training objectives. Your answers to the following questions can help you determine these specific objectives.

Q: Upon completion of the training, what should participants know about the topic that they do not already know?

Q: After the training, what should participants do differently?

In order to answer the above two questions, you must have an idea of your trainees' experience with the topic and what they already know about it. Therefore, you will need to determine how you will find out what participants already know and then take steps to assess their existing knowledge and experience.

Based on the answers to the above two questions and on the participants' existing knowledge and experience, develop specific training objectives related to learning, knowledge acquisition, and skill development. For example, one of the specific training objectives for this course is "Learners will understand the basic principles of adult learning and be able to apply them by developing training strategies appropriate to different learners."

After developing your training objectives, list how you will accomplish each objective – including what training methods you will use and the materials that you will need. After you have developed a complete list of objectives and identified your methods, proceed with the development of specific training materials.

In the case of the GRRT Workshop, you will want to compare the training methods, exercises, and logistics suggested in the training materials to the needs of the participants and the learning objectives you identify either before the workshop begins or on the first day of the workshop.

9.5.5 Preparing The Training Venue And Learning Environment

The workshop venue or facility is an important consideration. Does the group need to get away from the office in order to focus more intently on the topic? Or, do they need to be close to the office in order to respond to urgent work requests? Generally it is advisable to hold the training workshop off site and far enough away so that the trainees' attention is not divided between the workshop and the demands of their office. If the workshop is held on site or near trainees' offices, you are almost guaranteed to lose participants for small or major parts of the workshop. You will find yourself repeating information for those who missed parts of the training, and needing to reduce the amount of material that you can cover in the allotted time.

The training environment refers to all the things external to the trainer and the workshop thematic content that can affect the success of the workshop and the transfer of learning, including workshop duration, location, room temperature, number and mix of participants, room layout, and seating. Each one of these variables has a real effect on the quality of the training. For example, if participants are seated in rows arranged in a traditional classroom setting, a school mentality may prevail in which the trainer is considered to be the only expert and, therefore, the only one to speak while the participants sit passively taking notes, like students in grade school. On the other hand, if participants are seated in small groups of four to six, a team-building and collegial atmosphere is promoted. The successful trainer is able to manage the training environment to the fullest extent and minimize any negative effects. Generally, the workshop site plenary room should have movable round or square/rectangular tables that can accommodate five to seven participants each.

If the event is to run smoothly, the facility must offer a basic level of service. If administrators, facilitators, and trainers, for example, are constantly fighting bad lighting, space that is too small, and participants complaining about bad food and the distance to banks and shopping, the time and energy left for discussion and learning is greatly reduced. The cheapest venue is not necessarily the best venue. Some constraints are so difficult to overcome that even the best trainers and facilitators cannot succeed. When selecting a training venue, consider the space requirements, seating arrangements, equipment, and refreshment/dining facilities that the location provides.

9.5.6 Arranging for the Training Equipment and Materials

Since workshops rely on a variety of training methods, it is essential for the workshop coordinator to ensure that all of the necessary equipment and materials are present. The workshop organizer must consider the need for overhead projectors, VCRs and television screens, flip-chart paper and markers, masking tape, scissors, notebooks, writing pads, and many other equipment and material needs. Since workshops or training sessions often involve experts from different organizations or offices, make sure you communicate with these experts before the workshop to verify exactly what they will need. It is best to determine the minimum needs beforehand and ensure that the facility has them.

9.6 Icebreakers

The suitcase and the bin[2]

Time required: About 20 minutes

Supplies: An empty suitcase and a large bin and a pile of index cards

This exercise is great workshop starter, as it helps you immediately understand your audience's needs. It also creates space for any workshop resisters to feel their concerns can be voiced, heard, and then put aside.

2 Adapted from Bastick, Megan and Kristin Valasek, Eds. 2009. *Gender and Security Reform Training Resource Package.* Geneva: Geneva Centre for the Democratic Control of Armed Forces (DCAF).

After completing this exercise, trainees will be able to:

- Identify concerns and expectations concerning a workshop on greening disaster response
- Leave behind some of the negative concerns and engage with the positive expectations

Put an open suitcase and a large bin in the middle of the room about a meter apart. Distribute a pile of index cards to the trainees and ask them to identify any negative feelings toward addressing environmental issues in this workshop on one set of cards and any positive expectations on another. They can fill out as many cards as they want. Explain that the game you are about to play involves going on a journey. As space is limited you have to sort through your belongings and have to make a strict choice about what can and cannot come with you. You decide to take only nice and useful things (your positive expectations regarding environmental issues) with you, and leave worn-out things (your negative feelings regarding environmental issues) behind. Ask participants to get up and put their positive cards into the suitcase and their negative cards into the bin, reading out aloud what it is they take along and leave behind. As the trainer, take note of key items on a flip chart. As you wrap up, summarize the range of feelings you have come to know about. Make sure to explain how some of the issues mentioned will be addressed during the workshop.

You can limit this exercise to one negative and one positive card per person, if you have very little time. Should you not have a suitcase or a bin available, you can use any other large receptacles.

Speed debating[3]

Best with a fairly large group of around 20 trainees (must be an even number)

Time required: About 20 minutes

Supplies: A stopwatch

This exercise is meant to open trainees' minds to a discussion of environmental issues in the context of disaster recovery and to help the trainer to gauge the mood in the room. It is also a nice icebreaker: Trainees move around the room and expand the number of people they interact with beyond those sitting next to them. At the same time, the one-on-one interaction affords privacy that may help shy participants express their opinions.

After completing this exercise, trainees will be able to:

- Clarify their own beliefs regarding environmental issues
- Understand ways in which the environment influences decisions and policies
- Realize different ways of understanding the environment and its implications

Number all trainees in ones and twos, alternately. Those numbered "one" will sit across the table from those numbered "two." Read trainees a statement regarding the environment in the context of disaster recovery and instruct them to discuss it with their partners across the table, for two minutes only. After the two minutes, interrupt the discussions and ask all trainees to move one chair to their left. Read another statement and allow another two minutes to discuss. Repeat several times (for a total of five to six statements). After the last two-minute discussion, thank trainees and instruct them to return to their original seats.

3 Adapted from Bastick, Megan and Kristin Valasek, Eds. 2009. *Gender and Security Reform Training Resource Package.* Geneva: Geneva Centre for the Democratic Control of Armed Forces (DCAF).

The goal of the session is to ease trainees into an environmentally sensitive frame of mind, not to develop any ideas or to gather reactions to the statements provided; therefore, a group debrief is not necessary.

It is better to use statements rather than open questions. Statements help trainees take clear positions and make the debates livelier. It is important that the statements be absolute, not relative, and provocative without being outrageous, so that two people may reasonably disagree with each other. For instance, "women are inferior to men" is not a good statement to use, because defending (or disagreeing with) it will cause negative feelings and anger.

Below are some sample statements, but trainers should devise their own statements, tailored to trainees' interests:

- When working in a foreign country, international actors should respect local culture and traditions and not impose Western notions of the value and role of the environment.
- During the post-disaster emergency, saving lives and reducing suffering is all that matters. Protecting the environment can come later.
- All disaster response agencies should incorporate environmental activities into their projects.
- Even if implementing environmentally sustainable activities costs more and takes and more time, it is worth it in terms of long-term environmental objectives.

Team-building – juggling balls[4]

Best with a fairly large group: 20 trainees or more

Time required: 30 minutes

Supplies: Three balls or more (they can range in size, weight, color, etc. but it is best if they are soft balls to avoid injury)

This exercise is focused on solving problems in a team in a practical and fun way. It demonstrates the juggling of many tasks, including responsibility for environmental issues.

After completing this exercise, trainees will be able to:

- Laugh together about their ball-catching skills
- Understand that partners are necessary in problem solving
- Know to look ahead (and behind) when given many different tasks (including integration of environmental issues)

Ask the trainees to stand in a circle, shoulder to shoulder. Explain that each ball will be thrown to someone in the circle who will in turn throw it to someone else in the ring. This continues until all group members have thrown the ball once. Start with one ball. Have the group repeat the exercise but this time in reverse order. On the next round, after the ball gets to the third person, add a second ball, and a third, fourth, etc., depending on the size of the group and the number of balls you have. Next, tell the group that you will now give them a time limit (base this on how long that first time took). On the next round, shorten the time. Stop play and ask how they might be able to accomplish the task better and faster. Ask them how fast they think they can go. Have them try to do it in that time.

Process the exercise by asking the group to relate this to the juggling of tasks in their organization, including how to juggle the topic of the environment within the context of disaster response. Can they relate to "Sometimes you don't know what is coming," "Sometimes the person throws something to you without you knowing how to handle it," "Sometimes things go too fast and you drop the ball," etc.?

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4 Adapted from Bastick, Megan and Kristin Valasek, Eds. 2009. *Gender and Security Reform Training Resource Package.* Geneva: Geneva Centre for the Democratic Control of Armed Forces (DCAF).

ANNEX A: PREWORKSHOP SURVEY

Introduction

This is a brief pretraining survey for all participants who will be attending a workshop of the Green Recovery and Reconstruction training project. This survey will be used to:

- Give facilitators an understanding of participants' needs and expectations so they can properly structure the training
- Identify current skill areas of the trainees
- Help evaluate the effectiveness of the training after it is complete

Please note that this is not a test. This information will only be used to improve the quality of the training, so please be honest and open.

Please replace the [bracketed] text after each question with your answer. Your answers do not have to be very detailed; just a sentence or two will be good.

Background Information

Your Name:
[Name]

Your e-mail address:
[e-mail]

Other contact options that you can share (e.g., address, phone numbers, etc.):
[other contacts]

The country you are currently working or living in:
[country]

How would you describe your understanding of written and spoken English (none, basic, good, excellent)?

Written English: *[written English skill]* Spoken English:
[spoken English skill]

Please tell us about any other languages you speak:
[other languages]

What is your current job title/description?
[job description]

Please list your primary professional skills developed through training and experience.
[professional skills]

Training Topic Questions

Green Recovery and Reconstruction Concept

On a scale of 1–5, how would you rate your current understanding of the Green Recovery and Reconstruction (GRR) Concept (what GRR is, how GRR is used in other parts of the world, etc.)?
[scale 1–5, 1 being least or lowest and 5 being greatest or highest]

Please also write down any comments you have about your experience with the GRR concept and/or specific knowledge you hope to gain about the GRR concept.
[comments]

Environmental Management and/or Ecosystem Approach

On a scale of 1–5, how would you rate your current understanding of Environmental Management and/or Ecosystem Approach (what is it, what are the key concepts, etc.)?
[scale 1–5]

Please also write down any comments you have about your experience working with environmental management groups, and/or any specific knowledge you hope to gain about applying environmental management to disaster response.
[comments]

Technical Skills

On a scale of 1–5, how would you rate your current understanding and experience as a technician (knowledge of environmental management, conservation, or disaster management, including recovery and reconstruction, methods, tools and resources, etc.) in each of the following sectors or skills)? Place a number in each of the boxes to the left of the following topics.

Environmental management	Conservation	Disaster management	
			Environmental impact assessment
			Monitoring and evaluating humanitarian projects
			Physical planning
			Construction
			Procurement
			Water and sanitation
			Livelihoods
			Disaster risk reduction
			Green organizational management practices
			Other, related area: please describe
			Other, related area: please describe

Please also write down any comments you have about previous experience with environmental management, conservation, and/or humanitarian assistance, and/or any specific consulting skills that you hope to gain.
[comments]

Training

On a scale of 1–5, how would you rate your current knowledge and experience as a trainer (training methods, learning styles, etc.)?
[scale 1–5]

Please also write down any comments you have about your experience with training and/or specific knowledge you hope to gain about training concepts.
[comments]

General Comments

Finally, please give us any general comments or concerns you have about the upcoming training or your future work in post-disaster/conflict response, etc.
[general comments]

Thank you very much for your feedback. Your comments are greatly appreciated and will help shape a more effective training program.

GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries*. Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice*.

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source: World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future.* Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology
ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

1

GREEN

GUIDE TO

OPPORTUNITIES FOR GREEN RECOVERY AND RECONSTRUCTION: AN INTRODUCTION

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

1 GREEN GUIDE TO

OPPORTUNITIES FOR GREEN RECOVERY AND RECONSTRUCTION: AN INTRODUCTION

Emma Jowett, Consultant

NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase knowledge and skills for utilizing environmentally sustainable disaster response approaches. Each GRRT module package consists of: (1) training materials for a workshop; (2) a trainer's guide; (3) slides; and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-hour training session that introduces the principles of green recovery and reconstruction.

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MODULE 1: OPPORTUNITIES FOR GREEN RECOVERY AND RECONSTRUCTION: AN INTRODUCTION

Table of Contents

1 INTRODUCTION

1.1 Module Objectives

This module introduces the concept of green recovery and reconstruction. It provides an overview of the key environmental issues associated with post-disaster recovery and reconstruction and introduces strategies for addressing these issues. The module also describes the Green Recovery and Reconstruction Toolkit (GRRT) and its components. The training session for Module 1 is intended to be a one-hour session presented before the other modules (Modules 2 – 10).

Specific learning objectives for this module are as follows:

1. Describe how addressing the environment in a humanitarian response a) is critical to saving lives and livelihoods, b) reduces risk and vulnerability, and c) contributes to successful recovery outcomes
2. Explain the purpose of the Green Recovery and Reconstruction Toolkit and its components.
3. Discuss key opportunities, misconceptions, and challenges for mainstreaming the environment into humanitarian action.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 1 in a series of ten modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment, and taking advantage of opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction to help make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4, 5, and 6 pertain specifically to building construction, with Module 4 focusing on site planning and development, Module 5 on building materials and the supply chain, and Module 6 on building design and construction management. GRRT Modules 7 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

Module 1 is intended for people working as part of disaster recovery and reconstruction efforts, including staff involved in project design, implementation, and management. Target staff include project planners for shelter, water and sanitation, and livelihoods sectors, as well as the procurement and logistics staff who support them. It also includes staff who monitor and evaluate recovery and reconstruction projects, and who design and implement disaster risk reduction activities. Module 1 is also appropriate for field engineers, program and country directors, disaster management staff, spatial planners, environmental managers, facility managers, and private-sector representatives (e.g., construction contractors, suppliers, and estimators).

1.4 Module Key Concepts

This module builds on the following key concepts:

1. **Environmental sustainability is critical to the achievement of long-lasting disaster recovery results.** Shelter construction, livelihoods recovery, water and sanitation, and disaster risk reduction interventions must actively address environmental sustainability in order to ensure that communities, and the natural resources upon which they depend, are not put at further risk because of the unintended consequences of the disaster recovery process.
2. **Addressing the environment in post-disaster recovery projects has multiple benefits.** By minimizing negative environmental impacts, project planners not only increase the long-term sustainability of their projects but can also achieve other benefits such as cost savings, disaster risk reduction, gender equity, food security, and energy efficiency, among others.
3. The restoration of communities after disasters is a complex process that involves a wide range of actors and activities over many years. Given this complexity, it may appear that the only way to address environmental issues is to assign this responsibility to environmental experts or organizations whose sole function is to ensure that environmental issues are addressed. **While there may be a role for dedicated environmental teams in a disaster recovery effort, in practice, nearly all people involved in disaster recovery and reconstruction have the opportunity and responsibility to incorporate environmental sustainability into their activities.** While it is best to address environmental issues during the recovery planning phase early on after a disaster, **it is never too late to take some action to improve outcomes for people and communities.**
4. Disaster recovery and rebuilding attempts to build back in a few years what often took generations to develop. If not well-planned and executed, this race to recovery can put an enormous strain on natural resources, leaving people more vulnerable to disasters in the long term. With proper planning, however, **the recovery process can be an opportunity to build back safer.** In this context, building back safer means using an approach that minimizes environmental impacts, and building more environmentally sound communities than may have existed before the disaster. The goal is to move beyond pre-disaster conditions to meet the longer-term development needs of disaster-affected people.
5. The differences between disaster types, local communities, environmental conditions, infrastructure types, and available resources for disaster recovery mean that every disaster situation has unique characteristics. Given this fact, it is important for project planners to maximize their use of local knowledge whenever possible in order to **ensure that recovery activities are grounded in local context and are supported by local communities**.
6. In light of the unique nature and complexities of each disaster situation and local context, project planners can face enormous challenges when planning and implementing recovery activities. In order to address these challenges, and go

beyond simply identifying environmental problems, project planners must take a **solution-oriented approach** to creatively solving environmental challenges. The GRRT is designed to be solution-oriented and allows for multiple approaches to problem solving.

1.5 Module Assumptions

The basic assumption of this module is that the GRRT is applicable immediately following the disaster when recovery and reconstruction strategies are first being formed, and then throughout the recovery and reconstruction phase, which may last from six months to several years after a disaster strikes. The GRRT training should ideally occur before a disaster happens in order to equip responders with the knowledge, skills, strategies, and tools necessary to implement the GRRT approach. However, GRRT training can be deployed after immediate, life saving relief activities have taken place and alongside the recovery and reconstruction planning. All of the GRRT modules acknowledge that every situation is specific and that application of the tools and approaches will have to be adapted to the context.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Disaster risk. Potential disaster losses (in lives, health status, livelihoods, assets, and services) that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk.

Disaster risk reduction. The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

Ecosystem. Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems.

Hazard. A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards).

Resilience. The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies.

By incorporating environmental concerns into the recovery and reconstruction process, communities and individuals can lower their risk and vulnerability to future disasters. © Daniel Cima/American Red Cross

2 ENVIRONMENTAL SUSTAINABILITY IN DISASTER RECOVERY AND RECONSTRUCTION

2.1 Saving Lives and Reducing Risk

The human and economic losses caused by natural disasters and conflict are devastating. Over the past 35 years, between 1974 and 2009, disasters have killed over 3.5 million people, affected over 5.7 billion, and caused estimated damages of US$1.8 trillion.[1] Disasters are also on the rise: Between 1996 and 2005, over 6,400 natural and man-made disasters occurred globally, representing a 60 percent increase from the previous two decades. While the annual rate of people killed by natural disasters is falling, the number of people vulnerable to and affected by natural disasters is increasing. From 2000 – 2004, a third more people were affected than during the period between 1995 and 1999. According to the Intergovernmental Panel on Climate Change, extreme weather events, such as droughts and cyclones, will become more severe in the future as the climate becomes warmer.[2]

Humanitarian action remains the primary tool available to the international community to support individuals, communities, and governments when disaster strikes and when people's lives are threatened by conflict. In response to disasters over the five-year period from 2005 – 2009, the international humanitarian aid community contributed over $51 billion to rebuild shelters, install water and sanitation systems, provide medical assistance, support livelihoods, and reconstruct schools, among many other activities.[3] Every day humanitarian action helps to save lives and reduce suffering around the world.[4]

A critical component of saving lives and reducing risk after a disaster is ensuring that the natural resources that form the basis for human life and livelihoods are restored and protected for the future. Clean air, water, and soil are all essential for human health (preventing malnutrition and disease) and well-being (providing the raw materials for economic development and healthy living conditions). Sustainable supplies of timber, clay, sand, fish, agricultural crops, and other natural resources are fundamental inputs for the restoration and protection of lives and livelihoods, and scarcity of natural resources can lead to food insecurity and conflict.

Environmental issues have both direct and indirect impacts on human life and livelihoods. For example, if water sources are contaminated with chemicals such as mercury (used in mining) or pesticides (used in agriculture and aquaculture), there can be direct, negative impacts on human health. These may include poisoning, birth defects, or even death. Negative impacts are not only the result of industrialization or globalization; if clay is removed from hillsides to be used as a building material for post-disaster shelters, the risk of landslides and flooding can be increased, endangering human populations. The overexploitation of natural resources, such as fish or timber, may directly benefit the fishermen or logger when he or she sells a product, but indirectly harm future generations who will need these natural resources for their own livelihoods and well-being over the long term.

Humans rely on healthy ecosystems for the goods and services that are essential to human life, and the raw materials that are processed into food products, clothing, and building materials.

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1 Center for Research on the Epidemiology of Disasters. International Disaster Database. www.emdat.be (Accessed on June 14, 2010)

2 Intergovernmental Panel on Climate Change. 2007. *Climate Change Impacts, Adaptation and Vulnerability: Summary for Policymakers*. Working Group II Contribution to the IPCC Fourth Assessment Report: Climate Change.

3 As reported by UN Office for Coordination of Humanitarian Affairs. 2010. *Financial Tracking System*. www.ocha.unog.ch/fts/ (Accessed on April 15, 2010)

4 DFID. 2006. Saving lives, relieving suffering, protecting dignity: DFID's Humanitarian Policy.

Intact ecosystems such as wetlands, floodplains, forested hillsides, mangroves, and undeveloped land all provide critical functions in reducing disaster risk that physical infrastructure cannot duplicate. If natural resources are severely depleted or the environment significantly polluted, then the gains made in saving lives and reducing risk in the immediate humanitarian response may be lost in the ensuing months and years. When humanitarian activities do not address environmental issues, they can increase the disaster risk facing a community. Disaster risk is often expressed as a mathematical formula: **Risk = Hazard x Vulnerability**.[5] The formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Human vulnerability is the relative lack of capacity of a person to anticipate, cope with, resist, and recover from its impact. If the natural environment is degraded, then vulnerability is increased.

In some instances, humanitarian activities have the potential to put communities at risk if environmental issues are not adequately identified and addressed during project planning and throughout the life of the project. In general, the environmental consequences of humanitarian activities can be divided into the following categories: **pollution**, **habitat destruction and modification**, **unsustainable resource extraction**, and **human-wildlife conflict**. A set of examples is provided in the following table, which shows different types of environmental and human impacts related to the recovery effort after the 2004 Indian Ocean tsunami. An additional example from the 2010 Haiti earthquake is also provided in Annex 1.

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5 U.N. International Strategy for Disaster Reduction. Terminology of disaster reduction. www.unisdr.org/eng/library/lib-terminology-eng%20home.htm (Accessed on April 25, 2010)

RECOVERY ACTIVITIES: ENVIRONMENTAL AND HUMAN IMPACTS

The following photographs taken in Indonesia, Thailand, Sri Lanka and the Maldives show a few examples of environmental and human impacts associated with post-disaster recovery and reconstruction following the 2004 Indian Ocean tsunami. A detailed report on these issues is contained in: UNEP. 2007. *Environment and Reconstruction in Aceh: Two Years After the Tsunami.* Nairobi: UN Environment Programme.

Livelihoods. In the rush to restore fisheries livelihoods in the tsunami-affected countries, many aid agencies provided large numbers of boats and fishing gear without consideration as to whether the natural resource base could support existing let alone an increased fishing effort. Over-harvesting of natural resources at an unsustainable rate can cause or worsen food security and create conflict. In this photograph, a newly constructed boat (right) is larger and able to catch more fish faster than the original boat (left). (Module 8, Green Guide to Livelihoods contains additional information on addressing this issue.)

Building materials. The kilning of clay bricks requires a significant quantity of wood for fuel and results in air pollution as shown in this photograph. This can cause health impacts to workers and neighboring residents. Timber harvesting for fuel can also result in destruction of habitat that can lead to soil loss, water quality degradation, and reduction in wildlife which can lead to increased risk, food insecurity, disease and conflict. According to a report by the Food and Agriculture Organization, a typical brickworks in Sumatra, Indonesia, produces approximately 10,000 bricks per week, enough to build one home. It requires approximately 9 cubic meters of wood to fire this number of bricks. Therefore, roughly twice as much wood is needed to fire the bricks for a brick house than to build a wooden house.[6] (Module 5, Green Guide to Materials and the Supply Chain contains additional information on addressing this issue.)

Building materials. Uncontrolled soil mining can put communities at risk by increasing landslides, as well as causing soil erosion and sedimentation of rivers as shown in this photo. Rivers and other sources of clean water can be contaminated with soil runoff leading to unsafe or unreliable water supplies and impacts to fisheries. (See Module 5, Green Guide to Materials and the Supply Chain for information on addressing this issue.)

6 Kuru, George. 2005. FAO *Assessment of Timber Demand and Supply for Post-Tsunami Reconstruction in Indonesia*. Report prepared for the Food and Agriculture Organization.

Land conversion. Illegal logging can result in water pollution, erosion, loss of habitat, and human-wildlife conflict.[7] This can lead to lack of clean water, disease, increased disaster risk, and fewer livelihood opportunities over the long-term. (See Module 6, Green Guide to Construction for ways to address this issue)

Solid waste management. The construction of new shelter settlements after disasters also requires proper planning for solid waste management. In this photograph, solid waste is disposed in an un-lined ditch creating water contamination, health concerns, and foul odor for neighboring communities. (See Module 7, Green Guide to Water and Sanitation for ways to address this issue)

7 Jakarta Post. 2007. Aceh to implement logging moratorium. Jakarta Post. *March 17.*

Shelter construction. The rush to construct houses after the tsunami resulted in some new homes being constructed in unsafe areas as shown in in this photo.. Flooded homes can lead to increased risk of water-bourne disease and unsafe living conditions. Note: a newly constructed sea wall in the background aggravates the problem because it prevents rainwater from flowing out to sea. (See Module 4, Green Guide to Strategic Site Selection and Development for ways to address this issue)

Site Selection. The selection of relocated housing sites resulted in the use of undeveloped land that infringed on elephant habitat, resulting in new incidences of human-wildlife conflict. Human-wildlife conflict can lead to increased injuries, loss of livelihood opportunities, and increased risk. (See Module 4, Green Guide to Strategic Site Selection and Development and Module 3, Green Guide to Environmental Impact Assessment Tools and Techniques for ways to address this issue).

2.2 Challenges to Addressing Environmental Issues

In the urgency of a humanitarian response setting, the critical roles that natural resources play in a healthy and secure human life are often overlooked. This might be because project planners:

- are not fully aware of the environmental impacts of their projects
- believe that the environment is of secondary importance to the goals of their project
- believe that addressing the environment is too costly or too time consuming
- feel that they do not have sufficient knowledge or skills to address environmental issues

Other important environmental challenges include:

Data: It can be difficult to find, interpret, and apply environmental data in pre- and post-disaster situations (Note: these challenges are also encountered in data collection and analysis for other sectors, whether related to the environment or not).

Time: Environmental change can be long term and may not always be measured within a project's life span.

Scale: Environmental impacts at times occur outside of the immediate project area.

Cause-effect: It is not always possible to determine definitive "cause and effect" relationships, since factors other than the studied intervention can contribute to the measured changes (attribution).

However, none of these challenges negates the importance of addressing the environment in order to improve outcomes for people and communities recovering from disaster. This module and the others in this GRRT series provide resources that can be used to address challenges by building understanding and ownership of environmental issues and illustrating the multiple benefits of incorporating the environment into disaster recovery.

It is important to acknowledge when the humanitarian imperative to save lives and reduce suffering must take precedence over other considerations. However, the humanitarian imperative does not have to be at the expense of the environment and, ultimately, of the people who depend upon the environment's health. Humanitarian projects can serve as a platform for improving environmental conditions in order to benefit people's needs related to shelter, water, health, and livelihoods.

2.3 An Opportunity to Build Back Safer

Disaster recovery and rebuilding attempts to build back in a few years what often took generations to develop. This recovery process represents an opportunity to *build back safer,* creating more environmentally sound communities than existed before the disaster. The GRRT uses the phrase build back safer instead of the more common "build back better" because build back better is often interpreted as building back infrastructure that is larger, or more modern, which is not always "better" in terms of long-term sustainability. A full discussion of the build back better concept is contained the paper "The Meaning of 'Build Back Better': Evidence From Post-Tsunami Aceh and Sri Lanka."[8]

8 Kennedy, Jim, Joseph Ashmore, Elizabeth Babister, and Ilan Kelman. 2008. The meaning of 'build back better': Evidence from post-tsunami Aceh and Sri Lanka. *Journal of Contingencies and Crisis Management.* 16(1): 24-36.

Once the immediate, life-saving needs are met in the earliest phases after a disaster, governments, aid agencies, and multilateral organizations have an opportunity and responsibility (as their policies and standards describe) to ensure that recovery and reconstruction activities support and strengthen longer-term development to achieve long-lasting outcomes for disaster-affected communities.

The goal of post-disaster recovery should be to move beyond pre-disaster conditions in order to enable the longer-term development needs of disaster-affected people. In the book *Rising from the Ashes: Development Strategies in Times of Disaster*, the authors point out:

> Too often, disaster responses in the form of relief aid have not contributed to long-term development and, worse, actually subverted or undermined it. *There is no reason why this should continue to be the case.* If the number of times external agencies intervene in disaster responses is actually increasing – and it is – then the necessity for designing relief interventions so that they contribute to long-term development becomes all the more important. Relief efforts directed at "getting things back to normal" will do just that and no more, leaving people as vulnerable to the next crisis as they were to the last.[9]

In recent years, a number of humanitarian agencies have taken steps to ensure that post-disaster recovery and reconstruction actively addresses environmental concerns and thereby supports longer-term development. Some of these activities have included the following:

- Encouraging the use of building materials that are from renewable natural resources
- Locating buildings outside of hazardous and environmentally fragile areas
- Taking advantage of technological innovations that can be successfully adapted to local contexts
- Reintroducing traditional methods that are more environmentally sustainable than modern approaches
- Reusing or recycling disaster debris
- Conserving water and accessing it only from sustainable sources
- Managing waste so it becomes an environmental asset, not a liability
- Building back governance capacity to sustainably manage natural resources

As explained further in Section 3 below, the GRRT contains numerous case studies, tools, and strategies that illustrate these examples of integrating environmental sustainability in disaster recovery.

There are multiple benefits to addressing the environment. By minimizing negative environmental impacts, project planners are not only increasing the long-term sustainability of their projects, but are also working toward other project objectives such as cost savings, disaster risk reduction, gender equity, food security, and energy efficiency, among others. For example, by ensuring that recovery activities do not degrade ecosystems, humanitarian project planners can help to ensure that the disaster risk reduction functions of ecosystems are maintained. Ecosystem functions include flood retention, slope stability, clean and healthy air and water, and food stores. In many cases, by addressing the environmental issues, humanitarian actors can address the underlying causes of the disaster itself. The following examples from Guatemala/Mexico and Somalia show how risk can be reduced through sound environmental management following a natural disaster.

9 Anderson, Mary and Peter Woodrow. 1998. *Rising from the Ashes: Development Strategies in Times of Disaster.* London: Intermediate Technology Publications.

REDUCING RISK THROUGH ENVIRONMENTAL MANAGEMENT AFTER HURRICANE STAN IN GUATEMALA/MEXICO

In the high-altitude upper watersheds of the Coatán and Suchiate rivers, straddling the borders of Guatemala and Mexico and flowing off the slopes of the Tacaná volcano to the Pacific Ocean, environmental degradation and climate change are increasing the risk of devastating flash floods. These watersheds have been deforested and are badly degraded in many places. Severe erosion of formerly deep soils has reduced their capacity to hold water. Population density is high and degradation of the environment has limited people's livelihood options. Communities are therefore increasingly vulnerable to flooding caused by tropical storms and hurricanes. In 2005 tropical storm Stan dropped torrential rains on the region, causing flooding and mudslides that led to an estimated 2,000 deaths and damage of up to US$40 million. Roads, bridges, water supply systems, crops, and local economies were destroyed. This disaster propelled communities to take action and find ways to reduce the risks of flooding. With the support of IUCN's Water and Nature Initiative and other organizations, local communities organized themselves into "micro-watershed councils" to coordinate watershed management among groups of villages. People have become aware of the effects of unsustainable environmental management. They have identified the different demands on water and defined priorities for managing and restoring watersheds that respond to their development needs. Driven by the need to expand livelihood options to reduce poverty, these community councils have led to the diversification of farming systems, including terracing of degraded slopes and reforestation through the introduction of agroforestry. Communities are investing their labor and capital in restoration of natural infrastructure. As self-organization expands, communities are becoming better equipped to adapt to climate change and are less sensitive to severe storms.

Source: Smith, D.M., and S. Barchiesi. 2009. *Environment as infrastructure – Resilience to climate change impacts on water through investments in nature*. Perspectives on water and climate change adaptation. The Hague, Netherlands: CPWC; Marseilles, France: World Water Council; Gland, Switzerland: IUCN; and London, UK: IWA. Cited in Sudmeier-Rieux, Karen, and Neville Ash. 2009. *Environmental Guidance Note for Disaster Risk Reduction: Healthy Ecosystems for Human Security*. Revised Edition. Gland: IUCN.

Community engagement and self-organization helps to ensure long-term project results and reduce disaster risk. This photograph shows a community center in Maderas del Pueblo Nuevo Paraiso, Chimpalas, Oaxaca, Mexico which acts as a forum for communities to discuss livelihoods, environmental issues, disaster risk, and other concerns facing the community. © Anthony B. Rath/WWF-Canon

CASE STUDY: GREEN RECOVERY IN XAAFUUN, SOMALIA, AFTER THE 2004 TSUNAMI

Reconstruction efforts in Xaafuun, Somalia, following the 2004 tsunami pinpoint the importance of environmentally appropriate site selection for a relocated community. Xaafuun is one of the few permanent fishing settlements on the northeastern Somalia coast, oscillating between 250 and 600 families depending on the season. In the damaged settlement, houses had been built at sea level near the beach, which had destabilized the fragile dune ecosystem of the area. Strong, sand-laden winds would regularly hit the village during the monsoon season, often burying structures and causing health problems, particularly for children, pregnant women, and the elderly.

To find a safe and environmentally sustainable site, a multidisciplinary team of urban planners, an economic development expert, and an environmental specialist collaborated to formulate the reconstruction plan. Key issues of sustainability included the potential for settlement expansion and construction in close proximity to both fishing and market locations. Protection from the elements was another important consideration, since Xaafuun is subject to strong winds and sand from the adjacent sand dune habitat. The team also looked at the suitability of a new site with regard to public infrastructure for water delivery systems, sanitation systems, and roadway access points.

The new location called for a carefully considered, integrated settlement layout with appropriate types of shelter, rather than a simple replication of what existed before. A preparatory sketch-plan discussed with all stakeholders allowed for swift land allocation to different agencies for immediate reconstruction activities. Meanwhile, a more detailed settlement layout was prepared by UN-HABITAT. A new mosque, a Koranic school, a meat market, a women's center, and a health center have been built.

The town plan was based on the following principles:

1. Compact settlement: this mitigates the impact of Xaafuun's strong winds on living spaces and housing units, ensures cost efficiency by reducing the total service area, and reduces infringements on the sensitive dune habitat.
2. Public border: a public zone, comprising public spaces and public buildings, faces the sea, and acts as a buffer between the residential area and the dunes.
3. Main road: this serves as the backbone of the development and is linked with the main public facilities.
4. Economic development: next to the formal market structures and the sites along the sea for a small-scale fishing industry, spaces for spontaneous economic activities and social gatherings are created.

The Xaafuun case illustrates that without compromising humanitarian efforts to save lives, it is vital to introduce a development perspective in the early stages of the post-disaster situation, fully taking advantage of the opportunities that might result from the disaster. The full case study is included as Annex 3 of Module 4, Green Guide to Strategic Site Selection and Development.

Source: Decorte, Filiep. 2008. *Paving the Way for Sustainable Development in a Post Disaster Situation – the Case of the Tsunami-damaged Village of Xaafuun North Eastern Somalia*. Nairobi: UN-HABITAT.

2.4 Environment in Post-Disaster Recovery International, National, and Local Policy

For the past few decades, governments, the UN, and civil society organizations have examined the role of a sustainable environment relative to disaster response and human development policy. Additionally, many national, regional, and local governments have legal mandates that require development activities to incorporate environmental issues and include environmental impact assessment. Project planners and managers involved in post-disaster recovery and reconstruction should address both the international-level policy (described below) and the applicable national, regional, and local laws that pertain to their projects.

2.4.1 Code of Conduct for Disaster Relief

The Code of Conduct for the International Red Cross and Red Crescent Movement and Non-Governmental Organizations (NGOs) in Disaster Relief was developed and agreed upon by eight of the world's largest disaster response agencies in the summer of 1994. Signatories include National Red Cross and Red Crescent Societies, Oxfam, the Save the Children Fund, and CARE, among others. It is currently being used by the International Federation to monitor its own standards of relief delivery and to encourage other agencies to set similar standards.

Principle 8 in the Code of Conduct specifies:

> **Relief aid must strive to reduce future vulnerabilities to disaster as well as meeting basic needs.** All relief actions affect the prospects for long-term development, either in a positive or a negative fashion. Recognizing this, we will strive to implement relief programmes which actively reduce the beneficiaries' vulnerability to future disasters and help create sustainable lifestyles. *We will pay particular attention to environmental concerns in the design and management of relief programmes. We will also endeavour to minimize the negative impact of humanitarian assistance, seeking to avoid long-term beneficiary dependence upon external aid.*

2.4.2 The SPHERE Project

The Sphere Project initiative began in 1997 as a response to a collective recognition within the humanitarian community of the need for quality and accountability mechanisms in humanitarian responses. Sphere is three things: a handbook, a broad process of collaboration, and an expression of commitment to quality and accountability. The Sphere Handbook has become a widely recognized tool for improving humanitarian response, not only by NGOs but also by United Nations agencies, host governments, donor governments, and other actors involved in humanitarian response.

In the Sphere handbook a number of crosscutting issues are identified that have relevance to all sectors in a disaster response, including the environment:

> The environment…provides the natural resources that sustain individuals, and determines the quality of the surroundings in which they live. It needs protection if these essential functions are to be maintained. The Minimum Standards address the need to prevent over-exploitation, pollution and degradation of environmental conditions.[10]

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10 The Sphere Project. 2004. Minimum Standards in Shelter, Settlement and Non-food Items. Sphere Handbook. Geneva: Oxfam Publishing. *Note: a revised version of the handbook will be published in 2011.*

The environment, disaster risk reduction, and climate change are issues that will be further explored in the revision of the handbook, which is planned for publication in 2010.

The Sphere handbook provides practical advice on programming related to the environment through the minimum technical standards, indicators, and guidance notes throughout the handbook. One example of this can be found in **Shelter and settlement standard 6: environmental impact**:

> The adverse impact on the environment is minimized by the settling of the disaster-affected households, the material sourcing, and construction techniques used. Gaps in reaching the standards can be used to advocate for additional resources where appropriate.

2.4.3 Hyogo Framework for Action

The Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters was launched in January 2005 when over 4000 representatives of governments, non-governmental organizations, academic institutes, and the private sector gathered in Kobe, Japan, at the second World Conference on Disaster Reduction. This Framework for Action, adopted by 168 states, sets a clear expected outcome – the substantial reduction of disaster losses, in lives as well as in the social, economic and environmental assets of communities and countries – and lays out a detailed set of priorities to achieve this by 2015. The Framework for Action identifies environmental management as a priority action for reducing the underlying risk factors to natural hazards.

The Hyogo Framework for Action built on the Yokohama Strategy and Plan of Action (1994), which stated that the representing Heads of State "resolve to pursue the following expected outcome for the next 10 years: *The substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries…*"

through the following key activities:

(i) Environmental and natural resource management

> (a) Encourage the sustainable use and management of ecosystems, including, through better land-use planning and development activities, the reduction of risk and vulnerabilities.
>
> (b) Implement integrated environmental and natural resource management approaches that incorporate disaster risk reduction, including structural and non-structural measures, such as integrated flood management and appropriate management of fragile ecosystems.
>
> (c) Promote the integration of risk reduction associated with existing climate variability and future climate change into strategies for the reduction of disaster risk and adaptation to climate change, which would include the clear identification of climate-related disaster risks, the design of specific risk-reduction measures, and an improved and routine use of climate risk information by planners, engineers, and other decision makers.

2.4.4 Millennium Development Goals

In September 2000, world leaders came together at United Nations Headquarters in New York to adopt the United Nations Millennium Declaration, committing their nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound targets – with a deadline of 2015 – that have become known as the **Millennium Development Goals (MDGs).** The MDGs relate to humanitarian response, because the humanitarian sector is part of the developmental process.

The four targets of Goal 7 address environmental sustainability. The targets are as follows:

1. Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources.
2. Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss.
3. Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation.
4. By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers.

2.4.5 United Nations Cluster System

Over the years the international humanitarian community has developed several mechanisms to improve the overall effectiveness of response to disasters. One prime example has been the humanitarian reform proposed by Jan Egeland, the former United Nations Undersecretary-General for Humanitarian Affairs and Emergency Relief Coordinator, and agreed to by the Inter Agency Standing Committee (IASC) in 2005. This reform seeks to improve the effectiveness of humanitarian response by ensuring greater predictability, accountability, and partnership. It is an ambitious effort by the international humanitarian community to reach more beneficiaries with more comprehensive needs-based relief and protection in a more effective and timely manner.

An essential part of the reform is the "cluster approach," a sectoral-based approach to more efficient and effective coordination. The cluster approach consists of groupings of UN agencies, NGOs, and other international organizations around a sector or service provided during a humanitarian crisis. Each of the eleven clusters (Protection, Camp Coordination and Management, Water Sanitation and Hygiene, Health, Emergency Shelter, Nutrition, Emergency Telecommunications, Education, Agriculture, Logistics, and Early Recovery) is led by a designated agency.[11]

The approach has the multiple objectives of developing adequate capacity and predictable leadership in all sectors to ensure that the following takes place:

- Identified gaps in all the main sectors or areas of humanitarian response are addressed, including crosscutting issues such as the environment.
- Responses are more strategic and are based on prioritization of available resources and clarity about who does what.

The Emergency Shelter Cluster has developed an Environment Advisor program to support Emergency Shelter Cluster field operations. The Environment Advisor provides advice and technical support to the Cluster Coordinator and Cluster members on how to identify and minimize the negative impacts of emergency shelter assistance. In 2010, Environment Advisors were deployed to Haiti and Indonesia following earthquake disasters in those countries.

The cluster approach includes the environment as a crosscutting theme that should be considered across all the technical clusters (or sectors). The GRRT training modules 1, 2, and 3 are applicable to all clusters. Sector-

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11 Interagency Standing Committee (IASC). 2006. *IASC Guidance Note on Using the Cluster Approach to Strengthen Humanitarian Response*. Geneva: United Nations.

specific GRRT modules relate to the clusters and Table 1, below, shows which GRRT modules relate to which cluster activities. It should be noted that the cluster system is not invoked in all disasters; however, many governments use a similar, sector-by-sector coordination approach.

TABLE 1. **LIST OF CLUSTERS AND THE GRRT MODULES THAT RELATE TO THE CLUSTERS**

CLUSTER	RELATED GRRT SECTOR-SPECIFIC MODULE
TECHNICAL CLUSTERS	
AGRICULTURE	Green Guide to Livelihoods (Module 8)
EDUCATION	No GRRT module relates directly.
EMERGENCY SHELTER	Green Guide to Strategic Site Selection and Development (Module 4) Green Guide to Materials and the Supply Chain (Module 5) Green Guide to Construction (Module 6)
HEALTH	Green Guide to Water and Sanitation (Module 7) Green Guide to Construction (regarding debris management) (Module 6)
NUTRITION	No GRRT module relates directly.
WATER, SANITATION, AND HYGIENE	Green Guide to Water and Sanitation (Module 7)
CROSSCUTTING CLUSTERS	
CAMP COORDINATION AND CAMP MANAGEMENT	Green Guide to Strategic Site Selection and Development (Module 4) Green Guide to Materials and the Supply Chain (Module 5) Green Guide to Construction (Module 6)
EARLY RECOVERY	All the sectoral GRRT modules support the principles and practices of the Early Recovery cluster. Green Guide to Livelihoods (Module 8) is especially relevant.
PROTECTION	No GRRT module relates directly.
COMMON SERVICES	
LOGISTICS	Green Guide to Materials and the Supply Chain (Module 5) Green Guide to Construction (Module 6)
EMERGENCY TELECOMMUNICATIONS	No GRRT module relates directly.

In addition, the UN Environment Programme (UNEP) assists with environmental issues related to disaster response.

3 THE GREEN RECOVERY AND RECONSTRUCTION TOOLKIT

World Wildlife Fund (WWF) has worked with the American Red Cross Tsunami Recovery Program (TRP) and their partners in the areas impacted by the 2004 Indian Ocean tsunami in Sri Lanka, Indonesia, Thailand, and the Maldives. Through this innovative five-year partnership (2005 – 2010), WWF and the American Red Cross have developed considerable knowledge as to what activities, strategies, and training can improve the disaster recovery and reconstruction process by helping to make communities more environmentally sustainable. In order to broaden the learning and experiences, WWF and the American Red Cross worked with over 30 subject-matter experts and humanitarian specialists from over 18 other organizations in order to develop this Green Recovery and Reconstruction Toolkit (GRRT). Participating organizations include the International Federation of the Red Cross Red Crescent Societies, Oxfam, CARE, Save the Children, Mercy Corps, Tearfund, United Nations Environment Programme, ProAct, World Conservation Union (IUCN), World Vision, RedR UK, the U.S. Agency for International Development, the International Strategy for Disaster Reduction, ProAct, the Danish Refugee Council, the Asian Disaster Preparedness Center, Shelter Centre, and Environment Foundation Limited.

The Green Recovery and Reconstruction Toolkit (GRRT) is a series of 10 standalone modules that address a wide range of topics and sectors vital to disaster response. The toolkit for each module consists of the following:

1. A content paper, presenting key information about the topic
2. A trainer's guide for training planners and facilitators on a proposed workshop agenda, participant learning objectives, key points for presentations, interactive learning activities, and PowerPoint slides to support the workshop
3. All the materials necessary to support a one-day workshop on the topic

Each topic presents a range of green recovery and reconstruction principles and practices. In addition, several modules combine to form a series of workshops with a focus on a broader application. Most participants in a GRRT workshop would benefit from a combination of the introductory module, which presents the context of green recovery and reconstruction, with one or more sectoral modules, e.g., Strategic Site Selection and Development (Module 4), Materials and the Supply Chain (Module 5), or Construction (Module 6). See Module A, Toolkit Guide, for complete details on ways to combine and manage GRRT workshops.

3.1 Who Is the Toolkit For?

The core audience for the Toolkit includes humanitarian, environmental, and conservation staff as part of disaster recovery and reconstruction efforts. Staff involved in the design, implementation, and management of recovery and reconstruction would benefit from the training program. Target staff includes shelter specialists, water and sanitation specialists, field engineers, program and country directors, disaster management staff, livelihoods specialists, spatial planners, environmental managers, and procurement staff. Other important stakeholders who may be interested include the local community, local and national government officials, and private-sector representatives (e.g., construction contractors, suppliers, and estimators).

In terms of the audience for workshops, the modules have been designed with exercises and other interactive activities for groups of 15 – 25. As a consequence, if a training planner is expecting a smaller or larger group, he or she will need to modify the exercises or the training plan accordingly.

3.2 What Does the Toolkit Try to Achieve?

The goal of the Toolkit is to equip humanitarian, environmental, and conservation field staff involved in post-disaster recovery and reconstruction with the practical information and strategies necessary to improve project outcomes for the affected population, build back communities that are more environmentally sustainable, and reduce risk and vulnerability to future disasters.

The Toolkit is available for use by organizations that want to train their own and partners' staff in the knowledge and skills of building back with a "green" approach.

3.3 How Is It Organized?

The GRRT consists of 10 modules in addition to this Guide. The titles are listed in the following table along with the modules' learning objectives and the intended audience.

TABLE 2: GRRT MODULE LEARNING OBJECTIVES

TITLE	**MODULE LEARNING OBJECTIVES** By the end of the training, participants will be able to….	TARGET AUDIENCE
A. TOOLKIT GUIDE	This is not a training module but a brief summary guide of how the GRRT works and recommended training tools and methods.	All trainers
1. OPPORTUNITIES FOR GREEN RECOVERY AND RECONSTRUCTION: AN INTRODUCTION	1. Describe how addressing the environment in a humanitarian response a) is critical to saving lives and livelihoods, b) reduces risk and vulnerability, and c) contributes to successful recovery outcomes 2. Explain the purpose of the Green Recovery and Reconstruction Toolkit and its components. 3. Discuss key opportunities, misconceptions, and challenges for mainstreaming the environment into humanitarian action.	All participants
2. GREEN GUIDE TO PROJECT DESIGN, MONITORING, AND EVALUATION	1. Understand why it is important to incorporate environmental considerations into project design, monitoring, and evaluation in order to improve outcomes for people and communities recovering from disaster. 2. Integrate environmental indicators into the project strategy and the key steps of the project cycle's development and implementation. 3. Select and measure environmental indicators using the same criteria as other indicators (e.g., SMART indicators). 4. Demonstrate that integrating environmental monitoring into a project does not have to be difficult, costly, or time consuming.	M&E Specialists, Program and Country Directors, Delegates Across Sectors, Environmental Managers

TITLE	MODULE LEARNING OBJECTIVES By the end of the training, participants will be able to….	TARGET AUDIENCE
3. GREEN GUIDE TO ENVIRONMENTAL IMPACT ASSESSMENT TOOLS AND TECHNIQUES	1. Describe the value and role of environmental impact assessment tools in post-disaster recovery and reconstruction project planning. 2. List the five elements of the Environmental Impact Assessment (EIA) process. 3. Use the ESR tool with a sample project to identify and assess the adverse environmental impacts and propose mitigation measures to prevent, reduce, and compensate for the impacts. 4. Describe several tools that are used for environmental assessments in post-disaster settings.	Delegates across sectors (Water and Sanitation, Livelihoods, Shelter, Disaster Risk Reduction), Field Engineers, Program and Country Directors, Environmental Managers
4. GREEN GUIDE TO STRATEGIC SITE PLANNING AND DEVELOPMENT	1. Understand the principles of environmentally sustainable site selection and development. 2. Conduct an assessment of post-disaster site selection, design, and adaptation to address environmental conditions in order to protect people and communities. 3. Identify strategic points of entry in the post-disaster recovery and reconstruction cycle to promote environmentally sustainable site selection and development.	Country Office Directors, Government Officials, Senior Program Managers, and Site Planners who make site planning decisions.
5. GREEN GUIDE TO MATERIALS AND THE SUPPLY CHAIN	1. Identify the typical environmental impacts of building material choices in order to minimize impacts to people and communities recovering from disaster. 2. Use environmentally aware approaches in the design of buildings and selection of materials for post-disaster housing reconstruction. 3. Identify the typical environmental impacts of material procurement options. 4. Describe strategies for procuring materials for post-disaster housing reconstruction that have the least negative impact on human welfare and the environment. 5. Explain the benefits and limits of environmentally conscious decision making in the selection and procurement of building materials after disasters.	Procurement Specialists, Shelter Delegates
6. GREEN GUIDE TO CONSTRUCTION	1. Describe the key principles of environmentally sustainable building design and architecture to protect people and communities recovering from disaster. 2. Describe the key principles of environmentally sustainable on-site construction management. 3. Demonstrate how to apply the key principles of sustainable building design and construction management to a community-based project.	Shelter Delegates, Field Engineers, Spatial Planners

TITLE	MODULE LEARNING OBJECTIVES By the end of the training, participants will be able to….	TARGET AUDIENCE
7. GREEN GUIDE TO WATER AND SANITATION	1. Promote and implement water and sanitation systems that improve community well-being by enhancing environmental sustainability. 2. Explain to stakeholders why water supply project infrastructure should include watershed protection to ensure sustainability, and identify examples of ways to achieve sustainability. 3. Demonstrate how water and sanitation projects can be made more sustainable for communities through initial technology choice, project design, and community consultation.	Water and Sanitation Delegates, Field Engineers, Hygiene Specialists.
8. GREEN GUIDE TO LIVELIHOODS	1. Explain how livelihoods, disaster recovery, risk reduction, and ecosystems are linked. 2. Identify the recurring environmental impacts of typical livelihoods interventions. 3. Understand and address solutions for sector-specific livelihoods challenges, and be able to identify sources of expertise to improve livelihoods project outcomes.	Livelihoods Delegates, Environmental Managers
9. GREEN GUIDE TO DISASTER RISK REDUCTION	1. Describe the ways in which disaster risk and environmental conditions are linked. 2. Integrate environmental issues into typical disaster risk reduction assessments. 3. Identify a set of ecosystem-based activities that can reduce risk and enhance disaster risk reduction programs. 4. Describe how disaster risk reduction activities can have negative impacts on the environment and how these impacts can be mitigated.	Disaster Risk Reduction Delegates, Environmental Managers
10. GREEN GUIDE TO ORGANIZATIONAL OPERATIONS	1. Describe the three core strategies of Green Organizational Operations and how they can be used to implement a plan for reaching greening goals and targets. 2. Assess opportunities for improving the environmental performance of the operational aspects of organizations and identify specific areas to address. 3. Describe three examples of "action items" for greening and discuss how they can be instituted within each of the core strategies. 4. Assign responsibility, motivate staff, and develop a green team to participate in greening efforts.	Facility managers, and other headquarters and field offices staff who have decided to apply the principles of sustainability to their own work environment

3.4 Principles of Green Recovery and Reconstruction

Through their work together, WWF and the American Red Cross have found that there are some key principles that guide how environmental issues can best be integrated into humanitarian operations. The GRRT Training Toolkit incorporates the following principles throughout the modules:

a) "Do no harm" to the environment and beneficiaries

The "do no harm" principle, developed by Mary Anderson in the 1990s, aims to get humanitarian practitioners to examine their programs to ensure that no unintentional negative impacts occur as a result of an intervention. This principle is linked to the "build back safer" concept, and, in the environmental context, means that all programs should be examined for unintentional negative impacts on the environment and the beneficiaries.

This theme is developed in a few of the modules. Specifically, Module 2, Green Guide to Environmental Impact Assessment Tools and Techniques, provides some tools for assessing whether planned activities will have a negative impact, and looks at ways of mitigating unintended impacts from programs.

This is further extended in Module 9, Green Guide to Disaster Risk Reduction, in which the idea of doing no harm is linked to the risk of harm from disasters. The module recognizes that activities presumed to reduce risk might themselves have a risk of doing harm. For instance, a risk reduction intervention to build floodwalls in one location may exacerbate flooding in another location. These secondary, "downstream," or unintended impacts are often not incorporated into the planning of disaster risk reduction interventions.

In Module 6, Green Guide to Construction, the first aim of sustainable construction must be to ensure that efforts do not worsen the environment or the quality of life for those whom the activities are intended to assist. In a similar vein, Module 4, Green Guide to Strategic Site Selection and Development, highlights that a failure to consider environmental sustainability in site selection and development runs counter to the "do no harm" concept, as this failure will likely result in additional harm to resettled individuals and their communities.

b) Multiple benefits of addressing the environment

There are many demands placed on people and agencies that respond to disasters, whose priorities include saving lives, reducing suffering, and jump-starting recovery. Staff may be tempted to address the environment as a lower priority, something that can be put off. However, making the environment a priority and addressing it from the beginning has multiple benefits. These benefits include the potential to do the following:

- Address the underlying environmental issues that may have contributed to causing the disaster in the first place.
- Improve the affected population's health and safety through reduction of air and water pollution (management of debris, liquid and solid wastes).
- Protect future livelihoods, shelter, and water-related needs by protecting the natural resources upon which those livelihoods depend.
- Implement mitigation activities that will preserve and protect people and the environment from future hazards.

Further, proactively addressing environmental issues can slow or reverse trends that lead to deforestation, desertification, soil erosion, and salinization, which impact significantly, for example, on food security and economic development in many countries.

c) Environmental issues cannot always be subcontracted; they require action on your part

This theme aims at ensuring that all humanitarian workers recognize their role in ensuring that their activities do not lead to a damaging environmental impact, or, in some cases, contribute to further disasters. Humanitarian workers must recognize that environmental issues are integral to solutions to mitigate the effect of further disasters. This is not an area that can be considered outside the remit of, for example, a water engineer or a health worker. Everyone must take a part in understanding how a program may affect the environment and ensuring that programs build back safer and do no harm.

d) Build back safer

The post-disaster situation allows humanitarian actors an opportunity to undertake projects that have an environmental component in order to build back safer. This may be, for example, in understanding and reducing shelter and settlement risks and vulnerabilities, or promoting better or changed practices in settlement planning and approach to construction and preparedness.

Principle 8 of the 1994 Code of Conduct for the Red Cross/Red Crescent and NGOs in Disaster Relief echoes this theme: Relief aid must strive to reduce future vulnerabilities to disaster as well as meet basic needs.

e) Be solution-oriented

While many of the modules discuss some of the negative examples of humanitarian practice, and the environmental degradation that has occurred, it is important that we look to solutions to ensure that this trend is changed. All the GRRT modules offer suggestions for ways to mitigate environmental impact and build back safer.

f) Emphasize the use of local knowledge in problem solving

This theme is an extension of the growing recognition in the humanitarian community of the necessity of involving communities in program design. This is to ensure that we are meeting the real needs of communities and individuals, and not those perceived by us, as well as to ensure that local capacity is utilized to the fullest extent.

In this photograph, humanitarian and government staff conducts a rapid environmental assessment with a community affected by Cyclone Jokwe in Mozambique in 2008. Community consultations can help project planners develop recovery strategies that incorporate local knowledge of environmental issues and effectively address the needs of the community. © Jonathan Randall/WWF

ANNEX 1

Environmental Concerns Related to the 2010 Haiti Earthquake

The following text is excerpted from a Rapid Environmental Assessment (REA) that was prepared after a major earthquake that struck Haiti in January 2010. The REA highlights many of the typical environmental issues associated with a disaster and the recovery effort.

The earthquake that struck Haiti on January 12, 2010, resulted in an estimated 230,000 deaths, and the damage or destruction of 285,000 housing units. In addition, up to 598,000 persons left the city of Port au Prince soon after the earthquake due to scarcities of shelter, food, and other basic needs.

As it was clear that an earthquake of that scale would have significant and numerous impacts on the environment, various elements of the U.S. government response dedicated specific efforts to identifying and managing environmental impacts to the greatest degree possible. As part of these efforts, U.S. Agency for International Development/Haiti commissioned CHF International and Sun Mountain International to field a team of Haitian and international staff to complete a Rapid Environmental Impact Assessment (REA) of disaster-affected areas and response operations.

The assessment identified a range of major (life-threatening) issues and actions to address these issues. These immediate actions and additional medium-term issues needed to be considered in planning and implementing the shift from immediate relief operations to sustainable recovery.

1. **Coordination, Management and Information**: The need for an environmentally sound response was generally accepted in Haiti, but the scale and scope of earthquake impacts and assistance far exceeded existing coordination and management mechanisms, leading to general inefficiencies, a weak focus on environmental issues and poor sharing of information.
2. **Sanitation and Waste:** Sanitation was very poor in many of the 400+ rural and urban camps occupied by earthquake survivors. Sewage was not properly managed. There were indications that safe-to-drink water was being contaminated due to improper household-level handling. Vector numbers and vector-related disease (e.g., malaria) appeared to be increasing. Liquid and solid waste disposal was [disorganized] and contributed to short- and long-term environmental degradation and health issues. There was a risk that the inappropriate use of portable toilets (e.g., chemical toilets) was resulting in negative environmental impacts. Hazardous waste, particularly bio-hazardous waste, did not appear to be well managed. Some proposed solutions for waste management, particularly sewage ponds, did not appear to be viable in the long term and could contribute to further environmental damage.
3. **Geophysical and Hydro-Meteorological Hazards Monitoring:** Geological and hydro-meteorological hazards had likely become more dangerous since the earthquake, with the likelihood of increased landslides, flooding and similar impacts with the onset of seasonal rains. These hazard events will affect populations without basic shelter and who may have moved to more hazardous locations than before the earthquake.

4. **Shelter and Shelter Sites:** Ad hoc shelter sites were established on the outskirts of Port au Prince, in ecologically fragile areas, near wetlands, and with limited resources for construction. Shelter in most shelter sites did not meet standards for transitional shelter needs (e.g., suitable for three to five years of use). Plans to build transitional shelter required upwards of 20,000 tons of wood, to be delivered in 45 days. Unless this wood was imported, significant additional damage to the already stressed Haitian environment was expected. The possible damage from shelter sites and transitional shelter was avoidable or could have been significantly reduced. However, an increase in squatting on hillsides (e.g., in the locations of previous, now earthquake-destroyed, buildings) or on new lands identified an obvious immediate need for improved planning and the management of transitional and permanent shelter assistance.
5. **Debris Management:** Between 20 and 25 million cubic yards of debris needed to be appropriately managed to avoid damage to the environment, livelihoods and recovery efforts. Debris disposal was [disorganized], and a proper management process slowly began to be established through a Government of Haiti-USG-UN Development Programme task force. This effort received an environmental review, but further monitoring and reviews would be needed as operations expanded to deconstruct thousands of government and privately owned buildings.
6. **Livelihoods and Food Security:** Livelihoods and food security were significantly affected, with hundreds of thousands of households losing productive assets, having social networks disrupted and facing widespread challenges in meeting food and other basic needs. Disaster survivors had to consider livelihood and food security options that could have a negative impact on the environment (e.g., increased charcoal production) and that could be extremely unsafe (e.g., recovering reinforcing rods from destroyed buildings). At the same time, livelihood strategies were in flux and food markets were unstable, presenting challenges in directing assistance to minimize negative environmental impacts.

Source: Kelly, Charles, and Scott Solberg. 2010. *Rapid Environmental Impact Assessment: Haiti Earthquake - January 12, 2010.* CHF International, Sun Mountain International, and U.S. Agency for International Development. March.

GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source: World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future.* Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

2 GREEN GUIDE TO

PROJECT DESIGN, MONITORING, AND EVALUATION

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

2 GREEN GUIDE TO

PROJECT DESIGN, MONITORING, AND EVALUATION

Sharon Pailler, World Wildlife Fund

Paul Thompson, InterWorks LLC

A NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster recovery and reconstruction approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on integrating environmentally sustainable approaches into project design, monitoring, and evaluation.

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MODULE 2: GREEN GUIDE TO PROJECT DESIGN, MONITORING, AND EVALUATION

Table of Contents

1 INTRODUCTION

1.1 Module Objectives

This module provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle of a post-disaster humanitarian aid project. This includes the development and analysis of project designs that incorporate sustainable environmental factors, the selection of appropriate indicators and targets to measure and monitor environmental impact, and practical guidance on how to monitor and evaluate environmental impact.

Specific learning objectives for this module are as follows:

1. Understand why it is important to incorporate environmental considerations into project design, monitoring, and evaluation in order to improve outcomes for people and communities recovering from disaster.
2. Integrate environmental indicators into the project strategy and the key steps of the project cycle's development and implementation.
3. Select and measure environmental indicators using the same criteria as other indicators (e.g., SMART indicators).
4. Demonstrate that integrating environmental monitoring into a project does not have to be difficult, costly, or time consuming.

The Green Recovery and Reconstruction Toolkit approach presented in this module does not require the adoption of new methods of responding to disasters, but rather requires minor adaptation of existing and commonly used methods with the goal of integrating and monitoring environmental indicators.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 2 in a series of ten modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment and taking advantage of opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction to help to make communities stronger and more resilient to future disasters. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

This module is intended for anyone involved in the conception, design, implementation, monitoring, or evaluation of a humanitarian aid project. It is to be used by people across various sectors, including organizations working with temporary camps, permanent housing, water and sanitation, livelihoods and income generation, or any other activity designed to assist communities recovering from a disaster. Specific audiences may include project managers and designers in the field or at headquarters, construction engineers, monitoring and evaluation specialists, physical planners, contractors, logistics and procurement officers, donors, livelihood specialists, water and sanitation project designers and managers, field engineers, and disaster risk reduction planners. The staff of local and national government agencies, as well as environmental specialists involved in the design, review, and implementation of recovery and reconstruction projects, would also benefit from the training. It is for both national and expatriate staff.

1.4 Module Key Concepts

This module builds on four key concepts:

1. Disaster response and recovery projects can impact the environment both positively and negatively.
2. Disaster response and recovery projects need to be assessed and designed to ensure that environmental issues are identified, negative environmental impacts are minimized, and positive environmental opportunities are supported.
3. Monitoring of disaster response and recovery projects needs to include indicators that identify and measure achievement of or changes to for specific environment-related objectives or sub-objectives.
4. These projects need to be evaluated to determine if the environment-related actions were appropriate and what their impact was, and to draw lessons for future projects.

1.5 Module Assumptions

This module assumes that users are familiar with the project management cycle for humanitarian assistance projects; have a basic understanding of how to design, monitor and evaluate their projects and programs; and are interested in learning how to integrate environmental considerations into this process. The module recognizes a continuum of activities in support of disaster survivors from the earliest hours of emergency life-saving functions through the permanent reestablishment of communities. The focus of this module is on the recovery and reconstruction phases. However, the principles can also apply to the emergency life-saving period after a disaster; addressing environmental issues need not delay project activities. The module is intended to provide ideas for a sustainable approach to humanitarian response, and is not intended to preempt or substitute for adequate consultation when expertise in environmental management issues is required.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success.

Environmental indicators for water quality are being monitored in a wetland. The results will be used to determine how projects should be adapted to reduce erosion, sedimentation, and contamination that can impact water supplies and fishing grounds. © Brent Stirton/Getty Images/WWF

2 PROJECT CYCLE AND THE ENVIRONMENT

2.1 Why Address the Environment?

Environmental issues have both direct and indirect impacts on human life and livelihoods. For example, if water sources are contaminated with chemicals such as mercury (used in mining) or pesticides (used in agriculture and aquaculture), there can be direct, negative impacts on human health. These may include poisoning, birth defects, or even death. Negative impacts are not only the result of industrialization or globalization; if clay is removed from hillsides to be used as a building material for post-disaster shelters, it can increase the risk of landslides and flooding and thereby indirectly endanger human populations. The overexploitation of natural resources, such as fish or timber, may directly benefit the fishermen or logger when he or she sells a product, but indirectly harm future generations who will need these natural resources for their own livelihoods and well-being over the long term. Humans rely on healthy ecosystems for the goods and services that are essential to human life, such as clean air, water, and the raw materials that are processed into food products, clothing, and building materials.

Environmental issues are not often addressed in a humanitarian setting. This may be due to the following reasons:

1. Planners are not fully aware of the environmental impacts of their projects
2. They may believe that the environment is of secondary importance to the goals of their project, or
3. They may believe that addressing the environment is too costly or too troublesome.

It is important to acknowledge that the humanitarian imperative to save lives and reduce suffering must take precedence over other considerations. However, the humanitarian imperative does not have to be achieved at the expense of the environment and, ultimately, of the people who depend upon its health. Humanitarian projects can serve as a platform not only for avoiding environmental degradation, but for improving environmental conditions in order to benefit people's health and livelihoods.

APPROACHES TO CONTROLLING DEFORESTATION AROUND REFUGEE CAMPS

Increased demand for fuel wood from large refugee populations can lead to shortages and scarcity. As refugees and people from local communities are forced to walk longer distances to retrieve fuel wood, the supply becomes further depleted. The search for wood rapidly changes from the relatively benign collection of dead wood to the cutting of live trees and deforestation. In areas of conflict, competition for the decreasing supply of fuel wood can create hostilities and place refugees at greater risk of attack. A similar phenomenon is also seen in association with water sources.

A typical response to this problem is to supply and distribute fuel wood from more remote or "surplus" areas. However, in some instances this approach has proven costly and relatively ineffective. Having obtained the minimum quantity of fuel wood required, refugees continue to collect wood either for additional consumption or to barter for other items. This is illustrated by the situation that arose in the Kagera camps in western Tanzania. Despite provision of US$1.2 million to supply fuel wood, deforestation by the refugee population remained well above normal (pre-refugee) levels.

A number of factors contribute to the pattern of fuel wood use, including the degree of fuel wood scarcity, the types of food refugees receive and cook, traditions, availability of improved stoves, and cultural acceptability of shared family cooking. Environmental objectives can be achieved more efficiently if, for instance, instead of fuel wood being freely distributed, the wood supplied to refugees is exchanged for their participation in environmental activities (e.g., environmental restoration work, such as tree planting). This approach has been used, with some success, in the Dadaab camps in eastern Kenya under the GTZ-RESCUE project.

Source: United Nations High Commissioner for Refugees (UNHCR). 2002. *Refugee Operations and Environmental Management: Selected Lessons Learned.* Geneva.

2.2 Scoping the Environmental Context

The environment affects humanitarian assistance projects. In turn, humanitarian assistance projects affect the environment. The environment must be considered within recovery and reconstruction activities in order to:

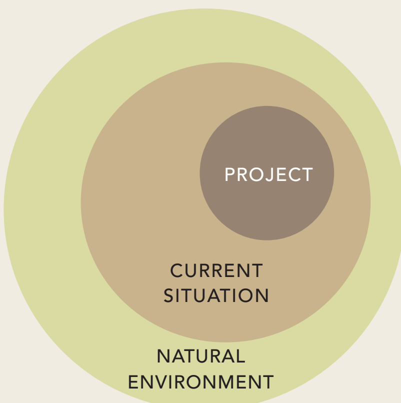
1. **Systematically detect changes in dynamic situations.** Humanitarian organizations work in very dynamic situations. Awareness of environmental issues helps build awareness of changes in these contexts. For example, environmental monitoring could detect the slow onset of a drought, which would adversely affect not only environmental factors such as vegetation but humanitarian factors such as food security.
2. **Systematically measure these changes and determine potential cause-effect relationships between a project and the environment.** In the case of a drought the impact on vegetation could lead to loss of ground cover, causing degradation of the soil, pollution of streams and rivers, and downstream flooding. This could ultimately lead to loss of food sources, starvation, and displacement.
3. **Make informed decisions regarding if and how a project should change to mitigate negative impacts on the environment and maximize positive impacts.** The ultimate project objective is a more appropriate and sustainable impact upon the people that are themselves part of and dependent upon the environment. In the above-mentioned drought, activities would need to be developed to identify alternative sources of water, and to protect the ground cover, stream channels, and different sources for food.

4. **Identify where there are specific threats to the environment and strategic opportunities to address them.** The ability to address environmental threats often depends on the timeliness with which those threats are identified. Projects designed with appropriate indicators can serve as early warning systems, providing sufficient time for agencies to mobilize resources and respond to environmental threats.

The environment is an inseparable part of the intervention context in all disasters and conflicts. Indeed, both natural and technological disasters may have major consequences for the environment and people. (Sometimes, however, natural phenomena like fires and floods are disasters only for people – not for nature.) Different degrees of human access to environmental resources (e.g., water, timber, diamonds, or oil) may result in conflict that can lead to negative a negative impact on the natural environment. Therefore, post-disaster assessments should include the identification of the environmental impact, whether direct or indirect. Sometimes this is expressed in non-environmental terminology, such as "quality of water," "available wood for cooking fuel," or "available land for kitchen gardens," all of which reflect the underlying issues of environmental quality and impact.

As Figure 1 below illustrates, the **Current Situation** occurs within the **Natural Environment**, and the **Project** occurs within the **Current Situation**. When considered as a whole, the **Project, Current Situation**, and **Natural Environment** make up the entire **Intervention Context**. It is essential to consider the role that the **Natural Environment** plays here, because the **Current Situation** (and any associated **Project**) is directly affected by the **Natural Environment**. For example, a disaster may create a temporarily high demand for building materials such as timber (**Current Situation**). Looking beyond the **Current Situation** at the **Natural Environment,** it can be seen that forest resources in the project area have been harvested unsustainably for the past decade. Therefore, in order for a **Project** to be sustainable, we may want to look for ways to minimize the use of timber and reduce demand on local forest resources.

FIGURE 1. INTERVENTION CONTEXT

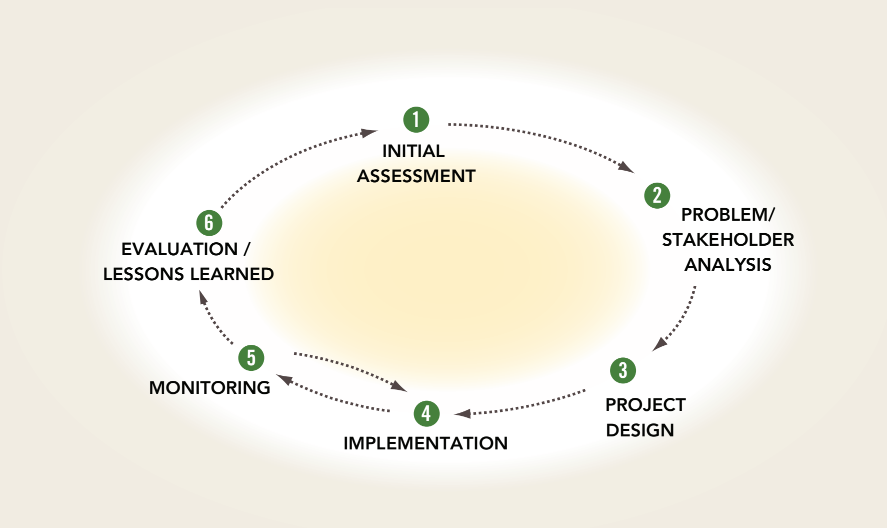


Recovery and reconstruction projects use or impact natural resources, and therefore affect the environment. To be aware of the overall impact and effectiveness of the project, organizations must understand what environmental resources are being used or impacted. This requires that they be addressed throughout the project. Thus, it is useful to develop environmental indicators that are integrated into the monitoring and evaluation (M&E) plan.

2.3 Environmental Considerations in the Project Cycle

In planning and carrying out their disaster response activities, many humanitarian agencies follow a standard project management cycle as depicted in Figure 2:

FIGURE 2: STANDARD PROJECT MANAGEMENT CYCLE

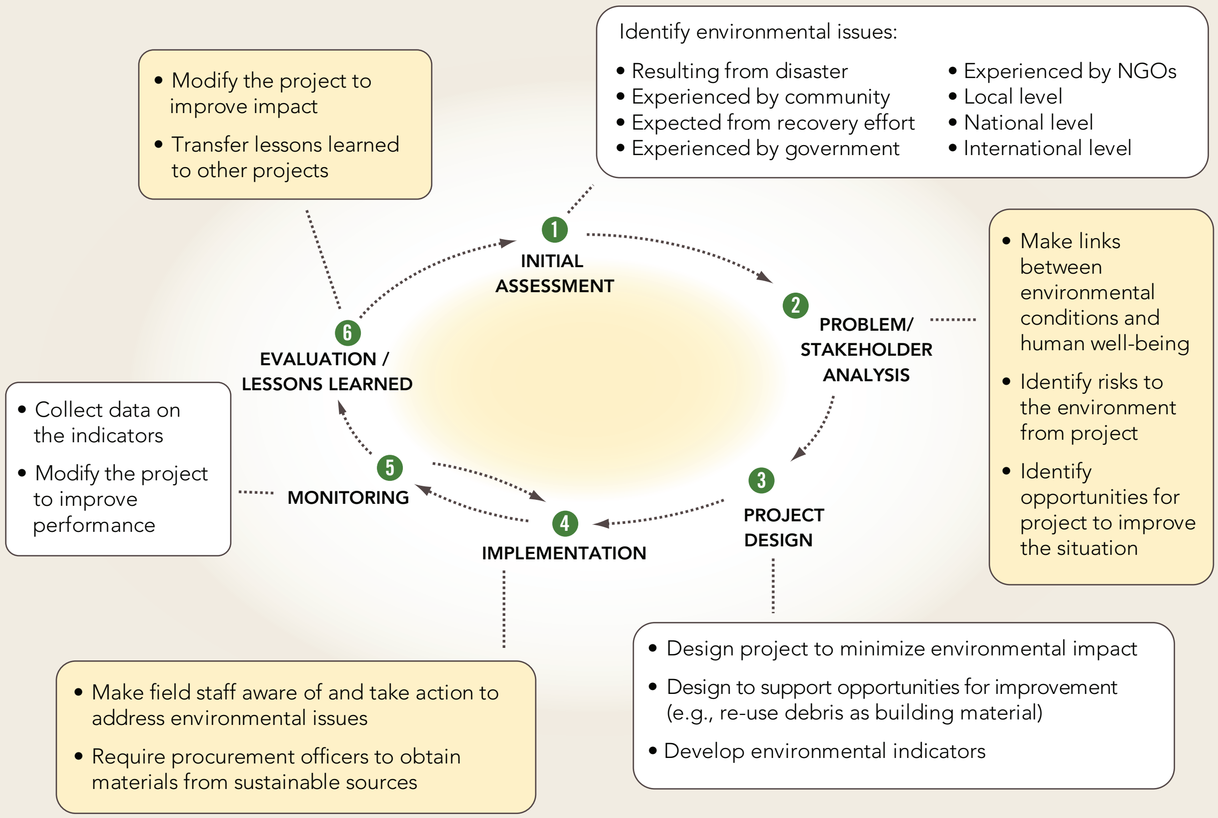


Incorporation of environmental factors into the project cycle allows organizations to better plan for and then gauge the environmental impact of recovery and reconstruction projects. Therefore, it is useful to review the key steps in a typical project management cycle.

Figure 3 provides a visual summary of the project cycle, highlighting key environmental considerations at each stage. Table 1 summarizes the key actions of the project cycle and their links to the environment.

It is important to understand that in emergency settings, the steps presented in the project cycle do not necessarily happen in an orderly sequence. For instance, implementation of the emergency delivery of food and shelter may happen before a project is fully designed. However, the general project cycle is useful in the discussions of the incorporation of environmental considerations.

FIGURE 3. PROJECT MANAGEMENT CYCLE AND ENVIRONMENTAL INTERVENTION POINTS



The initial assessment of the project context is a key opportunity to incorporate environmental considerations into the project. In a post-disaster context, an assessment seeks to identify needs, critical issues, problems, opportunities, potential obstacles, available resources, and, most important, how to address needs and improve the situation. Such assessments can and should include environmental factors. The initial assessment is an opportunity to identify potential areas where project activities may have positive or negative consequences on the environment. Literature reviews, document analysis, data collection, and various rapid and/or participatory rural appraisal tools are used during this stage. An important aspect during this phase of the assessment is identification of the environmental status or benchmark that a project planner may seek to maintain. GRRT Module 3, Environmental Impact Assessment Tools and Techniques, provides additional information on relevant assessment tools.

A stakeholder analysis is an important part of the initial assessment. The stakeholder analysis involves identifying the opinions, priorities, and concerns of key stakeholders, such as community members, government officials, NGOs, conservation environmental specialists, and donors. The stakeholder analysis is an important opportunity to incorporate environmental considerations that inform the project design by asking stakeholders to identify key environmental factors. These may include any current environmental problems (e.g., drought, desertification) and potential threats that humanitarian intervention may pose to the environment (e.g., invasive species), as well as the current fragile environmental states that a project should consider (e.g., delicate mangrove systems that may be harmed by the project's activities). It is important to engage relevant environmental actors such as environmental NGOs, government officials such as ministries of natural resources and environment, and others familiar with and working with relevant environmental issues in that particular area. Conservation and environmental specialists operating in an agency's intervention area will be best equipped (and likely keen) to offer specific advice regarding how humanitarian activities will impact the environment based upon the project's activities and the geographic area in which the agency is working.

The project design, implementation, monitoring, and evaluation stages build upon the information and analysis from the assessment stage. This will be discussed in the forthcoming sections of this module.

TABLE 1. PROJECT MANAGEMENT CYCLE ACTIONS AND LINKS TO ENVIRONMENT

STEP	ACTION	DEFINITION	LINK TO ENVIRONMENTAL MONITORING
1	**INITIAL ASSESSMENT**	Initial assessments provide an understanding of the emergency situation and a clear analysis of threats to life, dignity, health, and livelihoods to determine, in consultation with relevant stakeholders, whether an external intervention is required and, if so, what response is appropriate	The assessment needs to explicitly include environmental issues such as water quality, proximity to protected habitats, dependency on locally obtained fuel wood, farming systems, etc.
2	**PROBLEM / STAKEHOLDER ANALYSIS**	Identify the problem, consider alternative approaches to addressing the problem, and prioritize solutions.	Interpreting assessment results needs to explicitly include the analysis of observed impact on the environment or possible risks to the environment, as well as identify opportunities to improve environmental conditions.
3	**PROJECT DESIGN**	Determine what is required to implement the solution in terms of human and material resources, including work plan and project inputs. This also includes identifying logframe objectives, assumptions, and indicators, as well as the means to measure them.	The design of activities to implement a project needs to consider including sub-activities to mitigate environmental damage or support opportunities for sustainable practices.
4	**IMPLEMENTATION**	Put the plan and related activities into effect, resulting in outputs and outcomes.	Identify the outputs that address environmental goals. Take action to ensure that plan implementation (e.g., construction of a school) does not result in negative environmental impacts.
5	**MONITORING**	A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information.	Use environmental indicators in project monitoring.
6	**EVALUATION**	Systematic and impartial examination of humanitarian action intended to draw lessons to improve policy and practice and to enhance accountability.	Use environmental indicators in project evaluation.

2.4 Constraints to Addressing Environmental Issues

Incorporating environmental factors into the project cycle is not always easy. One of the more formidable challenges is misunderstanding of and resistance to such initiatives among project managers and key stakeholders who may argue that addressing environmental issues is too time consuming, too costly or simply not important. This can be addressed by carefully explaining and demonstrating the benefits of incorporating the environment into the project cycle. This module and the others in this GRRT series provide resources to address this challenge and build understanding of and ownership for environmental issues.

Other important challenges to consider include the following:

Lack of data: It can be difficult to establish environmental baselines, norms, and thresholds, especially in pre- and post-disaster situations. It can also be difficult to compare environmental data, and, depending on the source of data, it is often necessary for project planners to collect data.

Time: Environmental change is long term and may not be measured within a project's life span.

Scale: Often, environmental impacts and change occur beyond a project area or may be due to factors outside the project area.

Cause-effect: It is not always possible to determine definitive "cause and effect" relationships, since factors other than the studied intervention can contribute to the measured changes (attribution).

However, none of these constraints negate the importance of addressing the environment in order to improve outcomes for people and communities recovering from disaster. Furthermore, these challenges are also encountered in data collection and analysis for other intervention areas, whether related to the environment or not. Therefore, there are methodological approaches and tools that can help to address and minimize these constraints, as discussed further below.

This image shows an environmental monitoring specialist conducting a site visit at a dump site where medical waste is being improperly disposed of at a newly constructed health center. Following the 2004 Indian Ocean tsunami, several new health centers were constructed in Sri Lanka. This is an example of how environmental problems, such as solid waste management, can persist even after building construction ends. Project planners must consider the longer-term consequences of their humanitarian interventions during the early project design phase. © Vimukthi Wiratunga

3 INTEGRATING THE ENVIRONMENT INTO PROJECT DESIGN

The project-design phase is the period in which the project designer identifies and prioritizes needs and issues, and envisions how and where an organization may most effectively intervene. During project design, the task is to identify the problem the organization is interested in addressing, as well as all of the direct and indirect contributing factors to that problem, in order to develop an approach to addressing the problem. In a logframe, the approach is usually expressed in terms of "project objectives," which identify the overall goal and the intended results to achieve it.

Logical Framework (Logframe): There are different frameworks used to design and manage a project. This module adopts the vocabulary of the logframe table (goal – outcomes – outputs – activities) that is presented by the American Red Cross and Catholic Relief Services in *Monitoring and Evaluation Planning: Guidelines and Tools*. Logframe terms are defined as the following:

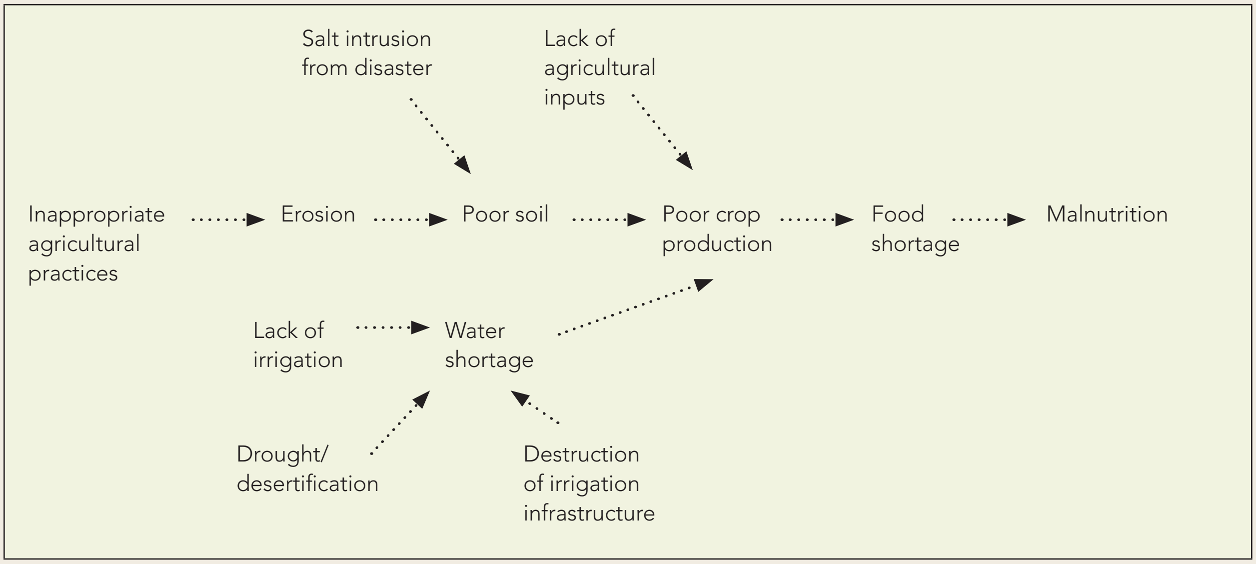
- **Goals** are simple clear statements of the impact or results to be achieved by the project.
- **Outcomes** are a set of changes needed to achieve the goal (usually knowledge, attitudes and practices).
- **Outputs** are products or services needed to achieve the outcomes.
- **Activities** are efforts needed to produce the outputs.

Oftentimes, the greatest environmental opportunities occur at the project design phase. For example, the decision to use construction debris as a building material has the potential to greatly reduce demand on local natural resources and thereby help communities achieve their own sustainability objectives. Similarly, the inclusion of household level composting of organic waste as part of shelter construction can reduce the amount of waste material being produced. The application of compost as fertilizer in home gardens can result in a healthier environment and reduce the need to purchase fertilizer.

3.1 Causal Analysis

Causal analysis is the process of using data from the initial assessment to identify key factors to change in order to improve conditions. The causal analysis informs the selection of a project's goals and the desired changes they seek to realize. Figure 4 illustrates how environmental factors relate to the causal analysis. It shows how the project context and the interrelated problems are embedded in the environment and are therefore affected by and, in turn, affect the environment. An example of a problem that may have emerged from this analysis is malnutrition following a drought. At first glance, one may think that the environment has little to do with malnutrition; however, a closer look at the post-disaster situation reveals several environmental issues that contribute to malnutrition.

FIGURE 4. EXAMPLE OF CAUSAL ANALYSIS INCORPORATING ENVIRONMENTAL FACTORS



The above causal analysis shows the following:

1. Poor soil fertility is contributing to malnutrition. This finding provides an opportunity to improve malnutrition rates by improving environmental conditions (for example, rehabilitating soil that has been contaminated by salt intrusion from a disaster).
2. Water is currently insufficient for good crop production. Stakeholders (during the stakeholder analysis) reported that drought and desertification are an issue that will directly affect an agriculture-based program and should therefore be considered in the analysis. A cycle of drought and inappropriate natural resources management practices, coupled with climatic change, may lead to desertification.

This example illustrates a causal chain in which malnutrition is caused by a food shortage, which is caused by poor crop production, which is caused by a combination of factors including lack of inputs, poor soil, and water shortage. Poor soil is caused by soil erosion and salt intrusion, which are caused by inappropriate agricultural practices. Water shortage is caused by lack of irrigation, drought, and desertification.

3.2 Plan the Response: Developing the Strategy

After identifying the problem(s) to address, it is possible to identify the overall goal and key outcomes of the project. These higher-level objectives are linked to the problem(s) identified in the causal analysis. The next step is to identify the outputs needed to attain the outcomes, and then the activities needed to achieve the outputs.

The logical framework approach helps to clarify how changes in conditions will lead to attainment of the overall goal. Each level in the logframe – goal, outcomes, outputs, and activities – involves identification of the needed results to realize the changes and the impacts necessary to achieve the overall goal. That is, the project designer can describe an improvement in the "problem" or "condition" identified in the causal analysis through a series of "if – then" statements. This is where the strategy is developed and the project comes to life. For example, if the problem of soil erosion is addressed through the introduction of better management practices (*activity*), then farming will become more sustainable (e.g., will minimize slash and burn agriculture) (*output*), more topsoil will remain within agricultural areas (*outcome*), the soil water-holding capacity will increase (*outcome*), crop yields will improve (*outcome*), more food will be available (*outcome*), and the incidence of malnutrition will be reduced (*goal*).

TABLE 2: TEMPLATE FOR LOGICAL FRAMEWORK

PROJECT OBJECTIVES	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
GOAL			
OUTCOME			
OUTPUT			
ACTIVITIES			
INPUTS			

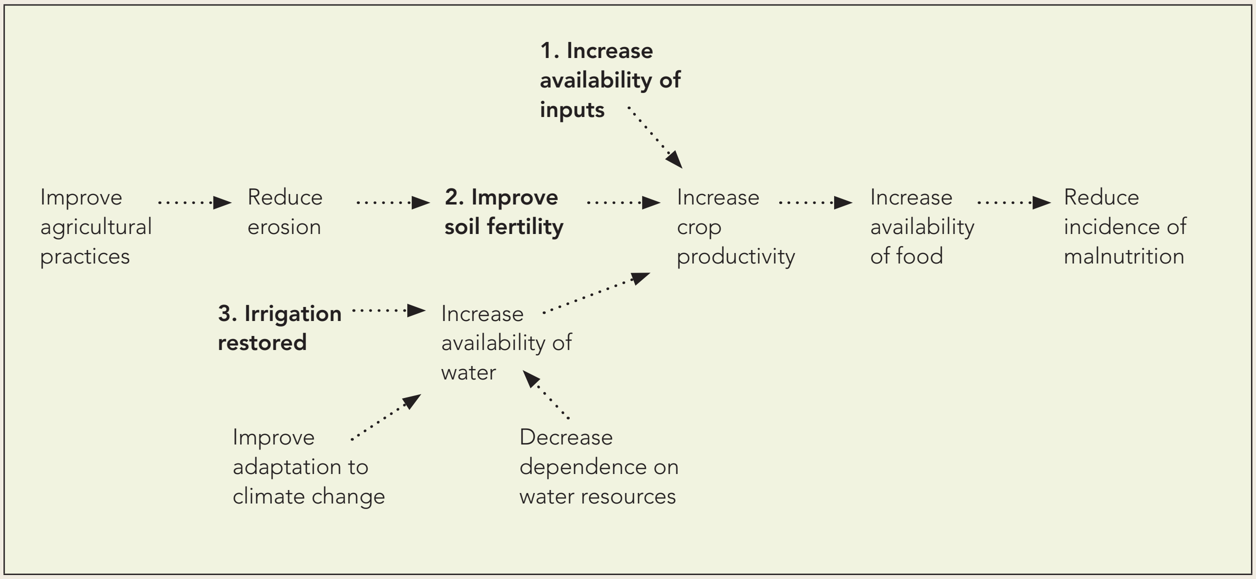
Where the Environment Comes In

When the project designer identifies the root cause of the problem he or she also identifies opportunities for points of entry for solutions. For example, the project designer can solve the problem of malnutrition by importing more food. But that doesn't address the underlying cause of poor crop production. The activities therefore need to address the causes of poor crop production, and may take the project designer through the intermediary causes all the way back to the root cause of inappropriate agricultural practices.

The next step is to identify activities that address the specific problems in this causal chain. This requires the identification of all the potential inputs and processes that go into implementing those activities. Here is where environmental impact considerations enter the picture. The project manager should consider the potential environmental impacts for each of the identified activities. GRRT Module 3, Environmental Impact Assessment Tools and Techniques, provides specific details on how to conduct these assessments. This step will be very helpful in identifying the potential negative impacts on the environment of the proposed activity. In addition, the environment is contributing to the current state the project is trying to improve, and therefore needs to be monitored and considered in the project design. Project designers may identify opportunities to improve environmental conditions in order to achieve the overall goal of the project.

Building upon the initial causal analysis, Figure 5 illustrates objectives for each problem area identified.

FIGURE 5. EXAMPLE ENVIRONMENTAL OBJECTIVES FOR THE CAUSAL ANALYSIS



The following three activities have been identified from the above model:

1. INCREASING THE AVAILABILITY OF AGRICULTURAL INPUTS

		POTENTIAL ENVIRONMENTAL IMPACTS
ACTIVITY	Supply seeds and tools	Spread of invasive/non-native species
OUTPUT	Increased farming activity	Destruction of forest for agricultural uses
OUTCOME	Increased crop yields	None

2. IMPROVED SOIL FERTILITY

		POTENTIAL ENVIRONMENTAL IMPACTS
ACTIVITY	Supply fertilizer	Increased energy requirements and chemical pollution from the processing, transportation, and use of chemical fertilizers (note: can be mitigated if organic fertilizer is used)
OUTPUT	Increased application of fertilizer	Health impacts on farmers if chemical fertilizers are used
OUTCOME	Increased soil fertility	None

3. IRRIGATION RESTORED

		POTENTIAL ENVIRONMENTAL IMPACTS
ACTIVITY	Supply materials to restore damaged channels (shovels/ wheelbarrows)	None
OUTPUT	Digging channels	Improper disposal of excavated materials (e.g., in wetlands); disruption of water flow and water quality in rivers
OUTCOME	More water provided to fields	Depletion of freshwater resources

ADDRESSING THE ENVIRONMENT IN POST-TSUNAMI RESETTLEMENT IN SOMALIA (2004)

In Xaafuun, Somalia, a team of experts from UN-HABITAT determined that the best strategy for reducing health and livelihood risk for people living along the coast was to move houses and living spaces away from the seasonally shifting sand dunes in the aftermath of the destructive tsunami. Strong, sand-laden winds would regularly hit the village during the monsoon season, often burying structures and causing health problems, particularly for women, children, and the elderly. After careful integration of development goals with post-disaster reconstruction, UN-HABITAT and its partners outlined plans that would allow for the restoration of fragile dune habitat adjacent to the damaged settlement area. Reconstruction plans called for the creation of a buffer zone of public space between human settlements and the dune. This in turn allowed for stabilization and recovery of the natural dune ecosystem. Other components of the project that addressed the environment included recycling of construction materials and replanting. A full case study of Xaafuun is contained in Annex 3 of GRRT Module 4, Green Guide to Strategic Site Selection and Development.

Source: Decorte, Filiep. 2008. *Paving the Way for Sustainable Development in a Post-Disaster Situation – the Case of the Tsunami-Damaged Village of Xaafuun North Eastern Somalia*. Nairobi: UN-HABITAT.

Now that the general environmental condition has been assessed with respect to the project, project designers know WHAT to be on the lookout for in terms of potential environmental impacts.

FAILED ENVIRONMENT FAILED PROJECT

Sometimes disaster or emergency response projects fail to integrate the environment into project planning and implementation, ultimately causing negative effects for the project **and** the environment. An example of this would be a project that fails to consider the environmental impacts of house rebuilding. If the building materials have not been sustainably sourced, local construction of houses is likely to lead to massive deforestation. With destruction of the forests, livelihoods based upon non-timber forest products are destroyed as well. Water resources may also be adversely affected, since the extraction of the natural protection that the forest once provided vanishes and sediment in water sources builds up.

3.3 Steps for Integrating the Environment into Project Planning

The following are changes project designers can make to a project monitoring system to better integrate environmental issues. Although they are listed as "steps," they do not have to be completed in the order listed below. Also note that if one of the steps has been missed, **environmental concerns can still be effectively addressed at any stage in the project cycle.**

Step 1. Adapting the Goal Statement to Include Environmental Conditions

Every aspect of a project builds from its overall goal. When the environment is considered in the overall goal of a project, the environment should be automatically considered in all other aspects (such as activities and outputs). If environmental factors are considered in the goal statement, then it will be easier to integrate environmental monitoring into many facets of the project.

However, even if the environment is not reflected explicitly in the overall goal, environmental concerns can still be incorporated into a project at the other levels of the project hierarchy, or even through a designated outcome focusing just on environmental considerations (e.g., monitoring key environmental indicators).

Following the previous drought and malnutrition example, if the goal is to *improve food security of vulnerable populations,* it will be difficult to incorporate activities, outputs, and related indicators that address the environment, because the environment is not a clearly defined aspect of this goal. As a result, environmental issues such as *depletion of freshwater resources, introduction of invasive species*, and *increasing forest conversion to agriculture* will not be explicitly accounted for.

Adaptation of the goal statement's wording is a subtle but powerful tool that can be used to integrate environmental issues into the project strategy, plan, and monitoring activities. Adaptation of this statement so that it considers environmental issues will enable project designers to address these issues throughout every aspect of the project.

Here the goal statement has been modified to incorporate environmental concerns: *Improve food security of vulnerable populations* ***without compromising integrity of local natural resources.*** Now that the overall goal addresses the sustainability of local natural resources, the related activities, outputs, and indicators can directly address those issues.

Since the addition of the "environmental clause" creates a compound goal, project designers may opt to capture the environmental goal as a secondary goal or as a lower level outcome.

Step 2. Adapting the Outputs to Reflect Environmental Priorities

In order to achieve the outcomes and overall goal of a project, the project designer must identify a number of outputs. By addressing environmental conditions in the output statements, the manager can achieve the following goals:

1. Highlight environmental considerations to inform project design and implementation
2. Identify the environmental priorities, elements, and factors that should be measured in indicators

As shown in Figure 5, outputs could include:

- *Seed-exchange networks established to serve target communities (the indicator could be the number of communities participating in a seed-exchange network)*
- *Intercropping techniques implemented*
- *Irrigation ditches or drip irrigation established*

While these actions are directly related to the identified *goal* (improve food security of vulnerable populations in post-conflict areas), they do not address related environmental issues. Because the clause "without compromising integrity of local natural resources" has been included in the goal (or sub-goal) statement, this element must be acknowledged in the outputs. This can be achieved by improving the statements as follows:

- *Established seed-exchange networks serving target communities, **distributing only noninvasive local seeds.***
- *Implemented intercropping techniques **without use of harmful chemicals.***
- *Established irrigation ditches or drip irrigation, **increasing availability of sustainably sourced water for crop production.***

Step 3. Integrating the Environment into the Project Activities

Activities are carried out with an expectation that planned outputs will be achieved; so once the desired environmental results have been defined the designer is ready to construct the project activities. Since the outputs have been revised to include environmental considerations, the project activities may need to be adapted. For instance, if the original outputs included *implement intercropping techniques*, without the added environmental clause, environmental damage could have resulted. For example, project designers may distribute fertilizers that contaminate the local water supply and disrupt the ecosystem.

This is the benefit of reformulating goal statements to consider the environment: it leads the project team to reconsider and adapt activities so that they are more supportive of the environment. Because the outputs incorporate environmental elements into the results, those elements are integrated into project activities, which may change accordingly:

- *Train members of seed-exchange networks on how to identify noninvasive seeds.*
- *Train local farmers in intercropping techniques that utilize only environmentally sustainable fertilizers.*
- *Plan, map, and construct appropriate small-scale irrigation systems where sufficient water sources exist.*

Step 4. Considering the Role of Environment in Assumptions and Risks

A critical aspect of the project design is the identification of assumptions. Assumptions are external conditions necessary to achieve the project goals, outcomes, outputs, and activities, but beyond the control of the project. Assumptions are actually risks stated as positive statements, i.e., what needs not to happen in order for the project to succeed. For example, if an activity is to import sustainably grown timber, there is a risk that inflation and rising fuel prices may increase transport costs beyond the budget of the project. This can be restated as an assumption: "Transport costs will remain within the budget of the project." Therefore, it is important to identify assumptions so that they can be monitored and contingency plans can be developed.

Assumptions and risks should include the consideration of environmental factors. This is particularly important because environmental factors (e.g., water quality, presence of hazardous materials, and availability of natural resources) need to be regularly monitored. The identification of key risks begins at the assessment stage, and it is important to list potential risks throughout the assessment and design stages of a project. For instance, the stakeholder analysis discussed earlier identified drought and desertification as environmental risks that may influence a project focused upon agricultural production. These can be restated as assumptions to be monitored.

The identification of risks not only informs conditions to monitor, but can inform the actual project design and objectives. For instance, if an environmental risk for a water provision project is that the water table may drop due to increased consumption, then the project may want to include a component that limits household water consumption (i.e., user fees). In the crop production example discussed earlier, if water scarcity is identified as a risk, then the project manager may select a more efficient irrigation system (e.g., drip irrigation) to conserve water resources.

Step 5. Integrating Environmental Indicators into Project Monitoring

Once environmental factors are incorporated into the project's goals, outcomes, outputs, and activities, the next step is to identify or develop environmental indicators to monitor the environmental aspect of the project. These indicators will help monitor progress toward objectives and identify unintended consequences and areas in which a project may need to be modified. Environmental indicators follow the same standards as do indicators for other sector areas. Primarily, they should be SMART:

1. **Specific:** The indicator clearly and directly measures a specific result for the goal, output, or outcome it is measuring.
2. **Measurable:** The indicator is unambiguously specified so that all parties agree about what it covers and so that the indicator can be measured in practical ways.
3. **Achievable/Available:** The measurement of the indicator is feasible and realistic, within the resources and capacity of the program, and the data are available.
4. **Relevant:** The indicator provides appropriate information that is best suited to measuring the goal, output, or outcome.
5. **Time-bound:** The indicator specifies the time frame during which it is to be measured.

> Here is an example of a SMART indicator for measuring whether an agricultural activity is sustainably using water: *the number of liters of water per hectare used during the farming season pre- and post-intervention, as compared to freshwater availability.*

Environmental indicators can measure each level in the logframe:

- **Inputs indicators** measure resources used for the activities, e.g., *Number of kilos of native, local seeds distributed.*
- **Output or process indicators** measure the activities pursued to achieve the outputs, e.g., *Percent increase in area of farmland planted with native, local seeds.*
- **Outcome or impact indicators** measure the key changes in the project necessary to achieve the outcomes and goal, e.g., *Percent increase in metric tons of crop yield* or *number of people whose nutrition status improved to an acceptable minimum.*

Often, there are industry standard indicators that can help in the identification of SMART indicators for the project's objectives. These indicators can be useful not only because they will save time, but because careful thought has gone into their development, and since they are recognized in the industry, there may be secondary data on them for the project area. The following is a list of predefined environmental indicators that measure common environmental issues associated with various domains of humanitarian activity.

TABLE 3. PREDEFINED ENVIRONMENTAL INDICATORS

SECTOR	COMMON EFFECTS OF HUMANITARIAN ACTIVITIES ON THE ENVIRONMENT	INDICATOR (NOTE: THESE ARE INTENDED TO BE GENERAL GUIDANCE INDICATORS THAT MAY BE TAILORED TO THE PROGRAM AND MADE SMART)
WATER AND SANITATION (SEE GRRT MODULE 7)	Increased stress and demand on existing water resources	• Change in supply/quality of freshwater • Separate water points for humans and livestock • Latrines and fenced livestock located downstream from water sources
	Decrease in water quality	• Dirty water disposal separate from clean water supplies • Incidence of waterborne diseases such as diarrhea, pneumonia, and typhoid decreasing • Incidence of skin disease decreasing
LIVELIHOODS (SEE GRRT MODULE 8)	Presence of toxic chemicals, or fertilizer or pesticide use	• The purchase and use of chemical pesticides classified by WHO as being in toxicity classes 1A and 1B is discontinued. • Animal manure is recycled for use as fertilizer. • Inorganic fertilizers are used. • Evidence exists of pesticide/fertilizer runoff into water supplies.
	Loss of soil fertility or erosion	• Agricultural activities are taking place on slopes steeper than 20°. • Rainwater/irrigation water runoff is controlled. • Crops are rotated regularly. • Livestock carrying capacity is determined. • Measures to mitigate erosion have been implemented.
	Unsustainable resource use (e.g., fish extraction, fuel wood collection)	• Change in extraction rate. • Agricultural land is allowed to lie fallow. • Environmentally sustainable local agricultural activities are practiced.
SHELTER / CONSTRUCTION (SEE GRRT MODULES 4, 5, AND 6)	Land degradation (loss of forest, mangrove, or wetland)	• Forest products are harvested at a rate that exceeds replacement capacity. • Vegetation important for erosion control, windbreaks, or shade is being protected. • Areas prone to soil erosion have been identified. • A drainage network has been constructed. • Construction project has resulted in the draining of wetlands or other habitats.
	Unsustainable material resource use (e.g., sand, timber)	• Change in extraction rate of resource (sand/timber).

SECTOR	COMMON EFFECTS OF HUMANITARIAN ACTIVITIES ON THE ENVIRONMENT	INDICATOR (NOTE: THESE ARE INTENDED TO BE GENERAL GUIDANCE INDICATORS THAT MAY BE TAILORED TO THE PROGRAM AND MADE SMART)
HEALTH (SEE GRRT MODULE 7)	Increased hazardous waste production, inappropriate storage of hazardous waste	• Change in amount and type of hazardous waste produced. • Health of staff and local population.
	Groundwater contamination from health-related products and waste	• Change in water quality.
LOGISTICS (SEE GRRT MODULE 5)	Energy and fuel consumption	• Change in fuel consumption • Distance from where supplies are procured • Fuel storage tank leaks
	Pollution	• Incinerators are used for disposal of hazardous materials. • Procurement strategies favor packaging without metal bands. • Cardboard/paper materials are recycled or composted.
	Goods procurement is unsustainable	• Quantity of materials originating from unsustainable sources • Environment-friendly procurement policy exists

Some donors require the use of their own predetermined set of indicators as a condition of project funding. One way to address this issue is to incorporate environmental criteria into the indicator **definition**. For example, a donor may require the following indicator: Percent increase of farmland planted. The project designer may choose to define this indicator in such a way that a piece of land would not be counted unless it was planted with native, local seeds. In fact, the project designer could further specify what types of seeds and farming techniques must be used so that the piece of land can be considered successfully "planted."

All logframes or other project plans should be accompanied by an M&E plan that describes exactly how the data will be collected, and gives more detail on these indicators are defined. As the following indicator matrix from UNHCR illustrates (Table 3), it is important to not only identify an indicator but to have clear guidelines for the measurement of the indicator.[1] The goal for this indicator in Table 3 is stated as *An overall goal of domestic energy-related programs should be to reduce the amount of fuel used.* Five clear guidelines are provided to clarify the monitoring objectives, and three methods are given for measuring the indicator. The indicator is expressed as *Percent Reduction in Average Fuel Consumption*, and a scorecard is included for rating the relative success of objective achievement.

1 United Nations High Commissioner for Refugees. 2002. *Environmental Indicator Framework: A monitoring system for environment-related activities in refugee operations.* Geneva.

TABLE 4. INDICATOR GUIDANCE: PERCENT REDUCTION IN AVERAGE FUEL CONSUMPTION.

This example from UNHCR demonstrates how data can be collected to determine the status of an indicator. In this case, the indicator is "percent reduction in fuel consumption." The guidance explains how the indicator can be measured and given a performance score of 0-5.

REFERENCE #	C3
INDICATOR TITLE	**REDUCTION IN FUEL CONSUMPTION**
INDICATOR TYPE	Output
RATIONALE AND OBJECTIVES	The overall goal of domestic energy-related programs should be to reduce the amount of fuel used. Solutions such as the use of fuel-efficient stoves and energy-saving practices are designed to reduce pressure on the environment and improve the well-being of refugees by relieving them of a high burden of fuel collection. It is important to try to encourage the maximum possible number of people to use fuel-efficient practices and devices, and to ensure that those who are doing so are satisfied with the process.
GUIDELINES	1. Clear and measurable targets must be established at the outset regarding the number of families (refugees and villagers) the project intends to reach – for a given time frame. 2. Baseline data on the quantity of fuel consumed (i.e., per household per month, per person per week, per camp block per month, etc.) must be collected so that the percent reduction in fuel consumption can be measured. 3. Emphasis should be on reaching the maximum number of people and on ensuring that those interested in the techniques and principles are convinced of their worth and continue to use them over a long period of time. Follow-up support is essential. 4. Special attention should be given to disadvantaged groups, such as single-headed households, the elderly, and the disabled. 5. Particular attention should be given to families that begin to use fuel-efficient stoves and practices only to later abandon them.
METHODS TO BE APPLIED	1. Spontaneous, random sampling by camp enumerators, project teams, and outreach officers 2. Wood intake surveys at camp level – frequency and time spent gathering wood, weight of wood collected, type of wood, etc. 3. Regular fuel wood weighing at household level – pre-selected homes and random sampling
DATA INTERPRETATION	1. Changes in the number of households using fuel-efficient stoves and practices 2. Alterations in the amount of fuel used at household and camp level, over time

C3 REDUCTION IN FUEL CONSUMPTION

PERCENT REDUCTION IN AVERAGE FUEL CONSUMPTION	Score
0-4	0
5-9	+1
10-19	+2
20-34	+3
35-50	+4
>50	+5

Note: if no target group objective has been established, the overall score is zero.

Step 6. Integrating the Environment into Project Evaluation

When a humanitarian assistance project has been completed, it is the implementing organization's responsibility to conduct an evaluation to determine if it met the project's objectives and to identify the project's impacts. For longer projects, an annual or midterm evaluation may also be conducted. Therefore this section is concerned with the *additional* elements that a focus on environmental impact may bring to project evaluation.

This module has thus far focused on ways to design projects that better address environmental issues associated with the project intervention. **Project monitoring** includes the collection of data that involves the progress made against the indicators. **Project evaluations** use this data to form the basis for identification of and judgments about the relative positive and negative impacts on the environment, and related consequences for the beneficiary population. The differences between monitoring and evaluation are summarized in Table 5.

TABLE 5. THE DIFFERENCES BETWEEN MONITORING AND EVALUATION IN HUMANITARIAN ASSISTANCE

	MONITORING	EVALUATION
DEFINITIONS	A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information	Systematic and impartial examination intended to draw lessons to improve policy and practice and to enhance accountability
OBJECTIVES	To collect information to inform management decisions and eventual evaluation of the intended program	To collect information to determine the general relevance, effectiveness, efficiency, impact, and sustainability of a project or program A formative or midterm evaluation is used to inform ongoing implementation and decision making. A final evaluation is used to inform future projects.
MAIN USERS	Internal managers, evaluators, donors	Wider groups of decision makers and stakeholders, including donors
TIMING	Continuous during implementation	Occasional, before, during, and/or after implementation

With environmental indicators, project designers will be attempting to measure impacts on the environment, including whether the project was able to minimize environmental impact. Therefore, as discussed in the previous section, it is useful to establish targets or thresholds from which to compare a project's intended, or unintended, changes. Targets are the intended changes for which a project strives, while thresholds indicate any substantial declines in environmental quality.

It can be difficult to absolutely determine positive or negative impacts. For example, it is not easy to quantify or measure what constitutes a substantial improvement in soil fertility. Similarly, some environmental indicators can be affected by seasonality and timing. Water quality measurement, for example, may change between wet and dry months. In such instances, it is useful to have the assistance of technical expertise in the field to determine if the thresholds and targets for the environmental indicators measured for monitoring are appropriate and have been met.

The evaluation report should include clear statements that inform the reader of the project's impacts in the environment – positive and negative, intended and unintended. The evaluation report should also relate the environmental impacts to the resultant impacts on the project's objectives, and ultimately on the target population. This information needs to be presented in the evaluation findings, discussed in the evaluation conclusions and lessons learned, and used to create concrete recommendations to inform environmental conservation in future programming.

An evaluation should specifically determine the following:

- **If** the project addressed the environment
- **If** the project had an environmental impact
- **What** effect the environmental impact had on human populations
- **What** was the extent of the impact
- **What** lessons can be learned from the environmental impact to inform future programming

The Terms of Reference (ToR) is an extremely important tool for ensuring that environmental issues are addressed in the planning, implementation, and monitoring of the project. The ToR for an evaluation should include these key objectives, and should specify the appropriate expertise required to make observations about the environmental linkages in the sector. Project planners should consider adding environmental specifications to the ToRs and contracts of their consultants and contractors.

3.4 Methods and Tools to Monitor Environmental Effects

The previous section discussed how to develop environmental indicators and how to integrate them into the project management cycle.

This section briefly presents the methods and the sources used to obtain the data required to determine the status of the indicator.

The GRRT approach does not require the adoption of new methods, but rather requires adaptation of existing methods to include environmental indicators. Various tools and methods can be adopted for use in monitoring environmental indicators, including:

- Comparison of the project status to the project plan as described in a logframe, workplan, budget, and staffing table
- Project outputs at the current stage of the project
- Before and after (or pre/post) comparisons of environmental conditions
- Rapid rural appraisal tools
- Interviews
- Remote sensing[2]
- Household surveys
- Market surveys
- Production/consumption data
- Direct observation (and measurement)
- Physical testing/sampling (soil and water)

Some tools and methods that have been developed specifically for monitoring environmental indicators include the following:

- **Environmental Report Card:** The Report Card is introduced in the GRRT Module 3, *Environmental Impact Assessment Tools and Techniques.* It provides a score of "Superior," "Adequate," or "Deficient" based on a project's environmental performance. Improvement or decline in the overall score of a project can serve as an indicator of the overall environmental performance of a project.[3]
- **Environmental Stewardship Review for Humanitarian Aid:** This is an expanded version of the Report Card that is used at the beginning of the project design phase in order to determine what environmental issues may be associated with the proposed project. It also includes suggestions on how to determine what the environmental impacts are likely to be, as well as how to mitigate these impacts.
- **UNHCR Environmental Indicator Framework:** This handbook is designed to help field staff and managers working in refugee and related situations apply a basic system of monitoring and evaluation to environment-related activities through the use of indicators.

Monitoring for environmental indicators can also be facilitated by coordinating with other organizations that are collecting data, e.g., UN agencies and government ministries. Of course, when using data that have not

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2 Remote sensing provides digital models of the earth's surface using special cameras on airplanes or satellites. It's increasingly used in the humanitarian field for project planning and monitoring, with useful applications for environmental monitoring.

3 The Environmental Report Card, the Environmental Stewardship Review for Humanitarian Aid, and the UNHCR Environmental Indicator Framework are included on the CD of resources for this module.

been collected by the project designer (secondary data), it is critical to make sure the data are relevant and reliable for the project's needs.

In the previous section, it was proposed that environmental indicators should be developed using the basic standards of SMART: Specific, Measurable, Achievable, Relevant, and Time-bound. Of these standards, the process and methods of monitoring focus on the task of measuring the indicators. **Methods for measuring environmental indicators** are no different than those used for any other indicator for any other indicator. Methods to measure indicators should be:

- Accurate
- Reliable
- Cost-effective
- Feasible
- Appropriate
- Timely

The monitoring methods should help a monitor to measure what needs to be measured in the most efficient, cost-effective, and reliable manner. The more costly and complicated it is to measure environmental indicators, the less likely it is that the measurements will be done.

Often, there are indicators that are already being measured by the project that can double as environmental indicators. For instance, one could be *Quantity of water provided to rural farmers via irrigation system.* In this example, the project designer may already be studying this information to see how much of a service the project is providing farmers. The water quantity information can also be used to monitor impact on that water resource. If withdrawals are greater than replenishment, then the extraction rate is unsustainable. The same indicator can be used to monitor project performance as well as environmental impact.

Environmental indicators may also be measured along with other monitoring mechanisms. For instance, if the project designer is conducting household surveys to evaluate beneficiaries' food security, he or she may also note in the survey whether or not the household is actively composting. This has no added cost and can still help with the monitoring of environmental indicators.

Finally, remember that the use of reliable and relevant secondary data can go a long way toward reducing data-collection costs, not to mention reducing the burden on communities from which data are collected.

3.5 Analyzing the Data for Evaluation

It is not enough to collect the data. Data must be analyzed and interpreted to evaluate the project and inform project management decisions. In relation to the environmental factors measured in the project, a good starting point is to determine what is "appropriate," what is an "improvement," and what is "degradation," and to use that information to make comparisons with changes that can be attributed to the project. Environmental changes related to the project can be compared with:

- **Baseline:** What was measured at the beginning of the project.
- **Threshold:** The tolerable limit for negative impacts.
- **Target:** The minimum desired level of positive impact.
- **Norm:** What the "usual" state is.

- **Before-after:** It is often difficult to compare pre-disaster with post-disaster conditions, but this comparison may be possible if a pre-disaster baseline is obtained.
- **Impact (comparison to control):** Compare similar areas with and without intervention; this is much easier to do in the intervention time frame of most humanitarian efforts.

Data analysis can be enhanced through communication with key stakeholders who live in the project area, or who are for some other reason (e.g., a local scientist) familiar with the environmental norms and how and why they have changed.

Tools like remote sensing are making it increasingly feasible to look at befores and afters and to gather a greater understanding about what the norm is or was.

Again, it will be helpful to have the input of experts familiar with the project context and with environmental issues. Even if the project designer knows, for instance, what the pre-disaster state is, he or she may not know the following:

- If that state is good or bad
- If a particular change in state can be considered substantial and outside of the normal range
- If that change is good or bad

ANNEX 1: ADDITIONAL RESOURCES

The following organizations and publications provide a variety of tools, resources, and information that elaborate on the concepts presented in this module.

Organizations

Conserveonline.org: Online library containing conservation tools and techniques. See in particular: Conservation Action Planning: Basic Practice 7. *www.conserveonline.org*

International Association for Impact Assessment (IAIA): Global network promoting capacity development and best practices in impact assessment across a variety of fields. A number of guidelines and best practices for social and environmental impact assessment can be found in IAIA's public documents library. *www.iaia.org*

International Union for Conservation of Nature (IUCN): Non-government organization focusing on pragmatic solutions to environmental issues. As a part of their Monitoring and Evaluation Initiative, IUCN maintains reports, tools, and training materials to promote effective monitoring and evaluation. *www.iucn.org*

United Nations Environment Program (UNEP): Functional organization within the United Nations system that focuses on environment and global sustainability issues. UNEP provides a variety of publications and policy guidelines in the field of monitoring and evaluation that can be accessed by using the search function provided by their website. *www.unep.org*

World Wildlife Fund (WWF): Non-government organization offering a broad array of resources on environmental issues. National and local WWF offices can serve as resources for technical expertise and insight into monitoring, evaluation and assessment of environmental issues at a local level. *www.wwf.org*

Publications

Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross and CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

European Commission. 2007. *Handbook on Environmental Integration in EC Development Cooperation.*

Kessler, J.J. 1998. *Monitoring of Environmental Qualities in Relation to Development Objectives.* Netherlands Development Organization.

Linster, Myriam. 2003. *Environmental Indicators – Development, Measurement and Use.* Paris: OECD.

The Nature Conservancy. 2007. *Conservation Action Planning: Developing Strategies, Taking Action, and Measuring Success at Any Scale.*

United Nations High Commissioner for Refugees. 2002. *Environmental Indicator Framework: A monitoring system for environment-related activities in refugee operations.* Geneva.

United Nations High Commissioner for Refugees and CARE International. 2005. *Framework for Assessing, Monitoring and Evaluating the Environment in Refugee-related Operations: Toolkit for practitioners and managers to help assess, monitor and evaluate environmental circumstances, using mainly participatory approaches.* Geneva.

GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source*:* World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future.* Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

3
GREEN
GUIDE TO

ENVIRONMENTAL IMPACT ASSESSMENT TOOLS AND TECHNIQUES

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT)
is dedicated to the resilient spirit of people around the world
who are recovering from disasters. We hope that the GRRT
has successfully drawn upon your experiences in order to
ensure a safe and sustainable future for us all.

3

GREEN

GUIDE TO

ENVIRONMENTAL IMPACT ASSESSMENT TOOLS AND TECHNIQUES

Jonathan Randall, World Wildlife Fund

Emma Jowett, Consultant

A NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster recovery and reconstruction approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on environmental impact assessment tools and techniques.

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MODULE 3: GREEN GUIDE TO ENVIRONMENTAL IMPACT ASSESSMENT TOOLS AND TECHNIQUES

Table of Contents

1 INTRODUCTION

1.1 Module Objectives

This module describes a number of analytical tools that can be used to determine the environmental impacts of post-disaster recovery and reconstruction projects, and presents a case study using the Environmental Stewardship Review for Humanitarian Aid (ESR).

Specific learning objectives for this module are as follows:

1. Describe the value and role of environmental impact assessment tools in post-disaster recovery and reconstruction project planning.
2. List the five elements of the Environmental Impact Assessment (EIA) process.
3. Use the ESR tool with a sample project to identify and assess the adverse environmental impacts and propose mitigation measures to prevent, reduce, and compensate for the impacts.
4. Describe several tools that are used for environmental assessments in post-disaster settings.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 3 in a series of ten modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment, and taking advantage of opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction to help make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4, 5, and 6 pertain specifically to building construction, with Module 4 focusing on site planning and development, Module 5 on building materials and the supply chain, and Module 6 on building design and construction management. GRRT Modules 7 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

Module 3 is intended for those involved in the conception, design, implementation, monitoring, or evaluation of a humanitarian aid project. It applies as well to those involved in the various planning and implementation stages of temporary camps, permanent housing, water supply projects, livelihoods interventions, or any other activity designed to assist communities that are recovering from disaster. Specific audiences may include project managers in the field or at headquarters, project designers, shelter and other construction professionals, monitoring and evaluation specialists, physical planners, logistics and procurement officers, donors, livelihood specialists, water and sanitation project designers and managers, and disaster risk-reduction planners. The staff of local and national government agencies, as well as environmental specialists involved in the design, review, and implementation of recovery and reconstruction projects, would also benefit from the training. The module may also be used by consultants working for humanitarian aid agencies, and by specialist staff responsible for ensuring that the environmental aspects of humanitarian aid projects are addressed. This module is for national as well as expatriate staff.

1.4 Module Key Concepts

This module builds on six key concepts:

1. Environmental issues directly affect humanitarian activities, and the environmental impacts of disaster and conflict can threaten people's lives and livelihoods.
2. The environmental impact of a project should be considered at the earliest possible stage of the planning cycle, preferably at the project inception phase.
3. Post-disaster needs assessments should begin to address environmental issues and the linkages between human well-being and the environment at the earliest stages. Disaster recovery projects in all sectors should incorporate activities that promote environmental protection and take advantage of opportunities to further human well-being by addressing the environment.
4. An environmental impact assessment may be required by donors, government regulations, your own organization, or as part of normal due diligence.
5. The standard EIA process in humanitarian settings has five components:
    - **Screening:** deciding if an EIA is required based on information collected
    - **Scoping:** gathering environmental intelligence through consultation with relevant agencies and experts and a review of applicable laws and regulations
    - **Impact assessment:** identifying and evaluating alternatives for achieving the objective, and the associated environmental impacts of each alternative
    - **Mitigation measures:** reviewing proposed actions to prevent or minimize the potential adverse effects of the project
    - **Action:** incorporating the mitigation measures in project design and implementation
6. Several tools exist for conducting EIAs in humanitarian aid settings, including the Environmental Stewardship Review for Humanitarian Aid, the Rapid Environmental Impact Assessment in Disasters, the Flash Environmental Assessment Tool, and the Environmental Needs Assessment in Post-Disaster Situations.

1.5 Module Assumptions

This training module assumes that participants are generally familiar with the project management cycle for a humanitarian aid or development project, and are interested in learning how to integrate environmental considerations into this process. The module recognizes that there is a continuum of activities in support of disaster survivors from the earliest hours of emergency lifesaving functions through the permanent reestablishment of communities. The principles of this module are intended to apply to recovery and reconstruction projects that are activated once immediate lifesaving activities have been completed. The module offers ideas for a sustainable approach to humanitarian response; it is not, however, intended to preempt or substitute for adequate consultation where expertise in environmental management issues is required.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation.

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

2 INTRODUCTION TO ENVIRONMENTAL IMPACT ASSESSMENT IN HUMANITARIAN SETTINGS

The immediate phase after a disaster is the period during which efforts to save human lives, alleviate suffering, and reduce economic loss take priority. During this phase, emergency needs, water supplies and sanitation, food aid, temporary shelters, and health needs must be supplied as quickly as possible. While environmental issues are often not considered during this phase, environmental damages can be caused that can negatively impact those trying to recover from the disaster. For example, debris created by disasters is often cleared into unsafe or ecologically sensitive habitats such as lagoons or wetlands that sustain livelihoods (e.g., fishing grounds) and provide other ecosystem services (e.g., clean drinking water), thereby causing additional problems for affected communities.

The longer-term recovery and reconstruction process also presents a number of environmental opportunities and challenges, such as increased demand for local natural resources (e.g., building materials) and the potential for increased air and water contamination. The planning phase for the longer-term recovery and reconstruction process represents a significant opportunity to ensure that communities are "built back safer" than they were prior to the disaster. Taking action to minimize the environmental impacts of the rebuilding process is one way to avoid the excessive exploitation of natural resources on which communities depend for their livelihoods.

This paper provides tools and guidance on how to carry out an environmental impact assessment in a post-disaster situation, and emphasizes the imperative of doing so to mitigate the short- and long-term effects of humanitarian projects on people and the environment. By understanding in full the environmental implications of proposed humanitarian projects and the linkages between people and the environment, humanitarian staff can help improve outcomes for those who are recovering from disaster – and that they are respecting the humanitarian imperative to "do no harm." The UN Office for the Coordination of Humanitarian Affairs and UN Environment Programme have summarized some key environmental issues in humanitarian response clusters, as shown in Table 1.[1]

TABLE 1: KEY ENVIRONMENTAL ISSUES IN HUMANITARIAN RESPONSE CLUSTERS

CLUSTER	ENVIRONMENTAL IMPACTS THAT CAN AFFECT HUMANITARIAN ACTIVITIES	HUMANITARIAN ACTIVITIES THAT CAN CAUSE NEW ENVIRONMENTAL IMPACTS
HEALTH	• Contamination by chemicals, hazardous waste, and weapons • Release of asbestos from collapsed buildings • Presence of debris and carcasses • Unsafe chemicals management	• Improper management of health care waste and expired medicines • Improper management of chemicals required for health protection (e.g., water treatment) • Improper management of waste, debris, and carcasses

1 The cluster approach consists of groupings of UN agencies, non-governmental organizations (NGOs) and other international organizations around a sector or service provided during a humanitarian crisis. Each of the eleven clusters (Protection, Camp Coordination and Management, Water Sanitation and Hygiene, Health, Emergency Shelter, Nutrition, Emergency Telecommunications, Education, Agriculture, Logistics, and Early Recovery) is led by a designated agency. Source: Interagency Standing Committee (IASC). 2006. *IASC Guidance Note on Using the Cluster Approach to Strengthen Humanitarian Response. Geneva: United Nations.*

CLUSTER	ENVIRONMENTAL IMPACTS THAT CAN AFFECT HUMANITARIAN ACTIVITIES	HUMANITARIAN ACTIVITIES THAT CAN CAUSE NEW ENVIRONMENTAL IMPACTS
WATER, SANITATION, AND HYGIENE	• Contamination of water sources by chemicals, hazardous waste, and weapons • Damage of water and sanitation infrastructure, leading to cross-contamination • Presence of debris and carcasses	• Over-pumping of groundwater aquifers • Improper rehabilitation and decommissioning of wells • Water contamination from sewage disposal • Inappropriate/energy-intensive water, sanitation and hygeine (WASH) systems (e.g., septic tanks, desalination plants)
SHELTER	• Contamination of land by chemicals, hazardous waste, and weapons • Environmental hazards (e.g., floods, landslides, volcanoes) • Loss of forests resulting in reduced access to fuel wood and building materials	• Unsustainable supply of shelter construction materials • Inappropriate design for a specific need, site, community, or culture, leading to misuse or nonuse • Unsustainable use of timber and fuel wood in shelter construction • Deforestation and soil erosion • Inadequate disposal of construction and packaging waste
CAMP COORDINATION AND MANAGEMENT	• Contamination of land by chemicals, hazardous waste, and weapons • Environmental hazards (e.g., floods, landslides, and volcanoes)	• Land degradation and biodiversity loss • Improper management and decommissioning of pit latrines • Unsustainable use of natural resources (e.g., timber, fuel wood) • Contamination by fuel spills and disposal of chemicals • Improper decommissioning of camps • Inadequate disposal of construction and packaging waste
LOGISTICS	• Environmental hazards (e.g., floods, landslides, and volcanoes)	• Improper management and disposal of fuel, waste oil, and tires • Chemicals and waste from logistics base operations • Procurement of goods produced through unsustainable practices
EARLY RECOVERY	• Damage to natural resources that support livelihoods • Loss of government capacity for natural resources management	• Unsustainable use of natural resources for reconstruction and livelihoods • Improper land use and urban planning • Failure to conduct strategic environmental assessments and environmental impact assessments • Inappropriate building designs or choices of reconstruction materials • Unequal access to natural resources and changes in tenure • Development of unsustainable livelihoods

Source: UNEP/OCHA Joint Unit. 2007. *IASC Leaflet Humanitarian Action and the Environment.*

2.1 What Is Environmental Impact Assessment?

The principle aim of an Environmental Impact Assessment (EIA) is "to give the environment its due place in the decision-making process by clearly evaluating the environmental consequences of a proposed activity before action is taken. The concept has ramifications in the long run for almost all development activity because sustainable development depends on protecting the natural resources which is the foundation for further development."[2]

An EIA aims to predict environmental impacts at an early stage in project planning and design, find ways to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. With the use of an EIA, both environmental and economic benefits can be achieved. For example, the EIA process can help reduce the costs and duration of project implementation, avoid treatment/clean-up costs, and comply with mandatory environmental laws and regulations.

An EIA is often mandated by law for major infrastructure, commercial, industrial, or residential development proposals. It is a widely recognized environmental management tool for mainstreaming the environment into development projects, and has been made mandatory by legal systems in many countries. In some cases, the EIA process can take two years or more to complete. The EIA tools discussed here, however, are specifically designed for use in disaster response during the relief, recovery, and reconstruction phases. While these tools follow the basic principles of the EIA model, they have been modified for a post-disaster setting so that they can be completed *within a reasonable time frame*.

Many existing assessment tools used in the humanitarian sector can be modified to include EIA components in order to streamline the process. For example, a Community Vulnerability Assessment (CVA) can include a section that clearly examines the environmental impacts of the proposed activities and suggests ways to minimize those environmental impacts.

The Green Recovery and Reconstruction Toolkit approach presented in this module does not require adoption of new methods, but rather calls for minor adaptation to existing and commonly used methods of integrating and monitoring environmental indicators.

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2 Gilpin, Alan. 1995. *Environmental Impact Assessment – Cutting Edge for the Twenty-First Century.* Boston: Cambridge University Press.

2.2 Benefits of Doing an Environmental Impact Assessment in a Humanitarian Setting

The benefits of conducting an EIA in post-disaster humanitarian settings include the following:

- **Sustainable solutions:** Conducting an EIA during the project design phase will provide information about the environmental conditions of the area. This information will allow project planners to better design and adapt their projects to ensure they do not inadvertently put people at risk from environmental degradation. For example, if project planners are designing a water supply project for a community. An EIA will help to determine if drawing from the water source will negatively impact neighboring communities who may depend on it for health or livelihoods. In another example, an EIA can determine the environmental issues associated with using clay bricks as a building material. Project managers may discover that the local clay mine is contributing to landslides, water pollution, and negative impacts on local health.
- **Mitigation of negative impacts:** A disaster and the subsequent humanitarian response can have significant negative impacts upon water, land, air, and other natural resources. If the response is not adequately managed, impacts on community health and livelihoods can also result, such as water contamination, loss of land, and conflict. Early assessment of these risks/impacts can ensure that appropriate mitigation measures and opportunities are identified and implemented. For example, conducting an EIA on an agriculture recovery project may reveal that a proposed irrigation canal would interfere with fish migration routes thereby negatively impacting the livelihoods of fishermen.
- **Reduce costs in the long term:** A short-term approach to humanitarian response can fail to consider the broader aspects – and impacts – of a disaster. Nonetheless, such approaches are often justified by demands on time and money. With donor funding windows notoriously short, implementing agencies often feel pressure to act quickly to produce tangible outcomes. A longer-term approach that includes an EIA process can reduce the likelihood of protracted negative effects and, ultimately, the overall costs of the disaster, as humanitarian assistance is intentionally linked more effectively with development processes. As noted by Concern Universal:

  "The key issue is that all humanitarian assistance should address the immediate, medium-term and long-term needs of a community, in order to reduce the likelihood of negative effects. There needs to be a continuum, whereby relief projects feed into long-term development programmes; they are not separate entities…Good relief should have a basis in future development work, with foundations laid for future recovery".[3]

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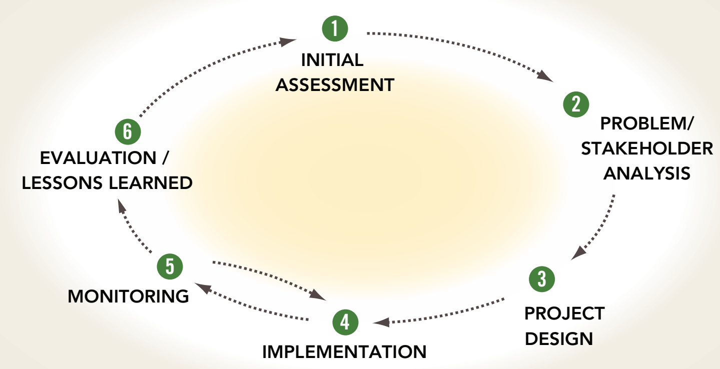
3 Cohen, Roberta and Francis Deng. 1998. *Masses in flight: the global crisis of internal displacement.* Harrisonburg: R.R. Donnelly and Sons Co.

2.3 Project Cycle and Environmental Impact Assessment

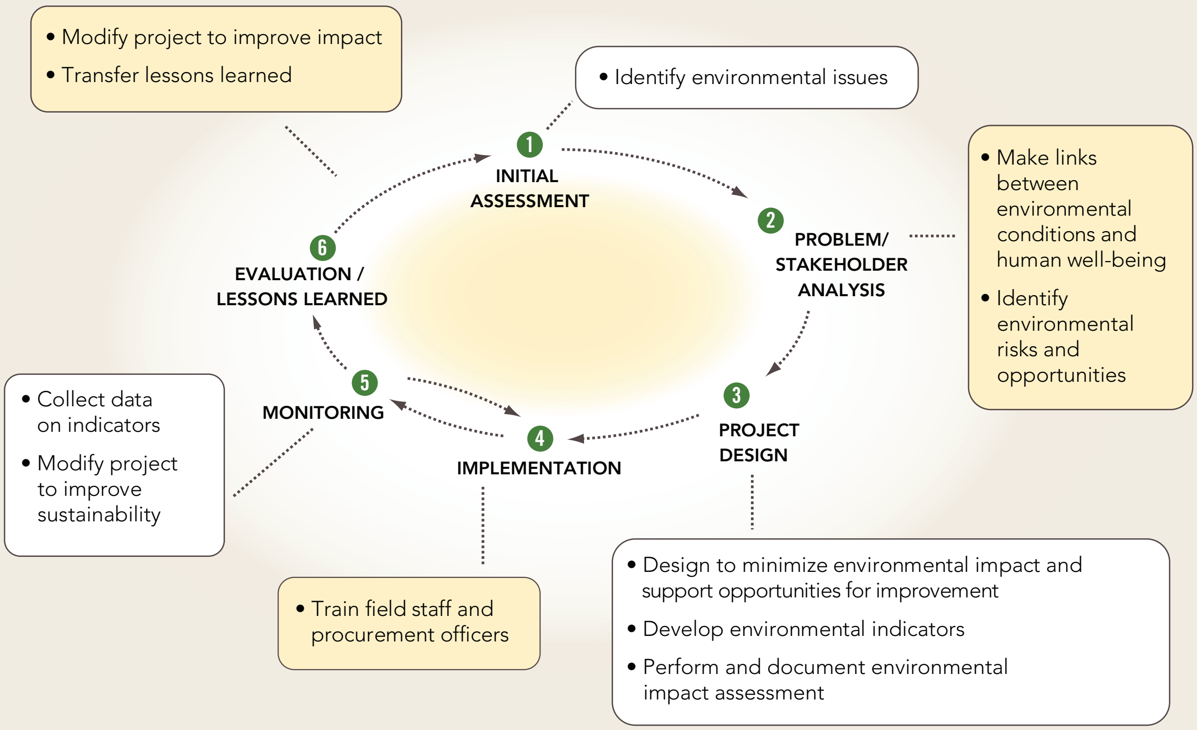
In planning and carrying out their disaster response activities, many humanitarian agencies follow a standard project management cycle as depicted in Figure 1:

FIGURE 1: STANDARD PROJECT MANAGEMENT CYCLE



The EIA planning process should begin by gathering information on the environmental context during the Initial Assessment and Problem/Stakeholder Analysis stages. For example, nearby rivers are being used by communities for drinking water. In the Project Design stage, once project objectives and activities have been determined, the impact assessment of the proposed humanitarian project is performed and documented. Specific environmental impact mitigation measures and action items are developed in this Project Design phase to take advantage of environmental opportunities and minimize potential human and environmental impacts. The Environmental Stewardship Review for Humanitarian Aid (ESR) described further below and included here as Annex 2 can be used along with other tools and guidelines described in this manual at this stage to determine likely environmental impacts and identify appropriate actions to protect people and communities. Action items are carried out by project teams and beneficiaries during the implementation and Project Completion phases. During these phases, specific indicators tracking environmental performance are monitored and opportunities for improvement are evaluated as shown in Figure 2.

FIGURE 2: PROJECT MANAGEMENT CYCLE AND ENVIRONMENTAL INTERVENTION POINTS



2.4 Common Problems, Shortcomings, and Solutions

While the EIA process is essential in designing projects with minimal environmental effects, some challenges to this process have been voiced.[4] An understanding of these challenges can help the humanitarian community develop solutions.

Lack of awareness: Many humanitarian agencies are increasingly becoming aware of the need to include environmental management in their operations. There is, however, an acknowledgment that available tools are not well-promoted or understood. It is felt by some that these tools are the domain of specialists and "too complicated" for a humanitarian relief setting.

> *Solution: Training programs such as the GRRT and tools such as the Environmental Stewardship Review (ESR) and Rapid Environmental Impact Assessment in Disasters (REA) provide practical methods for non-specialist staff and make minimal demands on time and resources. Additionally, humanitarian staff can consult environmental experts in governments, universities, and various NGOs for assistance in determining the key environmental issues associated with their projects.*

Perceived complexity of existing tools: Reasons sometimes given for the nonuse of EIA tools in disasters are that they are too cumbersome, time consuming, and generalized. There is a perception amongst practitioners that EIA tools are simply too complex to be readily applied in emergency situations. The need for participation by affected communities has also been seen as an impediment, it can be time consuming for a community to participate in the decision making.

4 Barret, Eamon, Sarah Murfitt and Paul Venton. 2007. *Mainstreaming the Environment into Humanitarian Response: An Exploration of Opportunities and Issues.* Environmental Resources Management Limited.

Solution: Several EIA tools have been designed specifically for the post-disaster setting using available information as described in Section 3.

Also note that even in immediate relief and emergency situations there are steps that can be taken to protect the environment, even if it is not practical to complete and document the entire EIA process. For example, if fuel wood is in high demand by refugees and there is a limited local supply that cannot be sustainably harvested without negatively impacting life and livelihoods, then a few options may be considered: 1) distributing fuel-efficient stoves that reduce fuel demand; 2) ensuring that distributed food items do not require a lot of cooking and fuel; 3) analyzing and securing sustainable sources of fuel wood; and 4) adding re-greening or reforestation activities.

Lack of evidence of success: Another reason for the nonuse of these tools is the lack of evidence confirming the actual value and success of environmental impact assessments. There is a need to link and integrate procedures and results to ensure that assessments provide useful and effective input into crisis management operations.

Solution: Specific environmental indicators should be included in project performance monitoring and evaluation.[5] Additionally, project teams should be sure to communicate lessons learned and case studies in order to inform future projects.

Integration: Another topic of debate is whether environmental assessment should be applied in standalone assessments or integrated with the various other assessments undertaken during relief and recovery operations. Most humanitarian agencies have response protocols that are tailored for each disaster situation. Efforts to integrate environment impact into these protocols would ensure that the critical linkages between the environment and disasters are recognized and acted upon, thereby ensuring a more holistic assessment.

Solution: Humanitarian staff can streamline the assessment process by combining multiple assessments into one; environmental considerations can be included as well. This creates efficiencies and highlights the key linkages between human well-being and the environment.

5 More information on developing environmental indicators is included in GRRT Module 2, Green Guide to Project Design, Monitoring, and Evaluation.

Environmental Impact Assessments can be incorporated into other assessments being conducted by humanitarian agencies, such as market assessments where survey staff ask vendors about the environmental issues they face in the day-to-day operation of livelihoods activities. Here humanitarian and environmental staff discuss fisheries issues with vendors in Sumatra, Indonesia. © Anita van Breda/WWF

INTEGRATING ENVIRONMENTAL REVIEW INTO PROJECT PLANNING

The following table shows how the American Red Cross added the Environmental Stewardship Review to the project assessment tracking table for water and sanitation interventions in Thailand.

American Red Cross

PROJECT NO.	VILLAGE NO.	VILLAGE NAME/ SCHOOL NAME	SUBDISTRICT	DISTRICT	PROJECT DETAIL	TYPE OF SYSTEM	WATER RESOURCES DATA					COORDINATE		
							RESERVOIR	BOREHOLE	WELL	SPRING	ROOF CATCHMENT	ESR	N	E
KRB1	7	Ban Lang Koh	Koh Sri Borya	Nuakhlong	Pumping and distribution pipes	Community water supply	✓							
KRB2	1	Lantarajprachautit	Koh Lanta Yai	Koh Lanta	Rainwater storage system	School water system		✓		✓	✓	✓	5E+05	8E+05
KRB3	3	Ban Khuan Tor	Khlong Kamao	Nuakhlong	Rehabilitation rainwater harvesting system and water distribution system	School water system	✓	✓	✓		✓	✓	5E+05	9E+05
KRB4	2	Ban Bakan	Aoluk Noi	Aoluk	Rehabilitation rainwater harvesting system and water distribution system	School water system		✓			✓	✓	5E+05	9E+05
KRB5	7	Ban Sang Ga-U	Koh Lanta Ya	Koh Lanta	New toilet and hand-washing basin	School sanitation system		✓			✓	✓	5E+05	8E+05
KRB6	1	Ban Koh Khlang	Khlongprasong	Mueang	Rainwater storage system	Health center water supply						✓	5E+05	9E+05
KRB7	1	Ban Bagan	Aoluk Noi	Aoluk	Garbage bank (training and study trip)	Solid waste management						✓	5E+05	9E+05
KRB8		Ban Koh Jum	Koh Sri Borya	Nuakhlong	Elevated water storage tanks	Community water supply			✓	✓			5E+05	

3 STANDARD ELEMENTS OF AN ENVIRONMENTAL IMPACT ASSESSMENT

Many governments have their own laws and regulations requiring the use of EIAs prior to the implementation of projects in their countries. These governments typically have a lead ministry or agency (e.g., Ministry of the Environment) that serves as the central coordinator for the EIA process in-country. Project planners should be mindful of EIA requirements as well as other applicable environmental laws as they pertain to their project, and should contact government representatives as needed.

In some post-disaster situations, governments may choose to waive or limit requirements to comply with environmental laws and regulations in order to expedite project implementation. This may be necessary in the immediate aftermath of disasters to save lives. **During the longer-term recovery and reconstruction phase, however, the protection of the environment – and thereby protecting people and communities – should be considered an essential component of any project.** In the absence of government capacity to implement environmental requirements, project planners should address these issues directly; the ESR or other tools can be used where government-mandated tools are lacking.

A number of donor agencies – e.g., the World Bank, Asia Development Bank, InterAmerican Development Bank, Australian Agency for International Development, U.S. Agency for International Development, and the European Commission – have their own sets of environmental compliance requirements and methodologies for conducting environmental impact assessments. One such example is the USAID Africa Bureau's Environmentally Sound Design and Management Capacity Building for Partners and Programs (ENCAP) in Africa (www.encapafrica.org). ENCAP provides tools, resources, technical assistance, and capacity building to USAID's Africa missions and partners in order to strengthen environmental management and environmental compliance. In addition to written guidance documents that describe the EIA process relative to the organization, each organization may also have EIA specialists on staff that can help with meeting their requirements.

There are several standard elements in EIAs that apply regardless of the type of project – e.g., whether the EIA is for the installation of septic tanks at the household level or for the large-scale construction of an international airport.

It should be noted that the EIA process is used to identify *priority* environmental issues rather than to generate a comprehensive list of all potential environmental issues. The aim of the EIA process is to allow the project manager to be informed about the environmental issues that can be addressed – all the while acknowledging the primary humanitarian aim of saving lives and alleviating suffering.

THE KEY ELEMENTS OF AN EIA IN POST-DISASTER SETTINGS ARE:

1. **Screening:** deciding if an EIA is required based on information collected
2. **Scoping:** gathering environmental intelligence through consultation with relevant agencies and experts and a review of applicable laws and regulations
3. **Impact assessment:** identifying and evaluating alternatives for achieving the objective, and the associated environmental impacts of each alternative
4. **Mitigation measures:** reviewing proposed actions to prevent or minimize the potential adverse effects of the project
5. **Action:** incorporating the mitigation measures into the project design and implementation

Based on UNEP. 2002. *Environmental Impact Assessment Training Resource Manual.* 2nd Ed. Geneva.

4 OVERVIEW OF ENVIRONMENTAL IMPACT ASSESSMENT TOOLS IN POST-DISASTER SETTINGS

This section provides a brief overview of different Environmental Impact Assessment tools that can be used in post-disaster settings. These include:

- Environmental Stewardship Review for Humanitarian Aid (ESR)
- Guidelines for Rapid Environmental Impact Assessment in Disasters (REA)
- Flash Environmental Assessment Tool (FEAT)
- Environmental Needs Assessment in Post-Disaster Situation: A Practical Guide for Implementation (ENA)

TABLE 2. A COMPARISON OF POST-DISASTER EIA TOOLS

	ENVIRONMENTAL STEWARDSHIP REVIEW FOR HUMANITARIAN AID (ESR)	RAPID ENVIRONMENTAL IMPACT ASSESSMENT IN DISASTERS (REA)	FLASH ENVIRONMENTAL ASSESSMENT TOOL (FEAT)	ENVIRONMENTAL NEEDS ASSESSMENT IN POST-DISASTER SITUATIONS (ENA)
DESCRIPTION	The ESR is designed to evaluate the environmental impacts of a proposed humanitarian aid project (e.g., installation of 100 septic tanks or providing seeds and tools for 1,000 families). It also helps users identify mitigation measures to prevent or minimize the environmental impacts of the project.	The REA is used immediately after a disaster to identify environmental issues that have resulted from the disaster, to help project designers prioritize their environmental activities, and to enable issues identified in the assessment to inform the overall recovery effort.	The FEAT tool's primary aim is to facilitate identification of existing or potential acute environmental impacts that pose risks for humans and nature following the release of chemical compounds.	The ENA is designed to address the many environmental issues that should be considered during early recovery and as part of the broader post-disaster needs assessment.
USUAL APPLICATION WITHIN POST DISASTER SETTINGS	The ESR can be used for any type of humanitarian project or activity. It is meant to be completed in one to three hours and typically includes a field visit to the proposed project site and consultation with project planners and other experts. It was designed especially for recovery and reconstruction projects but can be used during the relief phase as well.	The REA is designed for use in the first 120 days after the crisis. It includes an Organizational Level Assessment that is conducted by the agency leading the REA as well as a Community Level Assessment to capture the environmental issues from the perspective of the communities and groups impacted by the disaster.	The FEAT tool is specifically designed to be used in the hours and days immediately following a disaster. FEAT translates large quantities of scientific information on compounds, their environmental behavior, and their toxicity into basic effect types.	The ENA guide has been written with the expectation that it will be used primarily by a core group of people who might constitute an Environmental Needs Assessment Team (ENAT), with particular use by the ENA Team Leader. It is meant to address the environmental aspects of a broader post-disaster needs assessment.

	ENVIRONMENTAL STEWARDSHIP REVIEW FOR HUMANITARIAN AID (ESR)	RAPID ENVIRONMENTAL IMPACT ASSESSMENT IN DISASTERS (REA)	FLASH ENVIRONMENTAL ASSESSMENT TOOL (FEAT)	ENVIRONMENTAL NEEDS ASSESSMENT IN POST-DISASTER SITUATIONS (ENA)
ADVANTAGES	The ESR can be completed in a short amount of time by a nonspecialist with some expert consultation. It includes guidance on how to conduct the analysis within the worksheet itself.	Designed to be used by a nonspecialist within the first 120 days after a disaster. Includes a specific community-based component.	FEAT is a "first aid" tool to identify environmental impacts and support initial response actions in disaster contexts. The tool is focused on how to assess and address the impacts of release of chemical compounds.	The methodology is flexible and allows identification of the broader environmental issues associated with a disaster. Includes a comprehensive data-gathering component.
DISADVANTAGES	Since the tool is project focused, it is not designed for identification of broad, regional-scale environmental issues associated with a disaster.	The REA covers a broad range of environmental issues; however, it does not provide solutions for the problems that are identified.	FEAT requires a certain level of environmental expertise. It does not take the place of in-depth environmental assessments, which may be appropriate at later stages of the disaster response.	Designed to be used by a core team of around four to five people with some environmental expertise, and is expected to take three to four days to complete.
EXAMPLES OF PRACTICABLE APPLICATION	The ESR has been used by WWF, American Red Cross, CARE, Mercy Corps, ChildFund, FAO, CHF, IFRC, and IOM, among other organizations, after the Indian Ocean Tsunami (2004), Padang Indonesia Earthquake (2009), and Mozambique Cyclone Jokwe (2008).	The REA has been used after the Indian Ocean Tsunami (2004), Pakistan Earthquake (2005), Philippines Cyclone and Flooding (2005) and Mozambique Cyclone Jokwe (2008), among other disasters.	FEAT has been used in a number of disasters (Haiti hurricanes, Benin floods, Philippines typhoon)	ENA was used following the Ukraine Oil Spill (2008), as well as in several post-conflict situations, including those in Afghanistan, Macedonia, and Sudan.
REFERENCES	www.worldwildlife.org	www.proventionconsortium.org	www.ochaonline.un.org	www.oneresponse.info

4.1 Environmental Stewardship Review for Humanitarian Aid

World Wildlife Fund (WWF) and the American Red Cross developed the Environmental Stewardship Review for Humanitarian Aid (ESR) as a tool for evaluating the environmental impacts of humanitarian aid projects with a focus on the recovery and reconstruction phases after the disaster. The ESR can, however, be used during the early relief phase as well as in longer-term development phases as the EIA elements are standardized. The ESR is meant to be completed in about one to three hours and typically includes a field visit to the proposed project site and consultation with project planners and other experts (e.g., government officials at the Environmental Ministry or Water Quality Department). The ESR form is included here as Annex 2. A case study applying the ESR is described in more detail in Section 5.

4.2 Rapid Environmental Assessment in Disasters

To help nonspecialists understand the environmental issues that immediately follow a disaster and begin planning for the response, the Benfield Hazard Research Centre at University College London and CARE International developed the *Guidelines for Rapid Environmental Impact Assessment in Disasters* (REA) for use in disasters and other crisis situations. Supported by a one-day training in the use of the Guidelines, the REA is designed to provide nonspecialists with the means to quickly identify salient environmental issues. It uses a subjective process, incorporating the perspectives of organizations (e.g., NGOs, local government) and communities on the most important environmental issues related to the crisis. The REA process is designed for use in the first 120 days after the crisis, after which routine EIA procedures should be possible.

The four main components of the REA are shown in the table below.

TABLE 3: COMPONENTS OF RAPID ENVIRONMENTAL IMPACT ASSESSMENT IN DISASTERS

MODULE	OUTCOMES
ORGANIZATION LEVEL ASSESSMENT	Identification of critical environmental issues related to the disaster from the perspective of government, NGOs, and humanitarian agencies providing relief and recovery assistance
COMMUNITY LEVEL ASSESSMENT	Identification of critical environmental issues related to the disaster from the perspective of communities and groups affected by a disaster
CONSOLIDATION AND ANALYSIS	Integratation of organizational and community assessments for identification and prioritization of environmentally linked issues involving significant immediate threat to lives, well-being, and the environment
GREEN REVIEW OF RELIEF PROCUREMENT	A screening of the procurement activities for relief commodities and services to minimize negative environmental impacts

Source: Kelly, Charles. 2005. *Guidelines for Rapid Environmental Impact Assessment in Disasters*. Benfield Hazard Research Centre, University College London and CARE International.

A number of sources of information can be used to support the completion of the Rapid Environmental Impact assessment.

The first two modules – Organization Level Assessment and Community Level Assessment – are designed to guide the collection of the basic information necessary for the identification of critical environmental issues. These modules focus on five areas:

1. The general context in which the disaster is taking place
2. The identification of disaster-related factors that may have an immediate impact on the environment
3. The identification of potential immediate environmental impacts of disaster
4. The identification of unmet basic needs of disaster survivors that could have an adverse impact on the environment
5. The identification of negative environmental consequences of relief operations

The two types of assessments – Organization Level and Community Level – have different methods for ranking the environmental concerns. In the Organization Level Assessment, issues are given a priority rating in order to produce a preliminary ranking of concerns from the perspective of the organizations involved. In the Community Level Assessment, a preliminary ranking of concerns is established through surveys, from focus group discussions, and/or from other assessment reports.

The Consolidation and Analysis module moves the analysis process further by providing simple procedures to help consolidate and prioritize the issues identified in the two assessment modules. The consolidation and analysis process will result in a list of priority environmental issues that can serve as a starting point for developing solutions.

The final module in the REA, the Green Review of Relief Procurement, helps relief organizations ensure that the services and material assistance they are providing in response to a disaster have the least negative environmental impact possible. This module lays out the background to green, sustainable procurement and provides a simple evaluation tool for use in emergency procurement.

It is important that users fully complete the assessment process before taking any significant action to address environmental or disaster-related problems that have been identified. The REA is an incremental process designed to draw together many diverse aspects of disaster-environment linkages. The most significant issues requiring highest-priority action will not be fully evident until all assessment results are consolidated and analyzed.

4.3 Flash Environmental Assessment Tool

The Flash Environmental Assessment Tool (FEAT) was developed for use by United Nations field teams deployed in response to natural disasters. The Tool's primary aim is to facilitate identification of existing or potential acute environmental impacts that pose risks for humans and nature, such as the release of chemical compounds. FEAT prioritizes disaster-stricken facilities on the basis of potential risk in order to prevent further impacts. It is specifically designed to be used in the hours and days immediately following a disaster. It can be used on location and is intended to cover the maximum area that could be affected by the disaster. The FEAT was developed by the National Institute for Public Health and the Environment (RIVM), the Dutch Ministry of Spatial Planning, Housing and the Environment (VROM), and DHV Engineering Consultancy.

FEAT translates large quantities of scientific information on toxic compounds, their environmental behavior, and their toxicity into three basic effect types. These are direct effects on humans, direct effects on nature and so-called life support functions (such as drinking water, agriculture, and fisheries), and long-term effects on humans and the environment. The area around the facility where possible effects can be expected is presented in the form of a risk contour area. In summary, FEAT is a "first aid" tool used to identify environmental impacts with a focus on the release of chemical compounds. It does not take the place of in-depth environmental assessments, which may be appropriate at later stages of the disaster response.

4.4 Post-Disaster Needs Assessment

The UNEP Environmental Needs Assessment in Post-Disaster Situations guide was commissioned to address the many environmental issues that should be considered during early recovery and as part of the broader post-disaster needs assessment. It is intended to do the following:

- Identify environmental impacts and risks caused by the crisis and relief operations as well as potential environmental pressures of recovery efforts
- Identify the negative response-related activities or coping mechanisms resulting from an emergency that can impact the environment or create new environmental risks
- Assess institutional capacities at national and local levels to mitigate environmental risks and manage environmental recovery
- Provide a plan that aims to "build back better" by integrating environmental needs within early recovery programming and across the relevant relief and recovery clusters
- Provide a standard reference point for future environmental assessments in the post-crisis setting

5 CASE STUDY: ENVIRONMENTAL STEWARDSHIP REVIEW FOR HUMANITARIAN AID

In the following section, the ESR is examined in further detail with step-by-step instructions for completing the process. A completed example ESR is provided in Annex 2 based on a project done by a fictional aid agency called "Humanitarian International." Humanitarian International is proposing to relocate disaster-affected residents of an island in the Pacific island-nation of Rakudinia to a different island that was previously uninhabited. The proposed project is for the construction of 315 houses, primary school, secondary school, community administration building, community buildings, wastewater disposal system, electric network, roads, and street lighting.

Steps A – C: Review Project Aim and Options

In steps A – C of the ESR form, the project objectives are examined. While decisions may already have been made about the major goal of the project – for example, providing shelter for 295 households – opinions on the ways to achieve this goal may vary. The point of reviewing the project objectives is to reexamine the activities that are planned in order to achieve the project's goal with an eye toward capitalizing on environmental opportunities and reducing environmental impacts. In the shelter example noted above, questions might focus on the various ways by which the project goal (e.g., providing shelter for 295 households) could be achieved and how these different approaches could have different environmental impacts. One might ask, for example:

- Is the construction of new housing required? Or can people be temporarily re-located in existing buildings?
- Is the land of value for multiple purposes (e.g., agriculture, habitat for endangered species, water catchment areas for drinking water)? Will vital natural resources be destroyed?
- What are the building materials that will be used? Can these be sourced in a way that will not cause environmental damage?

The idea here is to write down the details of the project and note the specifics that may impact the environment – such as the location of the project, the scale of the project, the building materials to be used, additional infrastructure to be built, and transport and procurement arrangements.

In most cases, there is more than one way to achieve the project goal. If planned activities are carefully examined for their potential negative environmental impacts, then it may become apparent that more environmentally acceptable alternatives are required.

Step D: Consultation and Environmental Information Gathering

In Step D of the ESR, a list is drawn up of all the agencies or individuals that should be contacted to help project managers gain an understanding of the linkages between the project, the environment, and potential impacts to people and communities. The main point of this inter-agency coordination is to clarify the following:

1. Local, regional, national (and sometimes international) environmental issues that may be associated with the project (e.g., impact of using river sand in cement for use in building foundations)
2. Laws that apply to the project (e.g., buffer zone requirements)

3. Alternative ways to achieve project objectives in order to reduce negative environmental impacts (e.g., use of treatment wetlands instead of a septic tank and leach field in areas with a high water table)
4. The cultural, institutional, and environmental setting of the project, in order to ensure project sustainability

There are many individuals, institutions, and agencies that can provide information on environmental impacts, applicable laws, regulations, and standards. Environmental specialists exist in humanitarian NGOs, government agencies, environmental organizations, and universities. Many of these experts may specialize in one topic – such as hazardous materials, spatial planning, or sustainable sourcing of materials – so it may be worth talking to several to get a comprehensive view of the potential environmental impact of the project. Many donors have environmental requirements for the project proposals they review, and may have environmental officers on staff who may be able to assist with this stage of the EIA if necessary.

Depending upon the scale of the project and its potential environmental impacts, it may be worth hiring a consultant to conduct the analysis. This can be done in collaboration with other NGOs that may have complementary projects or projects similar to your own.

Decisions have to be made regarding how much information – both secondary and primary – should be collected to guide project directions. This includes the review of pre-disaster baseline (i.e., secondary) information before the actual on-the-ground (i.e., primary) data collection, observation, and verification is conducted.

Key sources of pre-disaster baseline information are likely to include the following:

- Environmental profiles for the country/region
- Satellite images and maps
- Project reports from national and international environmental agencies
- Local knowledge on natural resource management
- Previous environment-related assessments
- Specific databases; for example, a registry of protected areas or marine reserves within the affected area
- Wildlife and fisheries management plans
- Housing and related development plans
- Land tenure records

Engagement with a broad range of stakeholders is a fundamental part of this information gathering process. **Some consultation will naturally occur during the site assessment work, but given the importance of recording peoples' own voices and experiences as they identify their own needs and priorities, special attention should be given to this phase of work.** Consultations are an opportunity to ensure that members of the affected society have an opportunity to contribute to the process and, at the same time, to ensure that cross-cutting issues such as gender are properly addressed.

Actions to consider when engaging in stakeholder consultations include the following:

- Clarifying the purpose of each specific consultation
- Seeking permission from community leaders or heads of households before engaging in any consultation process
- Arranging group meetings at a time and venue suitable to the community representatives
- Preparing well for each consultation
- Consulting with a range of people from within the community – men and women, youth and elderly, different professions, etc.
- Obtaining information on the local environmental conditions that existed before the disaster
- Considering use of a semi-structured interviewing process (but have a mental or written checklist as a back up)
- Encouraging openness in all discussions and respecting peoples' opinions
- Encouraging people to tell stories about the environmental situation before the disaster
- Reviewing and verifying during the discussions whether there are gender differences in experiences/views and impact of disasters, and also in access to, control of, and use of natural resources
- Verifying secondary data by first-hand observations
- Being prepared to answer questions from the community
- Reviewing the line of questions and discussions before concluding the meeting: Have any new gaps been identified? Have cross-cutting issues been addressed through the discussions?

The table below highlights key actors and potential sources of information.

TABLE 4: CONTACTS FOR ENVIRONMENTAL INFORMATION GATHERING

LEVEL	TYPE OF INFORMATION
ONLINE SERVICES	• Maps • History of site and previous disasters • Databases on natural resources (e.g., water sources, hazardous material sites) • Information regarding risk mapping and analysis (e.g., landslide potential)
SURVEY REPORTS	• Previous Environmental Impact Assessments for projects in a similar area • Other post-disaster needs assessments • Other cluster-related reports (demography, livelihoods, shelter, etc.) • Disaster preparedness and recovery strategies/plans
LINE MINISTRIES	• Pre-disaster status reports on the environment • Presence of sites of ecological importance • Regulations governing access to natural resources • Information concerning possible sourcing of shelter and construction materials • Information on waste management systems, policies, and practices
SECONDARY DATA	• Pre-disaster environment baseline data collection (e.g., from local environmental NGOs) • Initial severity and impact information • Humanitarian relief information, disaggregated by age and sex
COMMUNITIES	• Former use of natural resources by community members, disaggregated by age and sex • Community level links with livelihood security before the disaster • Governance issues regarding land tenure • Customary regulations governing access to natural resources • Main immediate and longer-term needs
INDIVIDUAL – AND GROUPS OF – STAKEHOLDERS (FISHERMEN, FARMERS, PASTORALISTS, WOMEN'S GROUPS...)	• Pre-disaster use of natural resources by men and women, old and young people • Links with livelihood security before the disaster • Pre-disaster and current livelihood coping strategies • Trends in rural and urban activities in relation to natural resource use and management • Main immediate and longer-term needs of particular groups (men and women, old and young people) • Gendered division of labor (water collection, etc.); gendered pattern of land use and ownership

Source: UNEP. 2007. *Practical Guide to Environmental Needs Assessment in Post-Disaster Situations.*

Step E: Impact Assessment

Once you are satisfied with the quality and quantity of the information collected, the next step is to analyze how the project will impact (or be impacted by) the various environmental concerns, using the Environmental Issues Matrix in Step E. At this stage of the assessment it is important to consider and prioritize the potential negative environmental impacts of the project. The matrix can help inform decisions about which impacts are of highest priority and must be addressed. For example, a project whose construction activities are likely to stir up dust and affect air quality might not have a significant impact if those construction activities are temporary and the project's benefits outweigh the costs. On the other hand, if the project aims, for example, to install a fiberglass boat factory with recurring toxic fumes, then this could be a more significant problem. There is, unfortunately, no single magic formula for prioritizing the issues according to impact. Criteria that can be used include: 1) the severity of the environmental impact, 2) the number of people potentially impacted, 3) the size of the geographic area in which the impacts will occur, and 4) the duration of the potential environmental impact (short term versus long term). The consultations conducted in Step D (above) should assist efforts to prioritize issues and determine whether or not the impacts warrant changes to the project activities.

Step F: Other Information

In addition to understanding the potential environmental impacts of the project, it is also important to understand the local context of the project. Step F asks if the person preparing the ESR has conducted a site visit to the project area, considered local laws and management plans, and allowed the community to provide input on the project.

As part of the ESR process, it is important to consult relevant environmental experts (ESR step D) to help identify and address key environmental issues in disaster recovery projects. In this picture, project planners are consulting with a sustainable aquaculture specialist in Indonesia following the 2004 Indian Ocean Tsunami. © Cut Desyana/WWF

ENGAGING ENVIRONMENTAL CONSULTANTS AS PART OF PROJECT DESIGN

The Canadian Red Cross in Banda Aceh, Indonesia, engaged an EIA specialist to review its shelter projects in order to identify potential impacts on communities and the environment after the 2004 Indian Ocean Tsunami. The construction Terms of Reference was reviewed to make sure they stipulated that wood was to be sustainably sourced. The French humanitarian aid agency Triangle Génération Humanitaire also hired a local environmental consultant. This was to ensure that its livelihoods projects addressed important issues, such as community-based alternatives to pesticide use in agriculture fields, in order to reduce risks to public health and minimize the impacts of rice paddy rehabilitation on mangroves. This would ensure that fish breeding grounds were maintained for sustainable livelihoods.

Source: Roseberry, Rachel. 2007. *A Balancing Act: An assessment of the environmental sustainability of permanent housing constructed by the international development community in post-disaster Aceh.* University of Sussex.

Step G: Determine Need for Additional Studies

The ESR is designed to be used in the post-disaster setting and completed in a relatively short amount of time (i.e., one to three hours, not including site visits and expert consultations). Some projects, however, are of such a size, scale, and complexity that they cannot be adequately evaluated using the ESR tool. If, after completing an ESR, many unknowns about the potential impacts remain, it may be necessary to conduct additional studies to better understand the potential environmental impacts of the proposed project. Step G of the ESR will help you determine whether additional studies will be needed. Considerations include:

- **Size and scale of the project.** *If the project is of such a size and scale that it cannot be adequately evaluated in this worksheet, a more detailed EIA should be completed.*
- **Uncertain and potentially significant environmental risks.** *If the environmental effects of the project are not well understood and could lead to potentially significant risks to the environment and the beneficiaries who depend on the environment, consider preparing additional information and/or preparing a more detailed EIA.*
- **Cumulative impact.** *If the project has a relationship with other activities that, when considered cumulatively, might have a significant impact, then consider conducting additional studies and/or preparing an EIA to understand this impact. If, for example, the project involves the installation of groundwater wells in an area where other agencies are also installing groundwater wells, there may cumulatively be a significant impact on the area's groundwater supply; a groundwater resources assessment should therefore be conducted.*

Examples of additional studies include a hazardous materials survey to determine if the site has been contaminated by hazardous materials, a Solid Waste Management plan to develop a strategy for dealing with the solid waste generated by the project, fisheries management plans, biological assessments or forest management studies, and, as noted above, a groundwater study to understand the impacts of well installation on the groundwater table.

Step H: Design Mitigation Measures and Take Action

Assessments are only valuable to the extent that they inform decision making or result in some form of action. In Step H, based on information obtained in steps A – G, the following questions are considered:

- Does the project need to be changed in order to protect people, communities, and the environment? If so, how?
- Should the project be cancelled?
- What specific actions are needed to allow the community to take advantage of environmental opportunities and minimize potential negative impacts?

The Environmental Issues Matrix (Step E) in the ESR form offers practical suggestions for situations in which a project may need to be changed. For more detailed information on sector-specific actions that can maximize environmental opportunities and minimize impacts, refer to the following sector-specific GRRT modules:

Module 4: Green Guide to Strategic Site Selection and Development
Module 5: Green Guide to Materials and the Supply Chain
Module 6: Green Guide to Construction
Module 7: Green Guide to Water and Sanitation
Module 8: Green Guide to Livelihoods
Module 9: Green Guide to Disaster Risk Reduction
Module 10: Green Guide to Organizational Operations

Additionally, UNHCR's Environmental Guidelines (Annex 3) and IUCN's Environmental Field Manual (Annex 4.1) offer a number of ideas for mitigating the environmental impacts of various response activities. And also UNEP/OCHA, Humanitarian Aid and the Environment provides essential guidance for humanitarian actors. (See Annex 4.2)

As mentioned earlier, it is crucial to follow up on any action items by establishing feedback mechanisms with the stakeholders and by regularly monitoring the project. See GRRT Module 2, Green Guide to Project Design, Monitoring, and Evaluation for more information. It is also essential to address issues raised through the monitoring and feedback process and make relevant changes and adjustments to the project. Make a note of the actions you have taken in Step H of the ESR. This is important not only as a checklist to ensure that, where possible, mitigating action has been taken but also because these documents can serve as an archive and references for future post-disaster situations.

ANNEX 1: ADDITIONAL RESOURCES

The following organizations and publications provide a variety of tools, resources, and information that elaborate on the concepts presented in this module.

Organizations

Conserveonline.org: Online library containing conservation tools and techniques. See in particular: Conservation Action Planning: Basic Practice 7. *www.conserveonline.org*

International Association for Impact Assessment (IAIA): Global network promoting capacity development and best practices in impact assessment across a variety of fields. A number of guidelines and best practices for social and environmental impact assessment can be found in IAIA's public documents library. www.iaia.org

International Union for Conservation of Nature (IUCN): Non-government organization focusing on pragmatic solutions to environmental issues. IUCN maintains guidelines and tools for environmental assessment and monitoring under the "Conservation action tools" heading on their website. *www.iucn.org*

United Nations Environment Program (UNEP): Functional organization within the United Nations system that focuses on environment and global sustainability issues. Through their website, UNEP provides a variety of training and guidance in impact assessment, including materials tailored to development scenarios. See in particular the *Environmental Impact Assessment Training Resource Manual. www.unep.org*

World Wildlife Fund (WWF): Non-government organization offering a broad array of resources on environmental issues. National and local WWF offices can serve as resources for technical expertise and insight into monitoring, evaluation and assessment of environmental issues at a local level. *www.wwf.org*

Publications

Benson, Charlotte, John Twigg, and Tiziana Rossetto. 2007. *Tools for Mainstreaming Disaster Risk Reduction: Guidance Note 7-Environmental Assessment.* Provention Consortium.

Gilpin, Alan. 1995. *Environmental Impact Assessment: Cutting Edge for the Twenty-First Century.* Cambridge University Press.

Kelly, Charles. 2005. *Guidelines for Rapid Environmental Impact Assessment in Disasters.* Benfield Hazard Research Centre: University College London and CARE International.

UNEP. 2002. *Environmental Impact Assessment Training Resource Manual.* 2nd Ed. Geneva.

UNEP. 2008. *Environmental Post-Disaster Needs Assessment (PDNA): A Practical Guide for Implementation.*

UNEP. 2009. *Environmental Assessment of the Gaza Strip following the escalation of hostilities in December 2008 - January 2009.*

UNEP/OCHA Joint Unit. 2007. *IASC Leaflet Humanitarian Action and the Environment.*

UNEP/OCHA Joint Unit. 2008. *Flash Environmental Assessment Tool (FEAT).* www.ochaonline.un.org/ToolsServices/EmergencyRelief/Environmental EmergenciesandtheJEU/ToolsandGuidelines/tabid/5094/language/en-US/Default.aspx

UNHCR and IUCN. 2005. *UNHCR Environmental Guidelines.*

ANNEX 2: ENVIRONMENTAL STEWARDSHIP REVIEW FOR HUMANITARIAN AID

Environmental Stewardship Review for Humanitarian Aid

WWF American Red Cross

The purpose of this worksheet is to assist humanitarian staff improve project performance by identifying and addressing environmental sustainability issues. Use of this worksheet is consistent with SPHERE Standard #6. Include a completed worksheet with the project file.

A. Project Information

Implementing Agency: **Humanitarian International** Project Title: **Pa'agnan Island Relocation**

Project Location: **Pa'agnan, Rakudinia**

Project Coordinator: Joe Reconetto

Environmental Stewardship Review completed by: Achalo Nanathumo/ Mittaka Dangadasa Date: 08-02-2009

B. Project Objectives

Approximately 3,600 people were left homeless when the 2008 tsunami rolled across the tiny island of Ngeri in the country of Rakudinia. The project objective is to resettle the affected community members at an alternate location in the nearby Pa'agnan Island which was previously uninhabited in order to increase community resiliency against future disasters.

C. Project Description

Humanitarian International is planning to construct of a total of 315 houses, primary school, secondary school, community administration building, community buildings, waste water disposal system, electric network, roads and street lighting.

D. Coordination

(Develop a list of local, state, and national experts that can assist with identifying the key environmental issues associated with your project and contact them. Examples include the Ministry of Natural Resources, local planning authorities, Ministry of Fisheries, national and international environmental NGOs, and academic institutions. These contacts will also be useful for completing the Environmental Issues Matrix in Section E. Use the following table to record the results of coordination or attach additional sheets.)

Name	Organization	Key Issues	Date contacted
Sandib Mohammed Baaklini	Ministry of Energy, Environment and Water (MEEW)	Wastewater outflow to the marine environment, proper permitting	23-12-2008
Esther Chuyana	Atoll Office	Not using coral as a source of building materials. Maintaining fish stocks for the fishermen.	05-01-2009

Note: Humanitarian International is in constant contact with both these offices regarding various issues related to Dhuvafaaru, and to obtain permission for various construction activities.

Environmental Stewardship Review for Humanitarian Aid

E. Environmental Issues Matrix *(Complete the following matrix based on the coordination you completed in Section D, along with field visits, and additional research as needed. The objective is to identify the key environmental issues associated with your project and ways to address these issues. Instructions for completing the matrix are in the first row of each column.)*

		Environmental Issue	To answer…	Yes	No	Not sure	Comment	Action Taken
		This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.	*This column suggests ways to obtain the information needed to answer the questions at the right.*	*Check this box if the answer is "Yes."*	*Check this box if the answer is "No"*	*Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*		*This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Air	1	Will the project result in the emission of air pollutants (e.g., smoke, gases, dust particles)?	• Review project proposal. • Consult local natural resources department.	X			Emissions from the three generators installed have been controlled. However, solid waste is burnt under uncontrolled conditions in the open.	Ensure solid waste is burnt under controlled conditions. If not, in future waste burning could become a serious issue. There is also opportunity to improve the waste collection and separation to reduce burning of hazardous waste such as batteries, electronic items, etc.

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue *This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.*	**To answer…** *This column suggests ways to obtain the information needed to answer the questions at the right.*	**Yes** *Check this box if the answer is "Yes."*	**No** *Check this box if the answer is "No"*	**Not sure** *Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*	**Comment**	**Action Taken** *This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Water	2	Will the project result in alteration of waterways (addition of spring catchments, drainage infrastructure, placement of rock along river bank)	Review area maps. Consult with local environmental organizations.	X			The groundwater lens is 1m deep and currently clean. It has been noticed to be recharging relatively quickly in areas where rainwater is not being harvested. Each house has a well but there is no measurement of usage. The waste management centre and fuel storage sites are both concrete padded, and/or bunded with grease traps to collect any wastewater. Each house has a 2,500l rainwater harvesting tank. There are fourteen 10,000l community rainwater harvesting tanks. All the wastewater from households are pumped out to the deep sea. As the underground wastewater collection lines run close to the groundwater lens, there is a possibility for the wastewater pumping system to pump out the groundwater if there is groundwater infiltration into the pipes due to construction defects. This could reduce the groundwater sources rapidly as it is replenished only through rainwater.	Promote water conservation with the beneficiaries and ensure they understand efficient use of the groundwater source and protect it being polluted. Community sensitization programs would be required to ensure community understands their responsibility to conserve water and protect water resources. At present there is a drinking water shortage in the island. Rain Water Harvesting would need to be increased through increasing roof area used for water collection and increasing water storage tank volumes. Increased rainwater harvesting will reduce the recharging of the groundwater aquifer. However, considering the amount of open space available (through observations) for rainwater infiltration to ground, this would not pose a significant threat as long as open spaces are maintained at present levels. As the possibility of island roads and open spaces being paved are unlikely, increasing collection of rainwater at household level should not be a major environmental threat. Ensure the wastewater collection pumps are pumping only wastewater from houses and not the groundwater lens. Regular checkups must be made on the quantity of water pumped out at each pumping station and the total must be tallied with expected wastewater quantities from the island. This needs to be done regularly and systematically.

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue	To answer…	Yes	No	Not sure	Comment	Action Taken
		This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.	*This column suggests ways to obtain the information needed to answer the questions at the right.*	*Check this box if the answer is "Yes."*	*Check this box if the answer is "No"*	*Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*		*This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Water	3	Will the project result in pollution of rivers, streams, wetlands, or other waterways? Examples include: Addition of sediment, wastewater, hazardous materials, runoff from roads.	Review area maps. Consult with local environmental organizations.			X	There are no surface water sources on the site. The groundwater lens is very close to the surface and it is important that islanders understand the possible methods that could pollute this water source. Construction on the island has not affected the groundwater, but future activities by islanders may do so. Wastewater collected through the sewer network is pumped out to the sea. If the sewer outfall is not properly constructed as given in the designs there could be wastewater pollution within the shallow coral areas and wash zone.	Community sensitization programs would be required to ensure community understands their responsibility to protect the water resources. Ensure sewer outfall is properly constructed underwater.
Water	4	Will the project restrict access to water sources or other public use areas/resources?	Review spatial planning maps. Conduct site visit.			X	During dry seasons the water resources available are inadequate for the needs of the people.	As water is scarce in the area it is recommended that water conservation be encouraged within the community. Further, drinking water sources need to be improved as this is a serious issue. Rain water harvesting needs to be increased. For this roof area collecting rain water and storage volumes need to increased.

Environmental Stewardship Review for Humanitarian Aid

WWF American Red Cross

		Environmental Issue	To answer…	Yes	No	Not sure	Comment	Action Taken
		This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.	*This column suggests ways to obtain the information needed to answer the questions at the right.*	*Check this box if the answer is "Yes."*	*Check this box if the answer is "No"*	*Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*		*This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Hazardous Materials	5	Are there toxic or hazardous materials at the project site?	Ask neighboring residents about current and previous use of site. Conduct field survey	X			Fuel is present on the site which is needed for all the machinery. It is currently stored in un-bunded tanks. In the future fuel will be kept on site to run the generators. The fuel tanks are in bunded areas with grease traps for the wastewater. The wastewater goes into the main sewer line, which will be disposed beyond the reef into the ocean.	Ensure that the fuel tanks are filled with as little spillage as possible.
Hazardous Materials	6	Will the project result in the generation of hazardous materials?	Review project proposal.		X			
Cultural Resources	7	Are there cultural, archeological, prehistoric or historic resources at the site?	Talk with neighboring residents. Consult local heritage organizations, museums or universities. Conduct field survey.	X			During construction some archaeological remains were unearthed, together with an ancient well. These artifacts have been kept on the island in an area cordoned off for preservation of this historic site.	Ensure archeological site is kept protected.
Socio-economics	8	Will the project result in an increase in local fees, taxes?	Review project proposal.	X			The Government of the Maldives will be introducing taxes in the future. A management fee would be introduced for electricity and any other services.	These fees are necessary for operation and maintenance of the facilities. A reasonable fee mechanism must be set up to maintain the general community services.
Natural Resources	9	Will the project result in the extraction of natural resources? Examples: Fish, timber, water	Review project proposal. Talk with local natural resource organizations.	X			Water usage will increase with the increase in population. This could have a serious impact on the groundwater sources.	As water is scarce in the area it is recommended that water conservation be encouraged within the community.

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue	To answer…	Yes	No	Not sure	Comment	Action Taken
		This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.	*This column suggests ways to obtain the information needed to answer the questions at the right.*	*Check this box if the answer is "Yes."*	*Check this box if the answer is "No"*	*Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*		*This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Natural Resources	10	Are there any endangered species (e.g., sea turtles, orangutans) or their habitats located near the project or have the potential to be impacted by project activities?	• Talk with local environmental organizations. • Talk with local, provincial, or national natural resources organizations.		X		Turtles have been noted on the beach. The community is generally quite protective of these species.	
Natural Resources	11	Are there any sensitive habitats in the project area (e.g., mangroves, peat bogs, forests, marine resources)?	• Conduct field visits with local experts. • Review natural resources maps.	X			Coral reef surrounds the island. Local regulations stipulate that people are not allowed to remove coral/sand from the reef. Further there is a tendency for most islanders to throw garbage into the sea.	Ensure the community is aware of this regulation and encourage them not to damage the reef. Introduce solid waste management and awareness programs within the community to reduce future impacts on marine resources.
Natural Resources	12	Have construction materials been obtained from unsustainable sources?	• Talk with suppliers about the source of their materials. • Talk with local environmental organizations for additional information.		X		Not applicable at this stage as construction is completed.	
Natural Resources	13	Will the project result in the introduction of non-native species (e.g., exotic plant or animal species)?	• Review project proposal.	X			Beneficiaries will plant fruit trees, vegetables and exotic plants for their gardens.	Local regulations regarding removal of certain vegetative species from neighboring islands and bringing them to this one should be investigated and adhered to.
Disaster Mngt.	14	Is the project site subject to flooding?	• Review floodplain maps if available; • Talk with local planning authorities; • Speak with neighboring residents.		X			

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue *This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.*	To answer… *This column suggests ways to obtain the information needed to answer the questions at the right.*	Yes *Check this box if the answer is "Yes."*	No *Check this box if the answer is "No"*	Not sure *Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*	Comment	Action Taken *This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Disaster Mngt.	15	Is the project vulnerable to natural hazards such as typhoons, earthquakes, landslides, unstable slopes, fires, coastal erosion, wave action, tides, sea level rise?	• Talk to National Emergency Management Agency or similar agency to determine relevant natural hazards in the project area. • Review hazard identification maps.			X	This island is protected by the reef to a large extent. The maximum height of the island is 2.5m above sea level.	As any other island in Maldives this island is also vulnerable to sea level rise, tides, coastal erosion and typhoons.
Disaster Mngt.	16	Will the project result in the ponding of water (thus providing a disease vector for mosquitoes?)	• Review project proposal.	X			There is potential for mosquito breeding within the household wells and rainwater harvesting tanks more than in open ponds.	Protect wells and rainwater harvesting tanks with mosquito netting and filters to reduce mosquito breeding in clean water.
Disaster Mngt.	17	Will the project result in removal of vegetation on slope slides?	• Review project proposal. • Conduct site visit.		X		There are no slopes on the site.	
Disaster Mngt.	18	Will the project involve soil movement or excavation that could lead to an increase in landslides?	• Review project proposal. • Conduct field visit. • Talk with geologists or geo-technical engineers.		X			
Spatial Planning	19	Is the project located within a designated Coastal Zone buffer?	• Talk with local planning authorities to determine if there is a legally designated coastal buffer zone and how this coastal zone policy relates to your project.			X	Some construction activity visible close to the coastal zone.	
Spatial Planning	20	Are there any current or planned Parks or Protected Areas within 15 km distance to the project site?	• Review provincial maps. • Talk with local authorities.		X			

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue *This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.*	To answer… *This column suggests ways to obtain the information needed to answer the questions at the right.*	Yes *Check this box if the answer is "Yes."*	No *Check this box if the answer is "No"*	Not sure *Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*	Comment	Action Taken *This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Spatial Planning	21	Will the project impact or be impacted by other sectors in the project area, such as spatial planning decisions, water and sanitation projects, disaster management, livelihoods activities, etc.?	• Coordinate with other donor agencies and other organizations at work in the project area. • Review spatial planning maps.		X		Spatial planning could have been done better before the construction of the housing to maintain enough greenery within the island as it resembles a desert environment at present.	Greenings programs should be conducted urgently to improve the general environmental conditions. These could be done in partnership with home gardening programs at household level.
Spatial Planning	22	Will the project deviate from existing village plans?	• Review village spatial plans. • If village plans have not been developed speak with community planners/leaders.		X		Permission had to be obtained from local authorities and the government was responsible for planning of the island	

Environmental Stewardship Review for Humanitarian Aid

F. Other information *(Please answer the following questions)*

Are personnel preparing this form familiar with the site? x Yes ☐ No

Did personnel visit the site? x Yes ☐ No

Have local laws been considered and applied to the project? x Yes ☐ No

Are there existing local, state, or national management plans that pertain to the project (e.g., Village Plan, Integrated Water Resources Management Plan, Fisheries Management Plan, etc.)? x Yes ☐ No If so, list plan name(s):

> If plans exist, is the project consistent with existing plans? x Yes ☐ No
> *(If no, determine how the project can better fit with existing plans or whether existing plans need to be updated to reflect current conditions. If no plan exists, consider whether one should be undertaken in coordination with implementation of the proposed project)*

Has the community been given the opportunity to provide input on the proposed project? x Yes ☐ No. In not, ensure that community involvement has been integrated into project planning. If so, describe the method used to obtain community input:

Community has been involved in the project from the planning stage to the managing of the island after it was handed over to them. Housing allocation and beneficiary selection was also conducted in a participatory manner.

G. Determine Need for Additional Studies

Based on completion of Sections A – F, determine whether you require additional information or if the project requires an Environmental Impact Assessment (EIA). In determining whether additional information/EIA is required, consider:

- **Size and scale of the project**. *If the project is of such a size and scale that it can not be adequately evaluated in this worksheet, consider preparing a more detailed EIA.*
- **Uncertain and potentially significant environmental risks.** *If the environmental effects of the project are not well-understood and could lead to potentially significant risks to the environment and the beneficiaries who depend on it, consider preparing additional information and/or preparing an EIA.*
- **Cumulative impact.** *If the project has a relationship with other activities that, when considered cumulatively, would have a potentially significant impact, then consider conducting additional studies and/or preparing an EIA to fully understand the impact. For example, if the project involves the installation of groundwater wells in area where several other agencies are also installing a number of groundwater wells, there may be a cumulatively significant impact on the area's groundwater supply, and a groundwater resources assessment should be conducted.*

In consideration of the above factors, are additional studies or an EIA necessary?

☐Yes x No. If Yes, list the additional studies that are needed (examples include EIA, groundwater study, Fisheries Management Plan, hazardous materials survey, Solid Waste Management Plan, hydrology study, biological assessment, endangered species survey, Forest Management Study):

Environmental Stewardship Review for Humanitarian Aid

H. Take Action!

The most important component in environmental stewardship is to take action. In Sections D (Coordination) and E (Environmental Issues Matrix), you identified the key environmental issues associated with your project and ways to address these issues. These actions may have included improvements to the design of the proposed project, specifications in the Terms of Reference, or the need for additional consultations and research. Use this page to list the specific measures that were identified to eliminate or minimize the impact of the proposed project on the environment.

	Action	Has Action Been Taken?	
		Yes	No
1	Ensure solid waste is burnt under controlled conditions. If not, in future waste burning could become a serious health issue. Need to improve waste collection, separation and reduce burning of hazardous waste such as batteries, electronic items, etc.		
2	Introduce solid waste management and awareness programs within the community to reduce future impacts on water and marine resources		
3	As water is scarce in the area it is recommended that water conservation be encouraged in the community. Community sensitization programs would be required to ensure community understands their responsibility to conserve water and protect the water resources.		
4	Ensure sewer outfall is properly constructed underwater.		
5	Ensure the wastewater collection pumps are pumping only wastewater from houses and not the groundwater lens. Regular checkups must be made on the quantity of water pumped out at each pumping station and the total must be tallied with expected wastewater quantities from the island. This needs to be done regularly and systematically.		
6	Protect wells and rainwater harvesting tanks with mosquito netting and filters to reduce mosquito breeding in clean water. Conduct public health awareness programs for the community on mosquito borne diseases such as Dengue and Chikangunya.		
7	Initiate greening programs in the island and promote home gardening programs to increase greenery and shade. It would further improve the community livelihoods and make the island more habitable.		
8	Ensure fuel tank spillage will not harm the groundwater lens		

ANNEX 3: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES TO BE CONSIDERED IN AN EIA PROCESS

UNHCR's Environmental Guidelines[6] provide examples of the typical activities undertaken in the emergency, and care and maintenance phases of a disaster with related environmental impacts. Measures to reduce or eliminate environmental impacts are also provided. This is reproduced here in a tabular form for simplicity.

ACTIVITIES	RELATED ENVIRONMENTAL IMPACTS	MEASURES TO REDUCE OR ELIMINATE ENVIRONMENTAL IMPACTS
SUPPLIES AND LOGISTICS	Inadequate supply of basic items, e.g., shelter materials, may force displaced people to address needs (wooden poles, branches and grasses, etc.) at the expense of the local environment.	Adequate supplies of appropriate materials must be in place as soon as possible after arrival of camp residents to minimize environmental destruction; supply of other, more environmentally friendly, items (e.g., foods requiring little cooking and fuel) should be promoted where possible and appropriate.
	The volume of transport traffic to a camp can damage local infrastructure (roads and bridges).	Reduce excess transport and maximize use of empty vehicles: shipments of supplies and use of transport facilities should be coordinated with other implementing agencies to minimize overall transport requirements.
	Where excess shipping materials such as wood or cardboard cannot be reused by the affected, they must be removed from the site, burned,or buried in waste dumps.	Consider environmental impacts during procurement: Aim to reduce unnecessary packaging materials at source and/or use empty trucks to remove waste to a location where it can be recycled and/or disposed of in a more permanent dump or landfill site. Promote environmentally friendlier ("greener") procurement and avoid purchasing products whose development or use may damage the environment.

6 UNHCR and IUCN. 2005. *UNHCR Environmental Guidelines.*

ACTIVITIES	RELATED ENVIRONMENTAL IMPACTS	MEASURES TO REDUCE OR ELIMINATE ENVIRONMENTAL IMPACTS
PHYSICAL PLANNING	Camp resident health and protection concerns will be affected by such environmental factors as prevalence of endemic diseases, weather conditions, dust, drainage and soil conditions, water quantity and quality, and exposure to man-made or natural hazards such as polluted soils, hurricanes, radiation sources, earthquakes, and volcanic activity.	When selecting a site for a camp or settlement, factors to be considered include the physical carrying capacity of the site/region; the availability of natural resources and space; proximity to environmentally sensitive areas; topographical, drainage, and soil conditions; vegetation cover; weather conditions; the existence of endemic diseases; the risk of man-made or natural hazards; and the risk of conflict with the local population. Utmost care should be taken to avoid establishment of sites in or near forest reserves, other protected or locally important areas, or national historic monuments. All of these factors should be determined through systematic site surveys.
	Siting refugee camps near national parks, forest reserves, wildlife reserves, areas of cultural importance, open water courses, or fragile ecological areas increases risks of damage by overuse or unmanaged exploitation of natural resources. This includes deforestation, loss of biodiversity, rangeland degradation, erosion, siltation, and the pollution of water resources. Overuse of, and/or damage to, natural resources may cause conflict with the local population.	The size of a camp/settlement should in principle be determined by the carrying capacity of a proposed site. In exceptional cases, as an environmental mitigating strategy, the number of camp residents may exceed the carrying capacity as far as available forest products are concerned, in order to confine environmental damage to areas of lower environmental value. In these cases special measures will have to be taken to provide sufficient wood resources or alternative materials.
	Siting camps on steep slopes can increase risk of erosion, as does the inappropriate design of camps or settlements. Likewise, inappropriate location of a camp site will increase the risk of floods, the need to construct new access roads, and transport distances.	The site plan should determine where and how to build or site different camp elements and where to take special environmental measures such as establishment of greenbelts, construction of drainage canals, and terracing. A plan of action for community-based maintenance of camp infrastructure should be included in the site plan.
	Inappropriate camp layout and shelter design, and poor maintenance of camp infrastructures, may lead to increased risk of soil erosion, poor sanitary conditions, water pollution, and fire hazards, and exposure to wind, dust, and extreme temperatures.	Site preparation implies the careful implementation of the site plan. If heavy equipment is used, indiscriminate bulldozing or radical clearing of ground cover has to be avoided at all costs. During construction of infrastructure and roads, existing tree and bush cover has to be protected to the extent possible. Topographical factors have to be taken into account, following contour lines. The siting of shelter areas should be done so as to respect existing vegetation to the extent possible.
	Excessive damage may be caused because of overcrowding and lack of care. If insufficient shelter material is supplied, camp residents will extract needed materials from areas surrounding the camps. Poles cut from young trees are often the preferred choice of support – which can quickly degrade forests and woodlands – while branches, grasses, and leaves are often gathered as roofing materials.	For shelter construction, it is important to ensure the availability of appropriate materials that are either environmentally benign or have been gathered in a sustainable manner. If this is not possible, alternative building methods have to be explored or shelter materials have to be brought in from outside the region or country. Construction waste should be recycled or properly disposed of.
	In urban areas, displaced people are often accommodated in communal buildings or abandoned residential buildings.	In urban and/or cold climates, priority should be given to distribution of materials that will compensate for damage to dwellings, provide additional protection against cold weather, and/or establish proactive community-based maintenance systems.

ACTIVITIES	RELATED ENVIRONMENTAL IMPACTS	MEASURES TO REDUCE OR ELIMINATE ENVIRONMENTAL IMPACTS
WATER	Depletion of water sources due to unsustainable extraction/collection of water.	Designate competent technical experts for assessment and development planning of water supply systems, and give special attention to assessment of safe yield and quality of available water (throughout the year), and likely environmental impacts resulting from construction and implementation of water supply structures.
	Impacts to local environment due to construction and operation of water supply system (physical structures and chemicals, if used), the intensity and magnitude of which would largely depend on the nature and size of the project and the sensitivity of the local ecosystem.	Maintain water sources and storage facilities and protect them against pollution (e.g., from human waste, garbage, livestock, and siltation). Ensure proper control of any chemicals, such as chlorine, being used to disinfect water.
	Contamination of local water (surface and subsurface) regime due to improper disposal of wastewater and human waste; faulty design and operation/maintenance of piped water network; excessive extraction of groundwater (leading to saltwater intrusion in case of coastal zones and other harmful constituents in the local geological formation); and other related activities in the camp.	Ensure proper management of wastewater to avoid development of wet areas, which can become breeding grounds for mosquitoes and aid the spread of disease. Employ locally appropriate soil and water conservation practices such as bio-engineering, especially in camps that are located in vulnerable areas. Ensure consultations with stakeholders (including authorities/line agencies and representatives from host communities) throughout all the stages of water supply system development. Sensitize and educate the beneficiaries/refugees on the need to conserve water and promote best practices in the use of water. Develop environmentally friendly plans and operations for water supply and disposal systems.

ACTIVITIES	RELATED ENVIRONMENTAL IMPACTS	MEASURES TO REDUCE OR ELIMINATE ENVIRONMENTAL IMPACTS
SANITATION	Poor control of excreta can lead to pollution of surface water as well as groundwater. This can result in the spread of disease to a much larger proportion of the population, with resultant human and financial costs.	Design and put into operation a basic system for disposing of human excreta as soon as possible, taking into account expected needs as well as local conditions and customs. This system should be monitored and upgraded as necessary. Alternative technologies for excreta treatment should be used, to the extent possible, e.g., using excreta in biogas generation or as fertilizer, or other possibilities.
	Poor management of water distribution points and wastewater (i.e., if it is allowed to collect and stand in puddles) can provide breeding grounds for disease vectors.	Control wastewater at source and/or put into place drainage facilities or other remedial measures to prevent accumulation of standing water around water distribution points and camp resident shelter areas. Drainage systems for wastewater can be used to capture and recycle this resource, which can then be used to water vegetable gardens or trees.
	Inadequate provision of solid waste storage near point of use, collection, disposal, and stabilization, or reuse and recycling, could lead to contamination of the environment and the potential spread of disease by humans, animals, insects, or vermin.	A waste management system, appropriate to the demands and local site conditions, should be put into place, monitored, and improved as necessary. Special precautions need to be taken with all hazardous waste such as medical waste, empty pesticide containers, and used or expired chemicals. Implementation of a program involving the "3-Rs" (reduce, reuse, and recycle) should be part of a waste management plan.
	Dust carried in the air can be irritating or harmful to the eyes, respiratory system, or skin, and can contaminate food and damage sensitive camp equipment. Under some conditions, dust can be contaminated with fecal matter and may be a direct cause of disease. Smoke generated as a result of poor cooking practices and the wrong design of shelters can be a concern, as it is hazardous to human health.	Camp design (including shelter for camp residents) and operation should aim to minimize the production of dust and smoke. Ground cover should be maintained or replaced, to the extent possible.
	Insects and rodents are primary vectors for the spread of disease within a refugee camp and between refugee and local populations. These pests can also contaminate food supplies, either before or after distribution to refugees. Some measures used to control pests (i.e., chemical applications) can be toxic to humans (both beneficiaries and workers), to non-target organisms, and to the environment.	Insect and rodent control measures should be implemented, taking into account the toxicity of many pesticides and insecticides. Over the longer term, non-chemical pest-control methods should be instituted, to the extent possible.

ANNEX 4: GUIDANCE ON POSSIBLE MITIGATION MEASURES

Annex 4.1: IUCN Environmental Field Manual

1: Avoid over-exploitation of natural products.

- Ensure that fuel wood and timber are obtained according to plans set out in the contingency planning phase (where these exist).
- Ensure that natural resource extraction for shelter and food is carried out according to existing legislation.

2: Avoid unplanned habitat change.

- Put up shelters only in areas that have been identified for the purpose.
- Avoid clearing natural habitats if they have not already been identified for clearance.

3: Minimize solid waste pollution.

- Dispose of solid waste at locations identified in the contingency planning phase.
- Start a process of separating degradable from nondegradable waste and recyclable and reusable waste.
- Ensure that incineration is not used as a method of waste disposal, as this contributes to global warming and air pollution.
- Actively train persons at shelters to dispose of waste responsibly.

4: Minimize water pollution.

- Build toilets only in locations identified in the contingency planning phase.
- Manage wastewater only in the manner identified in the contingency planning phase.

Annex 4.2: Essential Guidance for Humanitarian Actors (UNEP/OCHA Joint Unit. 2007. *IASC Leaflet Humanitarian Action and the Environment.)*

1. **Hazardous substances:** All sources of acute risk (such as chemical spills from damaged infrastructure) should be identified as early as possible. The Joint UNEP-OCHA Environment Unit provides emergency assistance through rapid assessments and advice. Access should be restricted until clean-up or risk-reduction measures can be taken.
2. **Emergency waste management:** Plan the location of emergency waste disposal sites with local authorities to avoid contamination of water sources and agricultural land, and to avoid disease vectors and odors. Do not burn waste without a proper risk assessment, especially in the case of plastics. Medical and other forms of hazardous waste should be disposed of using appropriate methods, e.g., steam sterilization (autoclaves).
3. **Water use:** To determine sustainable levels of water use, an early assessment of the presence, quality, quantity, and recharge rate of groundwater sources

should be conducted. Monitor groundwater extraction to ensure that the natural recharge rate is not exceeded. Raise awareness of the importance of water conservation.

4. **Sanitation:** Take care to locate latrines downstream of wells, at least 30m from groundwater sources and at least 1.5m above the water table. Fitting pit latrines with concrete slabs eliminates the need for secondary wooden slabs or supporting beams and facilitates easy cleaning. Consider the up- and down-stream impacts of water use and sanitation, as well as its cumulative impact on a watershed.
5. **Energy consumption:** The use of wood or charcoal for domestic energy by displaced people has a major impact on the environment and livelihoods. Promote energy-saving measures, such as fuel-efficient stoves and cooking techniques, fast cooking foods, and consider using cleaner energy sources (e.g., gas and photovoltaic power).
6. **Refugee/IDP camps:** If possible, keep camp populations below 20,000 and locate camp sites at least 15km from ecologically sensitive areas and neighboring camps. Consider controlled harvesting sites or mud brick construction to avoid deforestation. Promote the "three Rs" of waste management in camps: Reduce, Reuse and Recycle. For more information, see UNHCR's Environmental Guidelines for Refugee Operations.
7. **Transport:** Well-maintained vehicles and eco-friendly driving techniques reduce air pollution and fuel consumption. Where possible, choose cleaner fuels and fuel-efficient, low-emission vehicles to minimize carbon emissions. Waste oil should be stored in plastic drums and properly disposed of or taken back to its source.
8. **Green procurement:** Smart procurement decisions are a simple way to reduce the environmental impact of humanitarian operations: Choose goods with the minimum possible packaging, especially containers that can be reused or recycled. Source materials from local or national markets to minimize travel miles and carbon emissions, and prefer recycled materials. Select suppliers with certified safe and sustainable production practices, in particular for forest products, water supply, metals, and plastics.
9. **Standards, tools, and guidelines:** Standards, tools, and guidance documents are available to assist humanitarian responders in managing environmental impacts and risks. In the absence of other guidance, the Sphere standards should be applied.
10. **UN assistance:** Humanitarian operations can be assisted on environmental issues through the Joint UNEP-OCHA Environment Unit (during the emergency phase) and the UNEP Post-Conflict and Disaster Management Branch (during the early recovery phase). Contact details: www.ochaonline.un.org/ochaunep

Source: UNEP/OCHA Joint Unit. 2007. IASC Leaflet Humanitarian Action and the Environment.

GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source*:* World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future*. Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

4 GREEN GUIDE TO

STRATEGIC SITE SELECTION AND DEVELOPMENT

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

4

GREEN

GUIDE TO

STRATEGIC SITE SELECTION AND DEVELOPMENT

Charles Kelly, Consultant

A NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster recovery and reconstruction approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on integrating environmentally sustainable approaches into site selection and development.

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MODULE 4: GREEN GUIDE TO STRATEGIC SITE SELECTION AND DEVELOPMENT

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1 INTRODUCTION

1.1 Module Objectives

This module describes the principles of strategic, environmentally sustainable site selection and development for post-disaster humanitarian aid projects. It presents a detailed set of guidelines and checklists as well as a post-disaster recovery time line. The time line includes strategic action points for ensuring that the long-term health and security of people and communities recovering from disaster have been factored into site selection and development.

Specific learning objectives for this module are as follows:

1. Understand the principles of environmentally sustainable site selection and development.
2. Conduct an assessment of post-disaster site selection, design, and adaptation to address environmental conditions in order to protect people and communities.
3. Identify strategic points of entry in the post-disaster recovery and reconstruction cycle to promote environmentally sustainable site selection and development.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 4 in a series of ten modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment, and taking advantage of opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction to help make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4, 5, and 6 pertain specifically to building construction, with Module 4 focusing on site planning and development, Module 5 on building materials and the supply chain, and Module 6 on building design and construction management. GRRT Modules 7 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

Module 4 is intended to support the training of physical planners, shelter and other construction professionals, and program and project managers in the field or at headquarters. It also supports project designers and environmental specialists involved in site selection and the planning and implementing of post-disaster construction of shelter or other buildings for disaster survivors. The trainees are expected to have familiarity with the basic procedures normally used in a shelter construction project and with the green recovery and reconstruction introductory concepts. This background can come from other modules in the GRRT or from other professional experience. The staff of local and national government agencies involved in the design, review, and implementation of recovery and reconstruction projects would also benefit from the training.

1.4 Module Key Concepts

This module builds on four key concepts:

1. Site selection and development involves a wide range of actions with social, environmental, and economic dimensions. These can result in a wide range of impacts, all of which play a role in the long-term health and security of people and communities recovering from disaster.
2. By following the Guidelines for Sustainable Post-Disaster Site Selection and Development (see Section 4), project planners can improve project outcomes by taking steps to protect people and their environment.
3. *Strategic* selection at key intervention points is important because the shelter site selection and development process involves decision making that spans a variety of sectors and time lines, from the earliest phase of post-disaster damage assessments and the location of temporary camps to longer-term reconstruction planning on a regional scale.
4. Considering environmental sustainability in site selection and development helps achieve the "do no harm" concept and will improve the lives of resettled individuals and their communities.

1.5 Module Assumptions

This training module assumes that participants are generally familiar with the project management cycle for humanitarian aid or development projects as well as the larger context of the post-disaster recovery and reconstruction process from immediate relief to longer-term reconstruction. This module focuses on the selection and development of shelter sites (emergency, transitional, and permanent) following a disaster. The term shelter site includes the housing, basic services (e.g., water, fuel, sewage), access infrastructure (e.g., roads, paths, bridges, etc.), and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities). The principles of this module can be applied to either an urban or rural area. The guidance provided in this module is applicable regardless of the economic or social status of a disaster-affected population.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

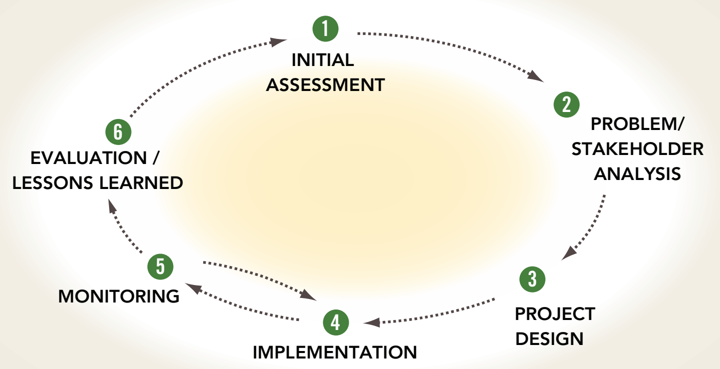
Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site development includes the physical process of construction at a building site, as well as environmental improvements such as the addition of home gardens and live fencing (e.g., fencing made out of live shrub cuttings) shown in this picture of housing built after the 2004 Indian Ocean tsunami in Aceh, Indonesia.
© Daniel Cima/American Red Cross

2 PROJECT CYCLE AND STRATEGIC SITE SELECTION AND DEVELOPMENT

In planning and carrying out disaster response activities, many humanitarian agencies follow a standard project management cycle, as shown in Figure 1.

FIGURE 1: STANDARD PROJECT MANAGEMENT CYCLE



Throughout the project cycle there are numerous opportunities for introducing and reinforcing the principles of Strategic Site Selection and Development as shown on the next page in Figure 2.

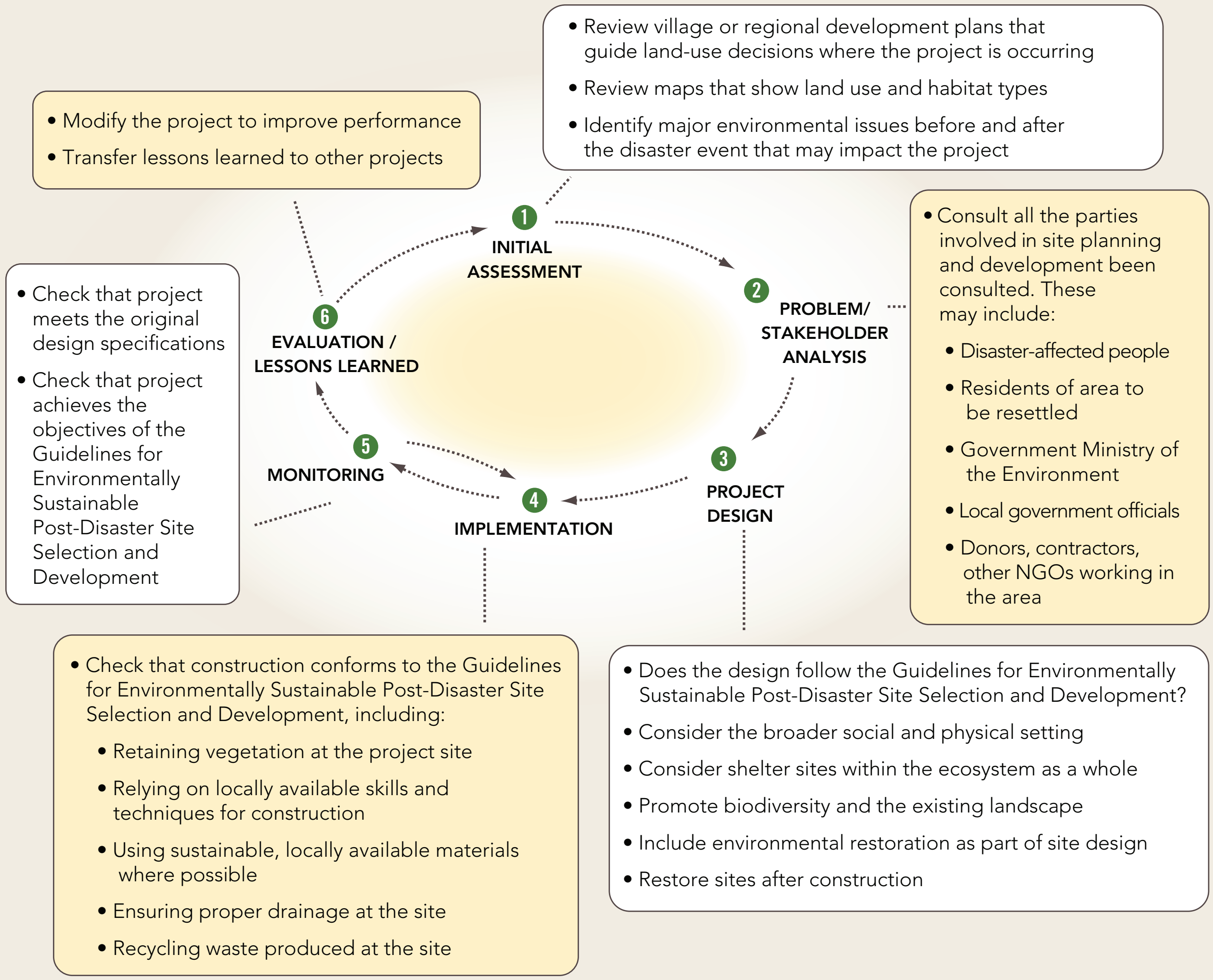
A full set of Guidelines for Sustainable Post-Disaster Site Selection and Development are included in Section 4. The Guidelines include a checklist to help project planners verify whether key elements contributing to sustainability have been identified and addressed in the site selection and development process.

At the initial assessment phase, it is important to find out whether the project area has any **preexisting village plans or regional development plans** that set forth the vision for future land-use planning. In most cases, these plans are the products of consultation with communities and with local, provincial, and national governments as well as with private-sector entities within the project area.

Even if the disaster event has dramatically altered the future course of development, these preexisting plans can give a good indication of community values, goals, and objectives with respect to land development. They can also be used as a source of information for the major types of industries (existing and planned) in the project area, the resources available (e.g., water, timber, agricultural resources), and areas of special (e.g., cultural) significance.

During the Problem/Stakeholder Analysis phase, it is important to engage all the relevant stakeholders to better understand the environmental context and the major actors in the project area. These stakeholders should be able to identify the major environmental issues that existed before and after the disaster, as well as provide some foresight into how the reconstruction process may impact different resources, such as the demand for raw materials for construction.

FIGURE 2: PROJECT CYCLE WITH OPPORTUNITIES FOR INTRODUCING PRINCIPLES OF STRATEGIC SITE SELECTION AND DEVELOPMENT



During the Project Design and Implementation phases, it is crucial that the Guidelines for Environmentally Sustainable Post-Disaster Site Selection and Development are reviewed and incorporated into project design and implementation.

During the Monitoring Phase, the project should be reviewed to ensure that it meets the original specifications of the design and that the implementation process conforms to the Guidelines. Any problems identified in the Monitoring Phase should be addressed as soon as possible. The results of the Monitoring Phase should also inform the Evaluation Phase in order to identify modifications needed to improve project performance. For example, solid waste management may be an issue not initially identified. If significant waste problems are detected, these should be addressed as soon as possible. If the correction is beyond the scope of the current project, it should be addressed during the evaluation phase when follow-up needs are identified. Development of specific indicators in the project logframe and/or Monitoring and Evaluation plan that relate to the Guidelines helps to ensure that the project achieves its sustainability objectives.

3 STRATEGIC SITE SELECTION AND DEVELOPMENT

Site selection and development involves a wide range of actions with social, environmental, and economic dimensions. These can result in a wide range of impacts, all of which play a role in the long-term health and security of people and communities recovering from disaster. The long-term impacts of site selection and development decisions need to be defined, considered, and addressed. Likewise, any opportunities that improve the overall well-being of disaster survivors beyond pre-disaster conditions should be maximized wherever possible.

The focus of this module is on ***strategic*** site selection and development. Strategic thinking is important because the shelter site selection and development process involves decision making that spans a variety of sectors and time lines, from the earliest phase of post-disaster damage assessments to the location of temporary camps to longer-term reconstruction planning on a regional scale. Addressing site selection and development issues solely within the context of an individual shelter project (e.g., the construction of 10 homes) is not sufficient to properly protect people and their environment; many of the aspects of site selection and development are interrelated and need to be addressed in a holistic manner across a range of site development activities, a process most effectively done from a strategic perspective. (NOTE: A full set of Guidelines for Sustainable Post-Disaster Site Selection and Development is included in Section 4.)

The period of recovery and reconstruction following a disaster represents an important opportunity to rebuild communities in ways that reduce disaster risks and increase sustainability for people and the environment. For instance, some communities affected by Hurricane Mitch in Honduras were relocated away from flood zones, and the site development incorporated park areas and open space that improved the quality of the local environment. Unfortunately, other communities in the same area could not be relocated away from flood areas, and continue to suffer repeated flooding.

The selection and development of resettlement sites following disaster often does not consider the full range of impacts on the environment, and does not take into account the concept of sustainability. Where resettlement sites do not take into account long-term sustainability, residents can experience the following problems:

- Increased impacts from hazards (e.g., flooding, landslides) that were not present or not as severe as they were before resettlement
- Living conditions actually worse than those that existed before resettlement
- Long-term environmental degradation (e.g., erosion, deforestation) due to insufficient consideration of local environmental resources will result in further damage to land, agricultural livelihoods, and safety and security.
- Increased air and water pollution will impact the health, welfare, and livelihoods of resettled and neighboring communities

Post-disaster housing reconstruction project built in flood plain in Aceh, Indonesia.
© Jonathan Randall/WWF

CASE STUDY: ACEH, INDONESIA
POST-TSUNAMI HOUSING PROJECT

These houses in Aceh Besar District, Sumatra, Indonesia, were built after the 2004 Indian Ocean tsunami. In the background is a newly constructed seawall that was built as a coastal barrier to protect residents from future tsunamis and storm surges. Unfortunately, the site plan and design for the housing project overlooked the fact that a significant quantity of freshwater flows from inland areas toward the ocean during periods of heavy rainfall and becomes trapped by the seawall before it is released into the ocean. As shown in the picture, the recurring floods have damaged the newly constructed shelter, water and sanitation systems, and roads, and have affected residents' health and quality of life. As a short-term fix, a costly drainage system was installed. To prevent these types of problems and added costs in the future, project planners need to ensure that there is coordinated planning among a range of stakeholders beyond the immediate project area. Planners must pay particular attention to the broader environmental context.

3.1 Disaster Cycle Time Line and Strategic Action Points

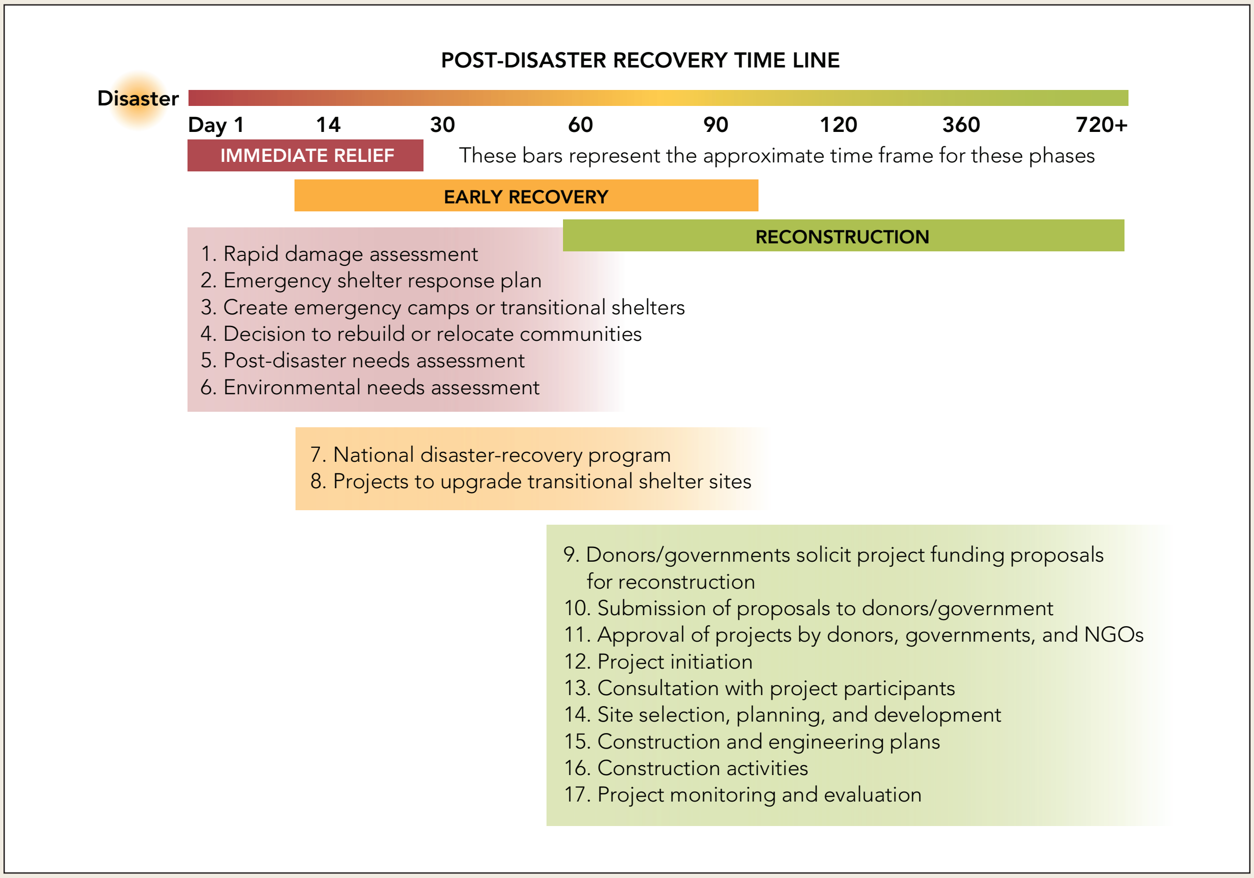
The recovery and reconstruction period after a disaster is not a one-time event; rather, it is a dynamic long-term process that represents an opportunity for planners to design strong communities, reduce the risks to and vulnerabilities of beneficiary populations, and enhance environmental sustainability. As such, the intervention points for strategic site selection and development occur at various stages during the recovery cycle.

The **Site Selection and Development Time Line – Recommended Actions & References** table (Annex 2) sets out key points on the "disaster to recovery" time line in order to provide opportunities for environment-focused actions to promote safer shelter sites for people and communities. The table includes a description of the environmental considerations at each intervention point and also lists key reference literature. The concept of sustainable reconstruction used here includes the management of natural hazards by site planners of natural hazards in order to limit the impacts on rebuilt or new communities.

The term "shelter sites" includes:

- Temporary shelter sites (e.g., camps and transitional shelter)
- Sites newly constructed after a disaster (e.g., relocated communities)
- Sites where shelter and shelter-related infrastructure are reconstructed after a disaster at or near their original location (e.g., rebuilt communities)

The focus of the table is on the construction of physical infrastructure. It is expected that standard participatory approaches will be used in the reconstruction process. The following diagram summarizes the key intervention points for addressing sustainable site selection and development. See Annex 2 for additional information.



Decisions about the siting and development of emergency, transitional, and permanent building sites begin within days of the disaster and continue for months. The decision-making process involves multiple actors working for multiple organizations. This can lead to coordination problems.

While early decisions are often strategic (e.g., "flood communities will be moved to safer locations"), subsequent decisions become increasingly site specific. At each decision point, different strategies and approaches are needed to ensure that decisions and actions support a sustainable recovery outcome.

The sequence of actions taken as the effort moves from disaster relief to recovery is influenced by a range of factors including the nature of the disaster, the level of assistance provided, and physical access. The Site Selection and Development Time Line is based on a rapid-onset event, such as a cyclone or earthquake, and needs to be adapted to the local context.

3.2 Planning for the Future

Many disaster survivors will have few assets in the immediate aftermath of disaster. However, site plans should anticipate that the site residents will replace lost assets over time, and the site will eventually experience normal growth.

As a result, all sites should be designed and constructed to allow space for future expansion without a reduction in the availability or value of environmental resources for site residents. This anticipation of future expansion can include plans for such things as:

- An expansion in the number of houses, and in house size and population
- Increased demand for fuel, water, and energy
- Increased waste water and garbage generation
- Expansion of and increase in commercial activities
- Increased demand for education and other social facilities
- Increased traffic volume and overall number of vehicles (e.g., road size and safety)
- Increased runoff and erosion potential due to an increase in impermeable surfaces

Sustainable site selection and development should specifically avoid underestimating the physical space and environmental requirements of a community, which can lead to overcrowding as more and more disaster survivors are settled on a limited number of shelter sites.

3.3 Maps as Tools

Maps are key tools in the selection and development of a new shelter site. Maps of appropriate scales can be used to:

1. Identify possible site locations, applying criteria such as elevation, slope, aspect (the direction the site faces), distance from roads and towns, proximity to natural resources, distance from rivers and other water supplies, risk to environmentally unique locations (e.g., parks or reserves), and distance from industrial or mining sites.
2. Design the actual layout of the site, taking into consideration guidance on matching the physical layout of the site with the infrastructure to be constructed.
3. Develop plans for the use of natural resources within or near the site as the site is developed (e.g., sourcing of sand and gravel) and once the site is occupied.
4. Help new residents and visitors find homes and services within the site.

Mapping can be done with various degrees of sophistication, from simple community-drawn diagrams on flip-chart paper to a detailed presentation of complex data using a geographic information system (GIS). The choice of the most appropriate and efficient mapping tools for use in shelter site selection and development depends on several factors, including:

- The physical size of the site
- The number of sites to be developed

- The complexity of the site development process and infrastructure to be built
- Available funds

In general, the more sites needed, the larger the sites, and the greater the complexity of infrastructure to be built on each site, the more sophistication in mapping technique is needed.

Most countries (at a national level and often at a local level) and almost all large-scale humanitarian operations, have the capacity to create maps. These capacities are often located in government agencies involved in planning, finance/taxes, environmental management, health and epidemiological surveillance, or public works. In some countries, the private sector can also be a good source of mapping capacities, with information available from surveyors, construction firms, computer services companies, and commercial delivery firms.

3.4 Stakeholders in Site Selection and Development

It is important to have a clear understanding of all the parties involved in the site selection and development process to ensure that there is proper coordination and consultation with the various stakeholders and a better understanding of the interconnections between and among sectors. The following are many of the parties that could be expected to be involved in site selection and development:

- The disaster-affected people to be resettled
- People living near the new site
- Local government officials involved in:
    - Selection
    - Construction permits and inspection
    - Public services, (e.g., health, education, water, sewage, garbage collection)
    - Environmental management
    - Finance
    - Security
- Regional and/or national government officials working in the areas of construction, selection, finance, the environment, and public services
- United Nation Clusters (e.g., Early Recovery or Shelter)
- Public and privately managed utilities (e.g., water, electricity)
- Donors funding the site development
- NGOs involved in the site development, including environmental NGOs (NGO staff may closely parallel the staff involved from local, regional, or national government)
- Contractors involved in all the construction activities at the site (the range and number of contractors will depend on the nature and scope of the site development work)
- Consulting firms providing design, selection, or architectural services, or conducting assessments (e.g., social, environmental) and monitoring and evaluating

- Local, regional, and national business persons interested in providing assistance to support reconstruction or interested in working under the recovery program
- Media representatives interested in documenting the recovery process
- Food sellers and other small-scale businesses that provide support to workers and site residents

CASE STUDY: XAAFUUN, SOMALIA, TSUNAMI (2004)

Reconstruction efforts in Xaafuun, Somalia, following the 2004 tsunami pinpoint the importance of environmentally appropriate site selection for a relocated community. Xaafuun is one of the few permanent fishing settlements on the northeastern Somalia coast, and oscillates between 250 and 600 families depending on the season. In the damaged settlement, houses had been built at sea level near the beach, and which had destabilized the fragile dune ecosystem of the area. Strong, sand-laden winds would regularly hit the village during the monsoon season, often burying structures and causing health problems, particularly for children, pregnant women, and the elderly.

To find a safe and environmentally sustainable site, a multidisciplinary team of urban planners, an economic development expert, and an environmental specialist collaborated to formulate the reconstruction plan. Key issues of sustainability included the potential for settlement expansion and construction in close proximity to both fishing and market locations. Protection from the elements was another important consideration, since Xaafuun is subject to strong winds and sand from the adjacent sand dune habitat. The team also looked at the suitability of a new site with regard to public infrastructure for water delivery systems, sanitation systems, and roadway access points.

The new location called for a carefully considered, integrated settlement layout with appropriate types of shelter, rather than a simple replication of what existed before. A preparatory sketch-plan discussed with all stakeholders allowed for swift land allocation to different agencies for immediate reconstruction activities. Meanwhile, a more detailed settlement layout was prepared by UN-HABITAT. A new mosque, a Koranic school, a meat market, a women's center, and a health center were built.

The town plan was based on the following principles:

1. Compact settlement: this mitigates the impact of Xaafuun's strong winds on living spaces and housing units, ensures cost efficiency by reducing the total service area, and reduces infringements on the sensitive dune habitat.
2. Public border: a public zone, comprising public spaces and public buildings, faces the sea, and acts as a buffer between the residential area and the dunes.
3. Main road: this serves as the backbone of the development and is linked with the main public facilities.
4. Economic development: next to the formal market structures and the sites along the sea for a small-scale fishing industry, spaces for spontaneous economic activities and social gatherings are created.

The Xaafuun case illustrates that without compromising humanitarian efforts to save lives, it is vital to introduce a development perspective in the early stages of the post-disaster situation, taking full advantage of the opportunities that might result from the disaster. The full case study is included as Annex 3.

Source: UN-HABITAT. 2006/2007. *Paving the Way for Sustainable Development in a Post Disaster Situation: the Case of the Tsunami-damaged Village of Xaafuun North Eastern Somalia.*

4 GUIDELINES FOR SUSTAINABLE POST-DISASTER SITE SELECTION AND DEVELOPMENT

The **Guidelines for Sustainable Post-Disaster Selection and Development** are designed to assist recovery program planners, recovery project managers, and on-site implementation staff in their efforts to do the following:

- Select, design, and develop sustainable post-disaster reconstruction operations.
- Work with affected communities in a collaborative approach to sustainable site design and construction.

A checklist covering key issues is included. This checklist can be expanded based on local environmental conditions and reconstruction requirements, and can serve as an aide-memoire in the choice of site selection and development planning. Material for this document has been adapted from Site Design (Chapter 5) in **Guiding Principles for Sustainable Design**[1] with a focus on making it relevant to post-disaster site selection and development.

The Guidelines are divided into two sections:

1. Basic Principles, providing five broad concepts on which to base environmentally sustainable site selection and development.
2. Site Selection and Design Considerations, identifying key sustainability issues to consider when selecting and designing a site or adapting an existing site for new construction.

This guidance takes the establishment of a new shelter site as a starting point for consideration of sustainable site selection and reconstruction requirements. However, the guidance can be used with on-site reconstruction as well. On-site reconstruction involves the planning of specific changes to a disaster-affected settlement so that the rebuilt infrastructure is more environmentally sustainable and less subject to disasters in the future. Since on-site reconstruction involves consideration of infrastructure, as well as social and cultural issues from before the disaster, the process of incorporating environmentally sustainable reconstruction is more challenging than it is for a site on which a settlement did not previously exist.

Reconstruction often proceeds without environmental concerns being addressed due to pressures from political authorities and from the disaster survivors themselves to rebuild quickly. This guidance is designed to be adaptive to the disaster-recovery situation. Users are urged to highlight the positive and immediate impacts that an environmentally sound sustainable site selection/development intervention can produce. Positive impacts include risk-reduction benefits of sustainable shelter, more cost-efficient use of local resources, and greater local ownership of project outcomes.

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1 National Park Service. 1993. *Guiding Principles of Sustainable Design.*

4.1 Basic Principles

4.1.1 Recognize the context

Site selection and development should consider the broader social and physical setting of the proposed intervention. Site selection/development should be avoided where social conflict may arise between old and new residents, or where there will be conflicting or, eventually, excessive demands on natural resources. A "ridge to reef/valley" approach[2] should be used in assessing the environmental impacts of a proposed site on the larger environment around the site. Environmental impacts may include those of the livelihoods of the eventual residents on the environment and on downstream communities. An environmental impact screening/scoping is a good tool with which to consider the situational context.

4.1.2 Treat ecosystems as interdependent and interconnected

Post-disaster shelter site development does not occur independently of the natural environment. The ecosystems surrounding a prospective site may serve to mitigate hazard impacts (e.g., forested slopes reducing flooding) and provide livelihood resources and public amenities. Waste generated at a new settlement site can create health and environmental problems in neighboring communities if not managed properly at the new site. Site development should complement and minimize damage to the ecosystems surrounding a site, and should integrate the physical development of the site into these ecosystems.

4.1.3 Promote existing landscapes

The site design and construction process should start with landscape mapping[3] prior to site clearance. The resulting data should be used to the extent possible to integrate site plans into the natural landscape rather than to re-engineer the natural landscape to fit the site and to maintain as much of the natural vegetation and habitats as possible. Maintaining existing vegetation will improve environmental conditions by, for example, providing shade to reduce solar heating, retaining access to indigenous sources of food and medicine, upholding soil stability, and providing more pleasant living conditions. Indigenous vegetation is also usually more resistant to local hazards and more resilient following disasters than is exotic vegetation.

4.1.4 Include environmental restoration as part of site design

For a variety of reasons, land with little economic or environmental value is often seen as the first option for post-disaster shelter reconstruction: Good land tends to go to the highest bidder, leaving the poorer, more vulnerable residents with the more hazard-prone sites. Proactive site development can re-house disaster survivors while restoring the environment of a degraded location. This outcome can be achieved through site design (e.g., establishing indigenous vegetation zones between houses), specific engineering interventions (e.g., water-retention areas supplying water to newly planted indigenous plants), and through social interventions (e.g., encouraging the resettled to plant trees or other vegetation near their homes, schools, and

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2 "Ridge to reef" refers to taking into consideration the environmental conditions from ridge-top to off-shore reef (or valley bottom) in planning sustainable interventions to limit negative environmental impacts. Specifically included in this approach is the impact of human occupation of a watershed, including use of forest resources, and farming, mining and other types of land use.

3 Landscape mapping is carried out to gain an understanding of the "lay of the land," such as natural drainage channels and preparing a vegetation and habitat inventory.

other community sites). Social engagement by the re-housed is important to this process, as they carry the responsibility for maintaining revegetated areas and managing these resources after the completion of any reconstruction project. It is worth noting that even already disturbed areas can still be used as migratory routes for certain types of wildlife, such as elephants, and steps should be taken to avoid siting shelter in these areas in order to reduce human-wildlife conflict.

4.1.5 Restore sites after construction

Whether from the increase in the number of people in a location or from the construction efforts associated with the building of houses, roads, and other infrastructure, resettlement can have profound, negative impacts on the environment. All site-related interventions should incorporate components to restore disturbed environments to pre-project conditions where possible.[4] These efforts should include areas from which natural resources have been extracted (e.g., borrow pits, logging sites) and the clearing and restoration of construction sites (e.g., restoring cement mixing areas, materials storage areas, vehicle maintenance yards). While a new shelter site does change the local environment, this change should be minimized by later restoration of the natural environment whenever possible.

Restoration should be a particular focus of on-site reconstruction. The changes to the physical infrastructure of a community following a disaster (e.g., destroyed buildings, roads, disrupted rivers, or access to new lands) provide an opportunity for organizations to work with the disaster survivors to establish improved environmental conditions during the reconstruction process. Such efforts can be as simple as planting trees, or as complex as reorganizing the layout of a community to improve air quality and drainage and create green spaces that can also serve as refuge points during floods. As well, the reconstruction process may provide opportunities for infrastructure improvement that can, if executed in a sustainable manner, have positive impacts on environmental conditions. Examples include replacing latrines with pipes and treatment sewage systems, and wells with piped water systems.

4.2 Site Selection and Design Considerations

Details complementing the strategic concepts presented above are presented in this section. This information can be used to define post-disaster resettlement options, plan for the establishment of a specific site, and review an existing shelter site in terms of rehabilitation or its evolution from a transitional shelter site to a permanent site.

Reference should also be made to local and national laws, regulations, and standards for site selection and development. Most locations have detailed laws and regulations about spatial planning, environmental impact, housing, and sanitary facilities, which lay out specific site selection and development requirements.

There are numerous factors to consider in selecting a site for the reconstruction of housing and related infrastructure following a disaster. While this document focuses on factors contributing to sustainability, other considerations, such as the availability of land, legal status of disaster-damaged communities, and the distance from the new site to sources for livelihoods, also play important roles in the selection process.

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4 This assumes, naturally, that pre-project conditions were environmentally acceptable and undisturbed by the disaster or human-made impacts.

Broadly, the sustainability component of the site selection and development process should focus on the selection of sites that will:

- Have the least negative impact on the environment
- Have the fewest possible threats from the environment
- Require the least extraction of natural resources for site preparation, construction, and operation
- Incorporate infrastructure and community-managed systems for minimizing and managing solid and liquid waste
- Offer the best quality of life for residents

These considerations are not absolutes. Every shelter site has some impact on the environment, and often compromise is needed to attain the best reasonable outcomes under competing demands and pressures to rebuild.

Ideally, post-disaster reconstruction efforts, including site selection and development and on-site reconstruction, should be integrated into the natural characteristics of the location where the site development is to take place rather than attempt to dramatically alter the existing physical environment. Realistically, all site development impacts the existing environment. The challenge is to minimize this impact to the greatest degree possible.

The following topics in this section are key attributes or considerations in site selection and development. Within the boxes are the summary recommendations for each topic.

4.2.1 Capacity

❑ The number of people at a new site will not result in resource requirements that unsustainably exploit locally available natural resources.

The number of people at a new site should not result in resource requirements that unsustainably exploit locally available natural resources, because this is likely to result in lack of access to vital resources in the future (e.g., overpumping of groundwater). As a rule of thumb, the per capita resource requirements of a new site will be as high as existed before the disaster, and may be higher if new housing, infrastructure (e.g., water, sewage), or livelihoods are introduced as part of the reconstruction process.[5] Planners should consider, as well, that some countries may have official criteria defining site capacity limits.

5 See The Sphere Project's *Humanitarian Charter and Minimum Standards in Disaster Response* for further information on minimum space and resource requirements for emergency situations. While intended for emergency situations, this guidance may be useful in calculating the expected needs of a permament shelter site.

4.2.2 Density

- ❑ The density of habitation of the new site will not be greater than it was where the inhabitants lived before the disaster.
- ❑ The density of habitation of the site meets local regulations or international best practice.

By definition, increasing the density of inhabitation at the site reduces additional land needs, thereby reducing the immediate environmental "footprint" of the site. However, sufficient space needs to be available to allow residents to conduct their livelihoods and social activities, and to live with dignity. An approach to defining density limits is to consider the normal social and livelihood activities of a typical family in the disaster-affected area, and to plan for sufficient space for these activities.

In general the density of a site should be no greater than it was before the disaster and should include space for upgraded infrastructure (e.g., sewage system) and services (e.g., schools with sport fields) after a disaster. An appropriate density of inhabitants for a site will also depend on cultural considerations, a process requiring the participation of the intended residents of the site and the recognition of gender-based differences in the use of space. Some countries may have official criteria defining density limits. There may also be circumstances in which a higher density is preferable for a short period of time so that the safety of residents can be better ensured in areas where security is an issue.

4.2.3 Climate

- ❑ The site plan incorporates measures to address current climatic conditions.
- ❑ The potential for negative changes to local climate, such as changes in rainfall or frequency of severe storms, has been considered in the site plan.

Most new shelter sites will be in the same climatic zone as was the pre-disaster shelter. However, new shelter sites should consider the impact of potential future changes in climate, such as the need for increased drainage because of future increased rainfall), and incorporate features to enhance local climate conditions. (See **Vegetation** on the following page.)

BOX: CLIMATE CHANGE AND SITE SELECTION AND DEVELOPMENT

The Intergovernmental Panel on Climate Change (IPCC) defines climate change as: "any change in climate over time, whether due to natural variability or as a result of human activity." Climate change refers in this section to the observed and projected increase in average global temperature as well as the associated impacts, including an increase in extreme weather events; melting of icebergs, glaciers, and permafrost; sea level rise; and changes in the timing and amount of rainfall. Climate variability is the change in weather that occurs over a matter of weeks, months, or, in some cases, a few years (e.g., El Nino). From the perspective of reducing vulnerability, it is unnecessary to separate "climate change" caused by humans from natural "climate variability."[1]

Site plans should anticipate climate change because of:

1. The short-term development of the site: Urban areas are usually warmer than rural areas; face a greater risk of flooding due to the larger areas of impermeable surfaces (e.g., roofs, roads); and suffer more air pollution, particularly from the concentration of vehicles, cooking, and commercial activities. These factors can create a microclimate more hazardous for the site inhabitants than would be the case in adjoining rural areas.
2. Long-term changes to weather patterns: These changes can exacerbate the local changes to climate induced by the development of the site and can increase disaster risks such as flooding.

Planning for the impact of climatic influences on the local environment should be based on an assessment of local hazards and identification of how these hazards can be addressed in both the short and long term. For instance, even with the same level of rainfall as before the reconstruction, site construction will increase the run-off at the site the impermeability effect noted above. The site should have a drainage system capable of handling larger flows than would be indicated simply by the amount of rainfall at the site.

If it is anticipated that future rainfall is likely to increase due to climate change, then the drainage system should be designed to handle even larger flows. Note, however, that for cost reasons, actual drainage structures (e.g., concrete gutters) will likely be built for flows anticipated over the short term (e.g., the next 10 years), with space made available for expanding structures if and when even larger flows become the norm.

1 Care International. 2009. *Climate Vulnerability and Capacity Analysis Handbook.*

4.2.4 Slope

❑ The slope of the land on the site does not exceed 5%.

Sloping land is very important for proper drainage, piped water, and sewage systems. However, it is preferred that new shelter sites be located on land with a slope of no more than 5%.[6] Where this is not possible, a combination of terraces, vegetation, and appropriately designed drainage systems should be installed to limit erosion. Steep slopes are also subject to landslides and slumping[7] and should be avoided measures to control these processes are very expensive and of limited reliability.

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6 The Sphere Project. 2004. *Minimum Standards in Shelter, Settlement and Non-food Items.* Sphere Handbook. Geneva: Oxfam Publishing.

7 "Slumping" is a mass-wasting event that occurs when loosely consolidated materials or rock layers move a short distance down a slope.

4.2.5 Cultural significance

- ❑ The cultural, historical, political, and social significance of locations at or near the proposed site have been considered as part of the site selection and plan development process.

Inhabitants near a prospective settlement site and the prospective residents of the site should be consulted on whether the possible site has any cultural, historical, political, or social significance that could inhibit its use as a settlement. A culturally significant site may not be clearly marked to outsiders and may be significant for one group in an area but not for others. In some locations, areas of significant cultural importance are also areas of considerable biodiversity precisely because they are treated as special and not used in the same manner as the surrounding landscape.

4.2.6 Vegetation

- ❑ The retention of vegetation has been maximized in the site plan.
- ❑ Indigenous vegetation with economic value [such as fruit trees], is maintained or reintroduced at the site.
- ❑ The planting of nonnative plants has been avoided or minimized.

As much of the natural vegetation should be retained at a site as is possible. Additional vegetation should be added through gardens, tree planting in public areas and near schools and clinics, planting along water courses and in designated greenbelts, and planting as privacy buffers between houses and to separate housing from public areas.

Indigenous vegetation with economic value [such as fruit trees], should be planted where possible, with community-level agreement as to their ownership and use. The ownership of trees or vegetated areas and their produce – whether by individual, household, or community – should be decided through participatory discussions to avoid potential conflicts.

The use of nonnative plants that have the potential to invade agricultural and wildland areas should be avoided.

4.2.7 Hazards

- ❑ A hazards assessment for the site has been conducted and mitigation plans have been developed.
- ❑ The hazard assessment covers both natural and technological hazards.
- ❑ Mitigation plans incorporate structural (e.g., flood walls), nonstructural (e.g., warning systems), and ecological (e.g., maintenance of natural floodways) measures.

The safe management of natural hazards should be integral to a site development plan. Hazards from natural or technological sources (e.g., a toxic dump) should be indentified in the site selection process and in the associated environmental screening.

As it is not possible to avoid all hazards, a risk management strategy should be established as part of the development of the site. This strategy should include both structural measures (e.g., drainage canals in flood areas, adequate roof attachments in cyclone areas) and nonstructural measures (e.g., community-based warning systems, education) to minimize hazard impact. Planners should note that some countries may have official regulations relative to use of land subject to significant hazards, e.g., flood plains and areas subject to landslides or avalanches.

Site selection should take into account hazards, such as flooding and landslides, that might affect relocated populations. If it is not possible to avoid all hazards, a risk management strategy should be established as part of development of the site. After the 2005 Kashmir Earthquake in Pakistan, some temporary shelters were located in potentially unsafe areas as shown in this photo. Because many "temporary" shelters are used for many months or years beyond their intended use, it is important for project planners to choose sites carefully and consult with disaster-affected households about hazard risks.
© Karl Schuler / IUCN Pakistan

4.2.8 Construction methods and materials

- ❑ Construction methods minimize negative environmental impacts.
- ❑ Building designs reduce energy requirements for heating or cooling.
- ❑ Construction methods rely on locally available skills and competencies, and take into account the need to introduce new methods to reduce disaster risk or increase sustainability.
- ❑ Methods to reduce disaster impact are incorporated into site and building design.
- ❑ The use of locally available materials for construction does not place unsustainable demands on the local supplies of these materials.

A discussion of environmentally sustainable construction methods and materials can be found in GRRT Modules 5 and 6.

In general, construction methods that minimize impacts on the environment are preferred. These include, for example, those requiring minimal land clearance or those designed to reduce energy requirements for heating or cooling. Where possible, building methods, should be based on locally available skills and competencies, and minimize the need for imported labor and skills.

There is often an interest in rebuilding in the same style and manner as before a disaster. However, reconstructed buildings and infrastructure should be hazard resistant, and this may require the introduction of new building design characteristics, new building methods and new skills. Planners should note that some countries may have official regulations that determine how different types of housing and other infrastructure can be constructed.

There is often a preference given to the use of local materials in reconstruction for cultural, economic, and logistical reasons; relief aid spent locally helps the economy and reduces transport needs. However, the total demand on local resources should be assessed in the site-design phase to ensure that use of local resources does not lead to environmental damage from unsustainable resource extraction or processing. Post-disaster reconstruction efforts will use local resources such as sand, wood, stone, and gravel at a rate typically higher than that of the pre-disaster period as attempts are made to quickly reconstruct buildings and infrastructure that may have taken decades to construct. It is highly unlikely that such demands will be sustainable locally for any significant reconstruction effort. Risks from unsustainable resource extraction should not be displaced to other communities.

4.2.9 Drainage

- ❑ The drainage plan is based on projected maximum daily precipitation as well as consideration of future climate impacts.
- ❑ Raised areas that can provide safety from possible floods have been established for humans, their possessions, and domestic animals.
- ❑ The permeability (i.e., ability of the soil to absorb water) of the site is maximized to reduce runoff.
- ❑ Unpaved areas are established to reduce flooding and to increase soil absorption of water.
- ❑ Warning systems are established for potential flood events.

The increased impermeability created by roofs, compacted roads, and other surfaces in a site may lead to locally severe flooding even where such flooding was not previously a problem. As a result, even moderate rainfall can lead to considerable damage to site infrastructure and lead to the concomitant loss of lives or property. Project design should account for local rainfall patterns and project impacts from climate change.

A sustainable site should have a drainage plan designed for the maximum expected level of precipitation. Provisions should also be made for safe sites (e.g., raised areas normally used for sports or similar space-extensive activities) where inhabitants can gather with essential possessions if heavy rainfall threatens to cause local flooding. Similar areas for livestock may be needed if animal husbandry is practiced at the household level.

By maximizing the permeable areas of a site, planners can reduce the potential for heavy runoff due to rains. This can be accomplished by increasing vegetative areas and trapping water from roof runoff for household use. Areas paved with bricks with open areas to allow water to drain can help reduce runoff.

Retention areas should be created where drains and slopes are expected to concentrate runoff, to avoid down-slope flooding and increase aquifer recharge. These retention areas can be used as gardens, recreation areas (such as sports fields), open spaces, or woodlots.

In addition to adapting project designs for local rainfall patterns and impacts from climate change, project planners may also consider establishing warning systems in order to minimize flood hazard risks to life and well-being.

4.2.10 Livelihoods

- ❑ The new site is close to the location of normal livelihood activities, and enables residents to pursue these activities without significant additional cost or difficulty when compared to the precrisis situation.
- ❑ Adequate space has been provided for livelihood activities at the household and community levels.
- ❑ Markets include sufficient water supplies and space and facilities for adequate sanitation and the handling of waste.
- ❑ Waste from markets and other commercial sites is recycled.
- ❑ Composting is used to add value to organic waste.
- ❑ There is adequate space between the location of economic activities and living and social areas, such as schools to decrease the impact of noise, air, and water pollution.
- ❑ All markets have adequate water supply, drainage, and waste-handling facilities.

A new shelter site should be in proximity to where residents previously pursued their occupations and secured their livelihoods.[8] Sites distant from locations where livelihoods are secured tend to be abandoned or only partially used by the intended residents: If they cannot pursue a living, they will not be able to afford to live at the site.

The spatial layout of a shelter site should also include sufficient space for household-level livelihoods such as weaving and food preparation, and for commercial enterprises such as furniture production, shops, and stores. Sufficient space should be allocated to avoid noise, water, and air pollution from commercial enterprises that could affect residential areas, schools, clinics, and other public locations.

Space for markets, live-stock handling facilities, and slaughterhouses should be included in a site plan. Markets should be sized appropriately in accordance with local consumer demand based on pre-disaster needs. Larger markets, livestock handling facilities, and slaughterhouses should be located away from housing and public services such as schools and clinics.

All markets should have adequate water supply, drainage, and waste-handling facilities. Specific attention should be given to the waste management needs of areas handling livestock, as well as to the impact of abattoirs and fish processing sites, which can produce considerable manure, offal, and water pollution. Some waste can be recycled for commercial uses such as fertilizer, but will pose considerable health and environmental risks if not managed properly.

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8 Livelihoods assessments are often conducted following major disasters and can be a source of information on livelihood needs in a new settlement; this information is generally complemented by participant discussions.

4.2.11 Utilities (water, energy, waste)

- ❑ Sufficient space is available for water, energy, and solid and liquid waste utility services.
- ❑ The growth of demand for water, energy, and solid and liquid waste utility services is incorporated into site plans.
- ❑ Utility networks are easily accessible and, where appropriate, integrated into green spaces.
- ❑ Storage areas for wood, coal, or other similar energy sources are available and limit fire hazards and the impact of pollution.
- ❑ Rainwater harvesting is used to reduce demand on surface or groundwater resources.
- ❑ Grey water is recycled where possible.
- ❑ Low-volume toilets are used where appropriate.
- ❑ Flow-limiting faucets are used for communal water sources (e.g., stand pipes).
- ❑ Environmentally beneficial and appropriate technologies (e.g., solar panels, solar cookers) are used to limit demand from other sources of energy.
- ❑ Solar cookers/water heaters and/or fuel-efficient stoves are used to reduce the demand for carbon-based fuels for cooking and heating.
- ❑ The types of toilets used reduce sewage production (e.g., composting toilets) and groundwater pollution (e.g., use of closed-box septic tanks).
- ❑ Sewage collected through septic system cleaning (e.g., pumping of latrines) or through piped systems receives tertiary treatment.
- ❑ All solid organic matter collected through sewage systems is composted and reused to improve soil quality (e.g., in agriculture, to support tree planting, or to restore areas of natural vegetation).
- ❑ Solid waste is recycled and organic waste composted and used to improve soil quality.
- ❑ The area allocated to landfills meets the expected future waste outputs of the site and is designed to meet appropriate sanitation and pollution-control standards.
- ❑ The need for landfill space or waste incineration is reduced through the practice of recycling, including composting for commercial or communal uses.
- ❑ Local laws, international standards, and best practices are followed in the development of waste management systems.
- ❑ Pricing is used to reduce resource demand, taking into account basic rights to water and local expectations of entitlements to water and energy resources.

Sufficient space should be provided for water, energy, and solid and liquid waste utility services, with the potential growth of the site taken into consideration. Utility networks should be easily accessible and can be integrated into green spaces where appropriate. If wood or coal or other sources of energy will be used in the site for cooking or heating, then storage areas outside the main part of the site should be identified and developed to limit pollution and fire hazards.

Consideration should be given to the provision of water, energy, and sewage services from nonconventional/ noncentralized sources. In the case of water, rainwater harvesting, low-volume toilets, or flow-limiting faucets can be used to reduce demand on surface or groundwater sources. In the case of energy, solar panels, solar cookers, fuel-efficient stoves, and similar appropriate technologies can reduce the demand from conventional energy sources.

A variety of latrine types can be used to reduce the need for sewage collection and the risk of groundwater pollution. With a piped sewage system, tertiary treatment in a conventional sewage treatment plant can reduce downstream pollution and produce fertilizer for agriculture and other uses. In the case of solid waste, commercial or social (e.g., school) recycling can reduce the volume and limit spatial and environmental impacts of landfill disposal.

Local environmental NGOs and universities may be good sources of information on recycling options and the reuse of grey water. Technical specialists should be consulted about optimal sustainable solutions to the management of liquid waste.

Local laws and conditions will determine whether landfills or incineration are optimal for solid waste disposal. Incineration, correctly done, is generally more demanding from a technological perspective, while landfills require more land and long-term, ongoing management. The parameters for the environmentally sound management of either option are well established.

Consideration should also be given to service pricing to reduce resource demand, particularly in the case of water and energy. As access to water and energy can be considered an entitlement in some societies, pricing regimes may need to be based on free access to a minimum level of service, such as a fixed number of liters of water per day, with charges applied to quantities used above the minimum level.

4.2.12 Site access

- ❑ The site is not physically isolated from road networks, towns, and markets.
- ❑ There are adequate roads and access within the site.
- ❑ Roads/paths within the site follow the contours of the site where possible, and steep roads/paths are avoided.
- ❑ Crossings of water courses are designed for maximum flows, and include pedestrian passages for use during periods of high water.
- ❑ Road surfaces limit dust and water erosion.
- ❑ Roads have adequate drainage to prevent flooding and surface erosion.
- ❑ Space is provided along roads for pedestrian traffic and for bicycles and motorbikes or carts, where these are a major means of transportation.
- ❑ Vegetation, indigenous if possible, is used to stabilize slopes and road shoulders.

A new settlement site should not be physically isolated from road networks, towns, and markets, and should have easy internal access to all parts of the site. Steep roads should be avoided. Where possible, roads should follow the contours of the site. Aligning roads along contours is helpful for disabled persons.

Road surfaces should be paved with stone, cement, or asphalt to limit dust and water erosion; stone is preferred for paving if sufficient quantities are available locally, so that water can be absorbed by the underlying soil. All roads should have adequate drainage systems to prevent flooding and surface erosion.

Vegetation, indigenous if possible, should be used to stabilize slopes and road shoulders. Runoff can be channeled to retention areas that can be used to water vegetated areas within the site.

Where a settlement reconstruction site is located close to a navigable body of water, space should be allocated for the on-land storage of boats and related equipment. Any docks and boat launch/recovery areas should be located away from sensitive marine habitats.

4.2.13 Public space lighting

- ❑ Public lighting is designed to minimize energy and maintenance requirements.

The lighting of public spaces within a new settlement site is often both a security and economic requirement. This lighting should be designed to minimize energy requirements through, for example, the use of energy-efficient bulbs, and to be as maintenance free as possible. While solar panels may seem to be an ideal solution for public lighting, consideration should be given to medium- and long-term maintenance, and to the threat of theft, as solar lighting systems may be of considerable value relative to local incomes.

4.2.14 Household-level agriculture

- ❑ Space is provided for kitchen gardens or small truck farms (as per local custom).
- ❑ Rainwater and/or grey water are used for household-level agriculture.
- ❑ Kitchen and other organic waste are recycled as compost or, in the case of food waste, as animal feed.
- ❑ Waste from household livestock is properly managed, including composting, and odors, as well as air and water pollution, are limited to the extent possible.

Market and kitchen gardens are often a key element of livelihood and food security strategies and need to be planned as part of new settlement sites. To minimize demands on primary water resources such as piped water or household wells, rainwater should be captured for garden watering. Grey water should also be recycled where this is practical. Shower water, for example, can be used to water banana trees and other similar vegetation.

Kitchen and other organic waste can be recycled as compost or, in the case of food waste, used as animal feed.

Where livestock is kept in or near housing units, provision should be made for waste management, including composting, and to limit odors, as well as air and water pollution.

4.2.15 Wildlife

- ❑ The impact of the site on wildlife populations has been assessed.
- ❑ The potential for conflict between wildlife and livestock has been assessed and addressed.
- ❑ The site is not in a wildlife transit corridor.

The presence of wildlife should be assessed as part of the site selection process. The potential for wildlife-human and wildlife-livestock problems should be discussed with the potential site residents and neighboring communities. Specific attention is needed to avoid placing a new settlement site in a wildlife migration corridor; the potential for wildlife-human conflict should be discussed with environmental professionals.

4.2.16 Pest management

- ❑ Pest breeding sites have been limited in the location and design of the site.
- ❑ The need for chemical pest control has been limited through site design and location.

Pests, such as flies, mosquitoes, and rodents, pose serious health problems. Sites should be planned to limit potential pest breeding sites such as stagnant water, areas of scrub land, or unmanaged vegetation, and to include building styles that do not encourage rodents to live in or near human habitation. While chemical methods such as pesticide spraying are appropriate for controlling some pests, these efforts should be complemented by environmental modification, site design, and communal activities such as clean-up campaigns to reduce the opportunities for pest populations to develop.

4.2.17 Wind

- ❑ Wind directions, including seasonal variations, have been plotted for the site.
- ❑ Roads and building direction take into account prevailing winds to provide good ventilation for the site.
- ❑ Doors and windows are positioned to limit the impact of winds considered unpleasant.
- ❑ Roads are designed to break the flow of the wind.
- ❑ In areas of potentially high winds (from thunderstorms, monsoon fronts, etc.) or heavy snow, roof slopes are 1:4 unless other structural measures are taken to limit the potential for wind or snow damage.

The siting of the building should reflect consideration of the local wind conditions. Proper siting can enhance passive cooling and heating of the building which will be more comfortable for building occupants. Adapting site designs for wind conditions can also reduce demand for fuel, lowering costs for building occupants.

4.2.18 Sun

- ❑ The sun track across the site has been plotted.
- ❑ Buildings are oriented to limit or promote solar heating as needed.
- ❑ Building design incorporates the need for shade to offset roof heating
- ❑ Options for solar water heaters have been investigated and heaters used where appropriate.

The siting of the building should reflect consideration of the sun track across the site. Similar to designing for wind, a site design for the sun track can enhance passive heating of the building which will be more comfortable for building occupants. Adapting site designs for sun conditions can also reduce demand for fuel, lowering costs for building occupants. In areas with high amounts of regular sunlight, project planners may consider promoting solar water heaters and other solar-based technologies.

4.2.19 Rainfall

- ❑ Precipitation data is used in the design of roads, housing, and drainage.
- ❑ Rainwater catchment systems at the household or community level are based on precipitation data and the seasonality of rainfall.
- ❑ In areas of heavy rainfall, vegetation is used to slow runoff and is complemented by retention ponds.

Precipitation data should be used in the design of roads, housing, and drainage. Rainwater catchment systems at the household or community level should be based on precipitation data and the seasonality of rainfall. Early-season rains collected through gutters and barrels may be able to provide sufficient water for a family for several weeks when other sources are under severe stress. Where rainfall can be heavy, vegetation should be used to slow runoff and be complemented by retention ponds (which can themselves be used for aquaculture.)

4.2.20 Topography

- ❑ The settlement is designed to match the existing topography; the location and orientation of roads, housing blocks, and community structures have been adjusted to fit the form of the land.
- ❑ Discussions on the disadvantage of a block-grid approach to site selection have taken place, and alternatives developed as financially and socially feasible.

Ideally, a new settlement site should be designed to match the existing topography, with the location and orientation of roads, housing blocks, and community structures adjusted to fit the form of the land. However, there is usually a considerable push to make post-disaster settlement sites as economically and spatially efficient as possible, leading to a grid layout and minimal consideration of topography. In advocating for a site layout that blends with the existing topography to the best degree possible, planners should highlight the problems inherent in a grid approach, which include the likelihood of increased erosion, increased construction costs (from placing a flat layout on an uneven surface), and poor social cohesion among eventual residents.

4.2.21 Geology/soils

- ❑ The permeability, structure, and composition of the soil and geology of the site have been assessed.
- ❑ The site does not include rocky areas and is not located on rocky terrain.
- ❑ The site plan should consider the permeability of the soil and geology of a site, and, in particular, the following elements:
  - Liquid waste disposal
  - Revegetation
  - Drainage
  - High ground water

The geology of a site is a significant factor in the cost of constructing a post-disaster shelter site. Rock or rocky terrain is more expensive and difficult to build on and can pose major problems in assuring adequate water supplies (e.g., it is very difficult to bury pipes or dig wells), drainage (e.g., in terms of water supply ditches), and livelihood activities (e.g., it is difficult to develope and maintain kitchen gardens).

The permeability, structure, and composition of the soil and geology below the site should be assessed early in the site selection process. Permeability is a key factor in determining the options for:

- Liquid waste disposal, e.g., soak pit latrines in high clay soils will not operate properly.

- Vegetation, e.g., rocky soils will need more organic matter to support vegetation.
- Drainage, e.g., sandy soils drain better and faster than clay soils, thus requiring less in the way of drainage systems and reducing the likelihood of standing water for extended periods of time.

On the other hand, areas with high permeability and high ground water levels can lead to excessive moisture in homes, posing environmental health problems.

The geological setting of a building site will also affect how susceptible a building will be to earthquake and landslide hazards. Local hazard maps should be consulted to ensure that building designs and construction techniques address geological hazards.

4.2.22 Aquatic ecosystem

- ❑ The sustainable use of aquatic ecosystems has been incorporated into the site selection.
- ❑ The risk of pollution of aquatic ecosystems from the site has been limited.

The presence of aquatic ecosystems – lakes, rivers, estuaries, wetlands, seas – at or near a site is a mixed blessing. Aquatic ecosystems present considerable options for livelihoods such as fishing, harvesting of aquatic vegetation, and gardening opportunities.

However, siting of settlements near aquatic ecosystems can also lead to excessive exploitation of aquatic resources as well as to increased pollution, as aquatic areas are generally downhill from the settlement site. Plans for the management of the aquatic ecosystems should be developed as part of the site development plan and developed in detail with the site residents in the early stages of the site development.

4.2.23 Vegetation

Vegetation should be retained to the greatest degree possible during site development. Where clearing is necessary, trees should be retained as a priority and trees with economic or food value should be accorded top priority. In most cases, a slight realignment of buildings on a case-by-case basis can result in the retention of a considerable number of trees on a site.

4.2.24 Visual characteristics

- ❑ The visual characteristics – *the look* – of the site have been considered in the site selection and development plans.
- ❑ Landscaping has been provided to improve the visual characteristics of the site.

Post-disaster settlement reconstruction focuses on returning affected populations to normal living conditions as quickly as possible. The fast pace of reconstruction often leaves little time to consider how the resulting settlement will actually appear.

Landscaping considerations should be incorporated into site layout plans prior to the site clearance process.

Leaving trees and planting new trees, creating vegetation buffer zones, and other forms of simple landscaping will improve the visual characteristics and the environmental conditions of the site, and will help improve the psychological health of and "sense of place" for disaster survivors.

These **Guidelines** do not provide comprehensive coverage of all aspects of site selection and development. Other subjects and key references that should be consulted in the selection and development process include:

- **Planning the rebuilding process: See Guidelines for Planning the Rebuilding Process – Resource Pack** published by Intermediate Technology Development Group – South Asia.
- **Rebuilding shelter:**
    - *After the Tsunami: Sustainable building guidelines for South-East Asia,* published by UNEP, contains guidance on rebuilding shelter as well as a "Project environmental review record" to track and note measures to address environmental issues related to rebuilding. www.preventionweb.net
    - *Home Again: A handbook for reconstructing housing and communities after disaster* (World Bank, in press), which provides general and sector-specific information on successful re-housing following disasters, with a limited section on environmental issues.
- **Environmental impact assessments:** (which should be completed for each reconstruction project and should incorporate a review of site-related environmental impacts). See materials available from the International Association for Impact Assessment. www.iaia.org.
- **Land use planning:** See *Guidelines for Land-Use Planning.* www.fao.org
- **Upgrading of transitional shelter to permanent shelter:** See *Emergency Shelter Environmental Impact Assessment and Action Checklist Identifying Critical Environmental Considerations in Shelter Site Selection, Construction, Management and Decommissioning* by ProAct Network and CARE International. www.proact.org

This list is not comprehensive. Specific site selection and reconstruction guidance is often developed following major disasters and is available from local or national government sources.

Useful background information on post-disaster shelter and site selection can also be accessed through the Shelter Centre (www.sheltercentre.org). Although much of the literature to date refers to emergency and transitional shelter and not specifically to sustainable site selection, this disaster-focused literature can often provide useful contextual guidance.

5 RELATED STANDARDS

5.1 SPHERE Standards

By addressing strategic site selection and development as described in this module, project planners can achieve consistency with the Humanitarian Charter and Minimum Standards in Disaster Response (SPHERE).[9] Relevant standards include:

- **Shelter and settlement standard 4: design.** The design of the shelter is acceptable to the affected population and provides sufficient thermal comfort, fresh air, and protection from the climate to ensure residents dignity, health, safety, and well-being.
- **Shelter and settlement standard 5: construction.** The construction approach is in accordance with safe local building practices and maximizes local livelihood opportunities.
- **Shelter and settlement standard 6: environmental impact.** The adverse impact on the environment is minimized by the settling of the disaster-affected households, the material sourcing, and construction techniques used.

5.2 Local and National Standards

Typically, local or national laws define the relevant standards (e.g., population density in resettlement sites) related to shelter and urban infrastructure. These laws and regulations may at times be modified or ignored in specific post-disaster reconstruction assistance. Nonetheless, it is important to acknowledge that such standards were established for a reason, that is, to reduce the risk of future disasters to communities, and ensure that a site's carrying capacity is not exceeded. Every effort should, therefore, be made to follow the standard.

It is often the case that normal environmental review procedures, which are now relatively standard worldwide, will be lowered or waived because of a perceived need to complete the reconstruction process as quickly as possible. In the absence of local or national requirements for environmental review, project planners can follow the guidelines used in this module.

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9 The Sphere Project. 2004. Minimum Standards in Shelter, Settlement and Non-food Items. Sphere Handbook. Geneva: Oxfam Publishing. *Note: a revised version of the handbook will be published in 2011.*

ANNEX 1: ADDITIONAL RESOURCES

The following organizations and publications provide a variety of tools, resources, and information that elaborate on the concepts presented in this module.

Organizations

Shelter Centre: Non-government organization supporting the humanitarian community in post-conflict and disaster shelter and housing. Provides guidelines and other resources for emergency and transitional shelter. *www.sheltercentre.org*

World Bank: Global financial institution involved in post-disaster reconstruction, often with a focus on longer term recovery. *www.worldbank.org*

UNEP's Post Conflict and Disaster Management Branch: Branch of UNEP providing post-crisis environmental assessment, disaster risk reduction and other green reconstruction information. *www.unep.org/conflictsanddisasters*

Swiss Resource Centre and Consultancies for Development: Swiss Non-government organization working in the fields of development and humanitarian aid. Provides resources on sustainable building and livelihoods. *www.skat.ch*

World Wildlife Fund (WWF): Non-government organization offering a broad array of resources on environmental issues. National level WWF offices can provide insight into environmental issues at a local level. *www.wwf.org*

Publications

FAO. 1996. *Guidelines for Land-Use Planning.*

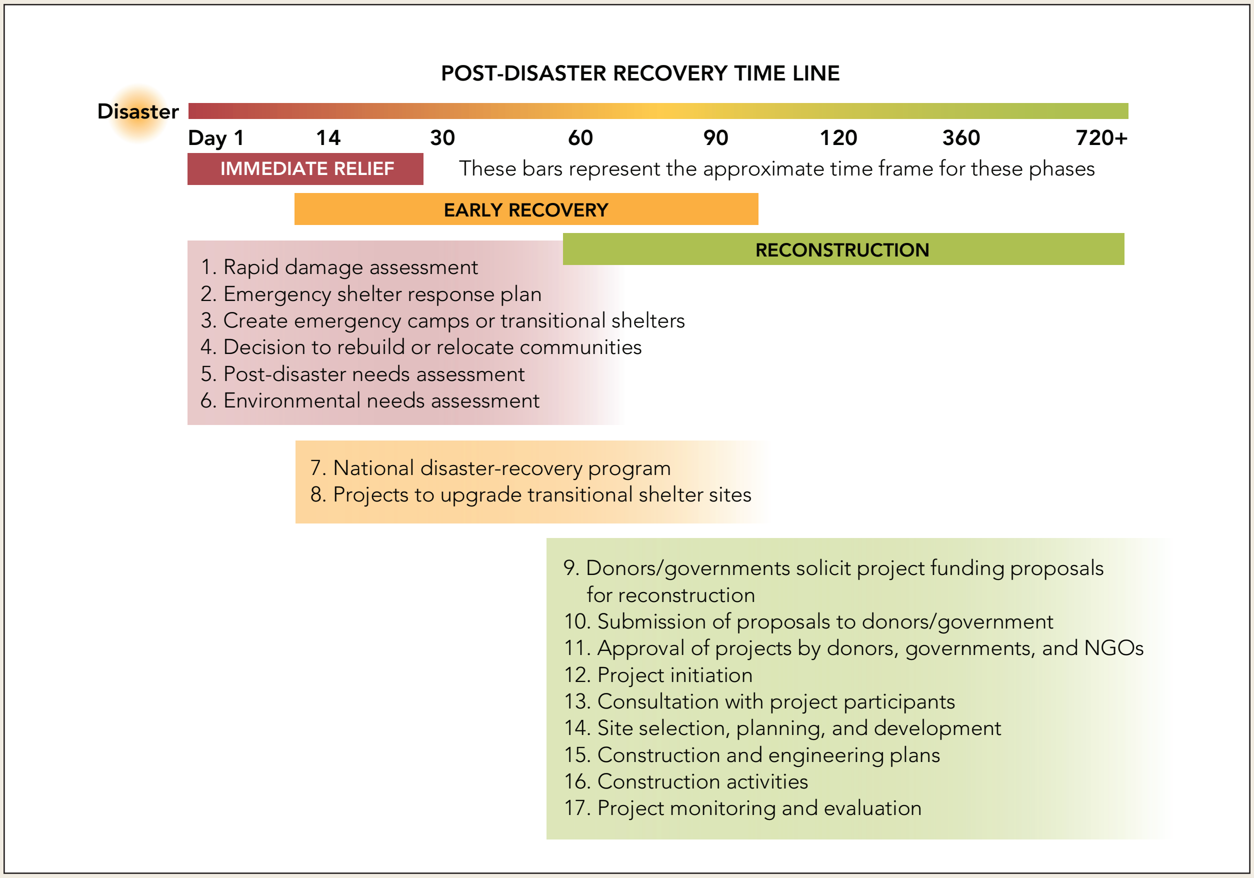
Intermediate Technology Group- South Asia. 2004. *Guidelines for Planning the Rebuilding Process- Resource Pack.*

Kelly, C. 2005. *Checklist-Based Guide to Identifying Critical Environmental Considerations in Emergency Shelter Site Selection, Construction, Management and Decommissioning.* Benfield Hazard Research Centre/CARE.

National Park Service. 1993. *Guiding Principles of Sustainable Design.*

United Nations Environment Programme (UNEP) and Swiss Resource and Consultancies for Development (SKAT). 2007. *After the Tsunami: Sustainable Building Guidelines.*

ANNEX 2: SITE SELECTION AND DEVELOPMENT TIME LINE – RECOMMENDED ACTIONS AND REFERENCES



Immediate Relief (approx. 1 to 30 days after disaster)

Early Recovery (approx. 10 to 120 days after disaster)

Reconstruction (approx. 60 to 720+ days after disaster)

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
1	**RAPID DAMAGE ASSESSMENT**	A. Review scale of damage, which can be an early indicator of future demand for reconstruction resources. B. Research the causes of damage agents and specific hazard locations, which can indicate whether settlements are in hazardous areas and may need to be moved or adapted in the future. C. Identify whether relocation will be necessary, because this will have significant impact on spatial planning and site selection in the future. D. Determine if disaster debris can be used as construction materials. E. Begin planning for proper disposal of disaster debris to mitigate negative environmental impacts.	As a rule of thumb, post-disaster reconstruction attempts to replace damaged infrastructure that was built over the course of 20 or more years in one or two years. This rapid rate of reconstruction places considerable demands on local resources, such as sand, rocks, wood, and water. Damage agents that indicate a hazardous location include flooding, landslides, rockslides, sea surge, and subsidence following an earthquake. Disaster survivors often use debris for immediate shelter construction. A debris management program is required following a disaster. The plan should include a sustainable disposal component and will generally include labor-intensive public works.	The Inter-Agency Standing Committee (IASC) **INITIAL RAPID ASSESSMENT (IRA): FIELD ASSESSMENT FORM** can be found at groups.google.com/group/globalwashimtools. Shelter Cluster guidance on assessments is provided in **Guidelines for Assessment in Emergencies** (www.humanitarianreform.org/). See Appendix 1 – *Shelter, Settlement and Non-Food Items Initial Needs Assessment Checklist*, Shelter, Settlement and Non-Food Items Chapter, **Humanitarian Charter and Minimum Standards for Disaster Response**. A **Rapid Environmental Impact Assessment in Disasters** (REA) process can also be used early after a disaster to identify critical environmental issues, but the REA does not focus specifically on site-related issues. (AVAILABLE FROM www.reliefweb.org). Information on debris management is available from Disaster Waste Recovery (www.disasterwaste.org/). A **Quick Guide: Post-Disaster Debris Management** is available from ProAct Network ((www.proactnetwork.org).

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
2	**EMERGENCY SHELTER RESPONSE PLAN**	A. Review the items being selected for use in shelter kits to ensure that they do not result in excessive demand on local resources. B. If the affected population is being relocated, consider and address the environmental impacts and hazards associated with new settlement sites. C. If formal emergency camps are being set up, specific site selection criteria are required to minimize the environmental impact of camps. D. Seek opportunities for recycling or reuse in permanent sites of materials used in the establishment of camps or transitional sites. E. Research the number of disaster survivors living with host families, at or near previous camps, or in camps. Monitor the environmental demands of survivors living under these different conditions. F. Determine how long people will need to remain outside normal shelter and without normal services, so that you can address cumulative demands for resources (e.g., water, food, fuel).	Kits provided without frames (e.g., metal or wood poles) can require users to collect frame materials from the local environment, with possible local environmental damage. The planned use of shelter kits should be reviewed to identify potential impacts on the local environment. The materials used to construct camps or transitional shelter sites can provide significant assets to occupants. Enabling the occupants to take these assets to their permanent shelter sites allows the recycling of these resources and reduces demand for additional assets to expand new housing or to support livelihood activities. Even short-term relocation can have negative impacts on the environment if adequate preparations are not made to minimize or mitigate these impacts. Environmental impacts can come from the creation of a camp (e.g., removing all vegetation from a site) and from the presence of residents (e.g., demand for water and shelter materials from scarce resources, the sustainable disposal of solid and liquid waste). In general, survivors living in camps place a greater immediate demand on environmental resources than do survivors living at or near previous homes or with host families, since they do not have access to the natural resources they normally use and need to exploit new resource sites to live and rebuild. Disaster survivors living with host families are less obvious than those living in camps or near former homes, but	See The Shelter Centre (www.sheltercentre.org) for extensive information on shelter options and site selection for camps and emergency and transitional shelter sites. Most core literature and reports on post-disaster shelter site development are available through the Centre's library (www.sheltercentre.org/library).

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
2	EMERGENCY SHELTER RESPONSE PLAN		can still impose unusual demands on the environment, such as the need for additional sand, wood, and other local resources for shelter reconstruction. The longer that individuals live with host families the greater the burden on existing systems (waste management, water demand, fuel [for cooking and heating], and resources), the greater the demand to expand existing shelter, and therefore the greater the potential impact on environmental resources. As a rule of thumb, the longer a displaced population is living in other than normal conditions, the more significant the demands and impacts on local resources, for instance from fuelwood collection, discharge of sewage, or livelihood activities (e.g., farming). While these demands may not be greater than under normal circumstances, they occur in a more concentrated manner than is the case under normal conditions. For example, populations displaced by disaster living in transitional shelter sites may not be able to travel far from the sites, and thus have to get food, fuel, and water from nearby forests, leading to local environmental damage. Such local damage was a major environmental problem arising from displaced Rwandan populations in western Tanzania. In some cases, this damage is transitory, with the environment recovering when the people leave, but in others it may be long term (e.g., the impact of refugees on national park areas in the eastern Democratic Republic of the Congo.)	

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
3	**CREATION OF EMERGENCY CAMPS OR TRANSITIONAL SHELTERS**	A. Ensure that specific camp or transitional site development plans conform to sustainable design criteria (see Guidelines in Module 4), including formal site assessments and site plans to minimize environmental impact. B. Materials used in emergency camps or transitional shelters should be chosen based on their ability to be reused for permanent shelter or recycled.	Environmental impacts can arise from the creation of a camp/transitional site (e.g., removing all vegetation from a site) and from the presence of residents (e.g., demand for water and shelter materials from scarce resources, the sustainable disposal of solid and liquid waste). A formal camp or transitional site requires an environment management plan covering site selection, construction, operation, and decommissioning.	UNHCR's **FRAME** toolkit can be used to assess the impact of camps and transitional shelter sites. FRAME is geared towards the identification and management of camp-related environmental issues. A copy of FRAME can be secured from www.unhcr.org. Additional information on camp creation, layout and management can be found in publications available from the Shelter Centre Library (www.sheltercentre.org/library). The library includes a wide range of reports, documents and manuals useful in camp development, site selection, shelter construction, and other reconstruction-related topics. The **Emergency Shelter Environmental Impact Assessment and Action Checklist** can be used to identify critical environmental issues for transitional shelter sites, temporary camps, or on-site reconstruction efforts. (Available from www.proactnetwork.org)

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
4	**DECISION TO REBUILD OR RELOCATE COMMUNITIES**	A. Consider whether relocation is really necessary or if survivor housing can be reconstructed in the same location to streamline the reconstruction process and cause less disruption to people and the environment. B. Ensure that consultations with survivors are completed before a decision is announced.	Relocation will require greater environmental resources than rebuilding and may involve moving people to previously unsettled areas. A general decision to relocate disaster-affected populations is often made early in the disaster response and may be based on politics rather than on detailed assessments. Relocation of affected communities requires numerous steps involving multiple parties. Keeping affected communities in the same location reduces the number of steps to recovery, but may also raise issues about risk reduction, for instance in the case of flooding. Decisions to relocate all or part of an affected population may be driven by other considerations, such as long-term urban plans or the desire to remove squatters from inconvenient locations.	Background information on relocation is available in the book, **Home Again**, Global Facility for Disaster Reduction and Recovery, World Bank (draft) and in **Housing Reconstruction After Conflict and Disaster** (Sultan Barakat, Humanitarian Practice Network, Overseas Development Institute, 2003, //www.odihpn.org/documents/networkpaper043.pdf), which discusses relocation or on-site reconstruction and provides a summary list of considerations in selecting a site.

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
5	**POST-DISASTER NEEDS ASSESS-MENTS (PDNA) WRITTEN BY GOVERNMENT, UN, OR NGOS**	A. Ensure that PDNA includes a component on the environment and linkages with human welfare. B. If the PDNA includes options for on-site reconstruction or resettlement, make sure that these options are presented in consideration of environmental factors.	PDNAs are normally conducted jointly by the host government, UN system, and international financial institutions (IFIs). Sometimes NGOs are involved. The PDNA process is adapted to each disaster and involves sectoral assessments and a consolidated results statement. A PDNA can involve a socioeconomic and environmental impact assessment procedure developed by the Economic Community for Latin America and the Caribbean. This procedure focuses on setting the monetary value of damage as a basis for determining the level of post-disaster recovery funding needed. This assessment does not necessarily consider the costs of sustainable recovery or risk reduction.	**Early Recovery: Compilation of Tools and Resources** www.humanitarianreform.org/. PDNA Schematic and Outline www.undp.org/bcpr/ **Needs Assessment Framework** (includes general questions about the environment by sector and overall): www.humanitarianreform.org/humanitarianreform/Default.aspx?tabid=143 The Economic Community for Latin America and the Caribbean assessment process (**Handbook for Estimating the Socio-Economic and Environmental Effects of Disasters**) (also used by the World Bank and others) and a number of assessment reports can be accessed here: web.worldbank.org/ **Environmental Guidelines for Small Scale Activities in Africa**, (USAID, www.encapafrica.org/EGSSAA/EGGSSA-front-&-back-cover.pdf) provides a review of environmental considerations related to housing, as well as checklists to assess these impacts. These materials can be used in assessing possible project interventions.
6	**ENVIRONMENTAL NEEDS ASSESSMENT**	A. Make sure that the PDNA includes a companion "Environmental Needs Assessment" that covers environmental issues related to shelter, water, sanitation, waste management, energy, biodiversity, agriculture, livestock, and fisheries.	**The Environmental Needs Assessment in Post-Disaster Situations** includes checklists on shelter, water, sanitation, waste management, energy, biodiversity, agriculture, livestock, and fisheries that cover possible impacts arising from the disaster and recovery. Reference is made to camps but not specifically site selection or resettlement.	**Environmental Needs Assessment in Post-Disaster Situations** www.humanitarianreform.org/

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
7	**(NATIONAL) DISASTER RECOVERY PROGRAM** **[Provides a master plan for recovery, including whether new or existing settlement sites will be used, and how fast reconstruction will take place]**	A. The establishment of a National Disaster Recovery Program should be complemented with a Strategic Environmental Impact Assessment (SEA) that identifies major environmental issues related to on-site or new settlements, including mitigation measures.	The disaster recovery plan can be set out in a Common Humanitarian Assistance Program (CHAP), Consolidated Appeals Process (CAP), or Flash Appeal. For significant recovery needs, a Donor Conference is often held, with a formal recovery plan presented. Any of these documents should include a review of environmental issues, including whether reconstruction will be on-site, at new sites, or both, and should establish parameters for addressing the related environmental impacts.	For information on CHAPs, CAPs and Flash Appeals, see www.humanitarianreform.org/humanitarianreform/Default.aspx?tabid=143. On the **Needs Assessment Framework** (includes general questions about the environment by sector and overall) which is intended to provide the overall framework for information to be used in a CAP or other appeal, see: www.humanitarianreform.org/humanitarianreform/Default.aspx?tabid=143 Information on SEAs and disaster-related topics: **Tools for Mainstreaming Disaster Risk Reduction:** www.proventionconsortium.org/themes/default/pdfs/tools_for_mainstreaming_GN7.pdf. **Strategic Environmental Assessment (SEA) and Disaster Risk:** www.oecd.org/dataoecd/54/26/42201482.pdf See **After the Tsunami: Sustainable Building Guidelines for South-East Asia** on issues related to sustainable reconstruction (www.preventionweb.net/english/professional/publications/v.php?id=1594).
8	**PROJECTS TO UPGRADE TRANSITIONAL SHELTER SITES**	A. Review existing environment-related conditions on sites and identification of upgrades to improve environmental conditions. For example, proper disposal of waste, fuelwood collection near housing site, etc.	If there is an extended period between the establishment of transition sites and the completion of reconstruction, then further assistance is needed to maintain and upgrade transitional shelter sites	The **Emergency Shelter Environmental Impact Assessment and Action** Checklist can be used to identify critical environmental issues linked to the upgrading of transitional shelter sites, temporary camps, or on-site reconstruction efforts. (Available from www.proactnetwork.org)

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
9	**DONORS/ GOVERNMENTS SOLICIT PROJECT FUNDING PROPOSALS FOR RECONSTRUCTION**	A. Many donors have statements of principles related to environmental impacts from reconstruction. These should be reviewed and incorporated into funding plans and proposals. B. Funding plans should also include the environmental issues developed in the Strategic Environmental Assessment for the disaster if one has been prepared.	Based on the (National) Disaster Recovery Program or other assessments, donors/ governments propose to fund a specific number or type of reconstruction, including whether efforts will focus on on-site or new-site construction.	Key literature and links to policy statements are usually available through a disaster-specific web site or through disaster-specific web sites developed by individual Clusters or the United Nations (e.g., www.Reliefweb.org, a disaster-specific Humanitarian Information Center web site, or an OCHA-managed country-specific web site).
10	**SUBMISSION OF PROPOSALS TO DONORS/ GOVERNMENTS**	A. Proposals should include details of how negative environmental impacts will be mitigated and environmental conditions will be monitored in the proposed project. B. The proposal should include details of interventions that increase environmental sustainability, such as bioremediation of waste, recycling programs, or environmental improvements.	Not all donors require environmental impact management plans, but good practice (and standards to the extent they apply to reconstruction) requires an environmental impact review of a proposed project.	Shelter, settlement and non-food items chapter, **Humanitarian Charter and Minimum Standards for Disaster Response** for guidance on minimum standards for settlements, including the need for environmental reviews. See chapters on *Introduction to Sustainable Reconstruction and Guidelines for Sustainable Reconstruction* on **After the Tsunami: Sustainable building guidelines for South-East Asia** on issues related to sustainable reconstruction (www.preventionweb.net/english/professional/publications/v.php?id=1594) for guidance on sustainability in designing projects. The document includes a project/program environment review checklist in Annex VIII. See the *Key Literature and Links* under the Project Monitoring Intervention Point below for indicators on sustainable recovery that should be considered in project design.

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
11	**APPROVAL OF PROJECTS BY DONORS, GOVERNMENTS, AND NGOS**	A. The approval document should state any specific measures needed to address identified environmental issues.	The approval process can include the waiving of specific rules and regulations related to environmental review procedures. However, the implementing organization still has an obligation not to cause avoidable environmental damage and hardship for disaster survivors.	Information on project approval may be available through a disaster-specific web site established by the disaster-affected country or the United Nations (e.g., Reliefweb, a disaster-specific Humanitarian Information Center web site, or an OCHA managed country-specific web site).
12	**PROJECT INITIATION**	A. Introductory meetings with beneficiaries and government officials should be held to review the terms and requirements of the project. Discussions should cover local environmental issues, hazards present at the site, and related issues such as land tenure and local availability of natural resources.	Local authorities and (environmental) NGOs may be aware of environmental issues at or near the site. Consultations with current or future occupants of a site may also identify environmental or related concerns. Possible source locations for natural resources to be used in construction should be identified and assessed. Local waste-disposal systems should be identified and assessed in terms of the additional load posed by the site(s).	See **Participation by Crisis-Affected Populations in Humanitarian Action. A Handbook for Practitioners** (ALNAP, www.alnap.org/publications/gs_handbook/gs_handbook.pdf). See the section on *Community Environmental Action Planning* in **FRAME** www.proactnetwork.org
13	**CONSULTATION WITH PROJECT PARTICIPANTS**	A. Efforts should be made to specifically solicit concerns about environmental issues from project participants, and obtain their agreement to the environment-linked activities of the project.	Participant consultations are an opportunity to identify how the project's environmental impact can be improved, to secure buy-in from participants to different approaches to managing environmental issues (e.g., bioremediation of waste water), and to identify areas of potential conflict over environmental resources needed for construction or livelihoods.	See the **Humanitarian Charter and Minimum Standards for Disaster Response** for guidance on minimum standards on participation. See **Participation by Crisis-Affected Populations in Humanitarian Action. A Handbook for Practitioners** (ALNAP, www.alnap.org/publications/gs_handbook/gs_handbook.pdf). See the section on *Community Environmental Action Planning* in **FRAME** (www.proactnetwork.org)

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
14	**SITE SELECTION AND DEVELOPMENT**	A. Site reviews should include a preliminary review of possible impacts of the site on future inhabitants and of the creation of the site on the environment. B. Site plans should address any physical hazards, minimize the loss of natural vegetation, and use the physical landscape to maximize living conditions (e.g., airflow, drainage).	Where sufficient data is available, geographic information systems (GIS) can be used to identify possible sites. However, all potential sites should be visited and local residents contacted about environmental and other site-related issues (e.g., ownership, hazards, and previous use).	General guidance on overall land use planning can be found in the FAO's **Guidelines for Land Use Planning** (www.fao.org:80/docrep/T0715E/t0715e00.HTM). See **Site Planning and Design,** Steven B. McBride, Professor of Landscape Architecture, West Virginia University (www.rri.wvu.edu/WebBook/McBride/main.html) for general guidance on site planning including ecological/sustainable site planning. Information on sustainable site development is available in **Guiding Principles for Sustainable Design,** National Park Service, Department of Interior, Leslie Starr Hart, December 15, 1994, Denver, Colorado, www.nps.gov/dsc/dsgncnstr/gpsd/toc.html or www.nps.gov/dsc/dsgncnstr/gpsd/ch5.html. See chapter on *Guidelines for Sustainable Reconstruction* in **After the Tsunami: Sustainable building guidelines for South-East Asia** on issues related to sustainable reconstruction (www.preventionweb.net/english/professional/publications/v.php?id=1594).
15	**CONSTRUCTION AND ENGINEERING PLANS**	A. Energy, and resource-efficient construction materials and methods should be incorporated into construction plans.	Particular attention should be given to the resources to be used in construction (e.g., sand, water) and whether different construction methods can reduce the demand for resources. The tendency to use locally available resources should be weighed against the potentially unsustainable demand for those local resources.	Chapter 3, *Construction*, **Environmental Guidelines for Small-Scale Activities in Africa**, (USAID, www.encapafrica.org/EGSSAA/EGGSSA-front-&-back-cover.pdf) provides a review of environmental considerations related to construction and provides information on likely environmental impacts and mitigation measures.

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
16	**CONSTRUCTION ACTIVITIES**	A. The generation of air and water pollution, and waste should be minimized (see Module 3 on Sustainable Construction).	As a rule of thumb, self-built sites are less polluting and more efficient users of construction resources, with contractor-based construction posing the greatest risk of pollution and waste. However, a good environmental management plan covering construction activities can reduce pollution and waste regardless of the approach used.	See Chapter 3, *Construction*, **Environmental Guidelines for Small Scale Activities in Africa**, (USAID, www.encapafrica.org/EGSSAA/EGGSSA-front-&-back-cover.pdf).
17	**PROJECT MONITORING AND EVALUATION**	A. Monitoring should include environmental indicators (see Module 3 on M&E), a focus on limiting waste and pollution, and the perception of beneficiaries as to environmental issues. B. The success of the project in addressing environmental issues identified during project design and implementation should be evaluated, as should any lessons encountered.	The use of beneficiaries to monitor the environmental impacts of a project should be considered. This is most practical at on-site reconstruction, but can be integrated into a broader beneficiary monitoring to the development of new sites. A post-project evaluation is a good tool for identifying successful approaches to sustainable site selection and development. It also provides an opportunity for project beneficiaries to express their views on environmental aspects of the project and identify ways that sustainability can be improved in similar situations.	See the section on *Evaluation* in FRAME, www.proactnetwork.org. See **The Good Enough Guide: Impact Measurement and Accountability in Emergencies**, published by Oxfam, available at publications.oxfam.org.uk/oxfam/display.asp?isbn=0855985941 overall impact monitoring.

ANNEX 3: XAAFUUN CASE STUDY

URBAN PLANNING IN A STATE OF FLUX Series

paving the way for sustainable development in a post disaster situation

the case of the tsunami-damaged village of Xaafuun
North Eastern Somalia

This brochure examines the UN-HABITAT role in post-disaster situations from its perspective of *'Sustainable Relief and Reconstruction'** by illustrating the case of the Xaafuun town. Using its holistic approach to human settlements and its planning and design expertise combined with components involving physical construction, UN-HABITAT acts as a catalyst for framing emergency/early recovery interventions within a long-term development perspective. Disasters of the magnitude of tsunami provide a clean slate to radically rethink the set-up and improvement of human settlements.
In the case of Xaafuun, UN-HABITAT, in partnership with UNICEF, took the emergency as an opportunity to set the stage for the renewed sustainable development of the area.

TSUNAMI IN XAAFUUN
disaster or opportunity?

The small village of Xaafuun, located on a remote peninsula along the north-eastern coast of Somalia, was severely damaged by the tsunami in December 2004. While an estimated 30 people perished, the extent of the damage caused by this natural disaster cannot be compared with the catastrophic scale of the events in Asia. However, the impact of the tsunami was yet another blow to a marginalized area already stricken by years of drought and civil war. With this reality in mind, the international spotlight on the tsunami-affected areas provided an opportunity to tackle the multitude of problems faced by the Somali coastal region.

FROM EMERGENCY TOWARDS DEVELOPMENT
The role of UN-HABITAT

As frequently happens after a major disaster, numerous organizations 'flooded' the area with pledges for assistance. As the traditional community leaders had no formal institutional set-up and no expertise in planning or coordinating development, the initial interventions were ad hoc and randomly located within the sensitive, unstable dune ecosystem near the old settlement. UNICEF, present from the start, partnered with UN-HABITAT to look at safe and sustainable solutions for the relocation of the settlement and its future development.

URBAN PLANNING IN A STATE OF FLUX - Towards Sustainable Urbanization

Urban planning was traditionally seen as a means to control and regulate the development of towns and cities. In the cities of the developing world, however, traditional planning approaches have failed to address the challenges of rapid urbanisation and the poverty, exclusion, informality and vulnerability it brings in its wake.
This series of brochures illustrates how UN-HABITAT has applied urban planning and design in a variety of ways, in very different contexts, to contribute towards sustainable human settlements development in general, as well as prevention, upgrading and integration of unplanned settlements, and the management of post-conflict and post-disaster situations, in particular. Each brochure introduces one thematic area or approach, and illustrates its impact on the built environment, and/or the planning legislation, policy and process. The specific context and programme within which the illustrated UN-HABITAT activities have been developed are mentioned at the end of each brochure, along with contact details for more information.

*see: *www.unhabitat.org/rdmu/* and *www.unhabitat.org/roaas/*

unicef

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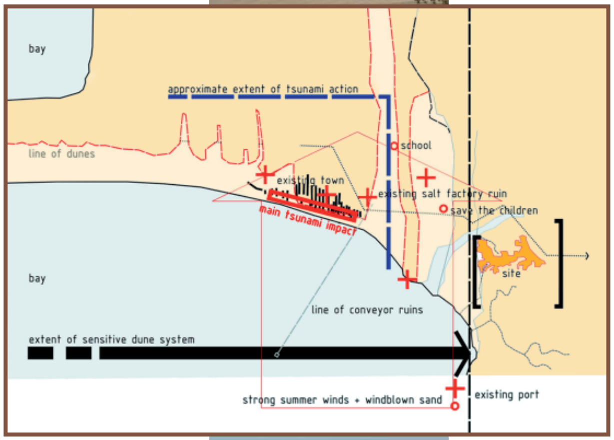
MOVING TO SAFER GROUND

finding sustainable space for development

The first step in the Xaafuun reconstruction process was to find a safe and environmentally sustainable site.



A multi-disciplinary team – comprised of urban planners, a local economic development expert (from ILO) and an environmental expert – recommended that the site be:

- Close to the sea and to different fishing locations (for economic sustainability);
- Protected from sand-laden winds and mobile sand dunes, and sufficiently elevated above sea level (for long-term environmental sustainability);
- Suitable for the cost-efficient establishment and operation of basic services (water, sanitation) and other public infrastructure;
- Easy to expand over time.

The final choice was agreed upon with the district authorities, the village elders and the women's representatives. It is not just land where people can settle safely, but it is a genuinely sustainable location, in other words a 'sustainable space'.

XAAFUUN VILLAGE

Xaafuun (pronounced ha-foon) is one of the few permanent fishing settlements on the north-eastern Somali coast, oscillating between 250 and 600 families, depending on the season.

In the damaged settlement, houses had been built at sea level near the beach, destabilizing the very fragile dune ecosystem of the area. Strong, sand-laden winds would regularly hit the village during the monsoon season, often burying structures and causing health problems, particularly for children, pregnant women and the elderly.

Fishery is the main source of income, but the rich marine resources are vastly under-exploited. The "industry" is very rudimentary: fish are sold directly to foreign boats lounging along the coast, and there is no internal market or fish processing business.

APPROPRIATE SETTLEMENT LAYOUT AND SHELTER TYPES

The new location called for a carefully considered, integrated settlement layout with appropriate types of shelter, rather than simply replicating what existed before. A preparatory sketch-plan discussed with all stakeholders allowed for swift land allocation to different agencies for immediate reconstruction activities. Meanwhile, a more detailed settlement layout was prepared by UN-HABITAT. A new mosque, a Koranic school, a meat market, a women's centre and a health centre have been built; the construction of additional public infrastructure continues. Such timely planning intervention has been vital, as organisations had a tendency to find the best 'spot' for their building without considerations for coherency and without consulting the other agencies. After this preparatory exercise, UN-HABITAT started the construction of the new houses.

The town plan is based on the following principles:

- Compact settlement: this mitigates the impact of Xaafuun's strong winds on living spaces and housing units. It also ensures the cost-efficient development and operation of basic services, reduces the extent of the area that needs to be protected against soil erosion, and controls infringements on the delicate coastal dune ecosystem.
- "Public border": a public zone, comprising public spaces and public buildings, faces the sea, acting as a buffer between the residential area and the dunes, as it was in the original settlement.

- Main road: this is the backbone of the settlement, as it is linked with the main public facilities and aligned with the access road to the settlement and previously built structures.
- Economic development: next to the formal market structures and the sites along the sea for a small-scale fishing industry, spaces for spontaneous economic activities and social gatherings are created.

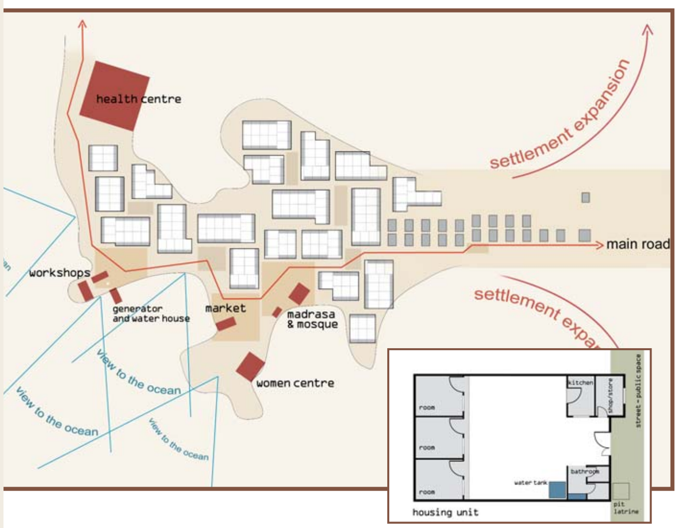
The design of the houses was based on environmental and cultural considerations, and the community made a final choice from three different types. The selected courtyard type was modelled on the most advanced houses in the old settlement, which had protected private spaces and room for expansion. Combining several units in blocks meanwhile increased compactness and cost-efficiency.

STATUS OF IMPLEMENTATION

As of April 2006, UN-HABITAT had built two construction workshops (to be converted into community centres on completion of the activities) and the first phase of 100 houses for the UNICEF-funded Xaafuun shelter reconstruction project. In total, it is anticipated that some 250 houses will be constructed under the presently available funding.

The buildings constructed by other agencies are in place and most of the public infrastructure has been finalized.

The remoteness of Xaafuun has presented a major access challenge. In addition, our participatory approach – adopted in the selection of the site, its layout and the design of the houses – has been time-consuming, but its benefits are clear. Houses built by another organization without proper community consultation, for instance, were not well received by the beneficiaries. Contracts are given to the community, organized through a newly created District Development Committee.



Xaafuun - *Workshops (above) and houses (below) constructed by UN-HABITAT*

CREATING SPACE FOR WOMEN AND CHILDREN

Both the settlement and individual houses were specifically designed to allow women to run economic activities from home. The basic house type has a room protruding into the street that can be used as a shop, small workshop or rental room. Small public areas around the settlement provide space for such things as playgrounds for children and water points, all in a safe environment. The women's centre is positioned close to the markets. A kindergarten and a primary school will be included in the settlement, and the first school built by UNICEF will be converted into a secondary school.

ROAD MAP FOR XAAFUUN: PLANNING THE WAY AHEAD

A lot more work remains to be done. While finalizing the 250 houses planned for 2006, suitable expansion areas will be designed. Xaafuun has attracted substantial investments that are turning a small fishing settlement into a potential pillar of coastal development. Links to the new fishing hubs need to be formalized alongside further investments being made in this sector. With the growth of the settlement, new problems of solid waste pollution and hygiene will have to be tackled. For this purpose, appropriate community-based solutions are being developed.

ENVIRONMENTAL REHABILITATION OF THE OLD SITE

Relocation of the settlement will allow the dismantling of the original settlement and environmental rehabilitation of the dunes. This has to be properly planned, to avoid the risk that the old settlement will continue to be used, especially by seasonal workers. District authorities have so far demonstrated a clear environmental consciousness – for instance, cutting of live wood has been forbidden. The construction materials of the old settlement can be re-used in the new settlement. Youth and women's groups have shown interest in re-planting the dunes to facilitate the disrupted ecosystem's natural rehabilitation.

SOME CONCLUDING THOUGHTS

The Xaafuun case described illustrates that without compromising humanitarian efforts to save lives, it is vital to introduce a development perspective in the early stages of a post-disaster situation, fully taking advantage of the opportunities that might result from a disaster. It furthermore illustrates that UN-HABITAT can make an important contribution to post-disaster contexts, using its holistic approach to human settlements and its specific expertise in environmentally sound planning and urban design. This is strengthened by the experience UN-HABITAT has gained over the years in the actual implementation of substantial infrastructure projects. Our approach highlights opportunities, but also enhances the capacity of the international community to efficiently coordinate interventions during early recovery , and shorten the period of crisis.

SUDP - urban development programme for the somali region

The SUDP is an umbrella programme for urban interventions in the Somali regions.
UN-HABITAT is the lead agency, and its partners are UNA, ILO, Novib and UNICEF, each of whom contribute in their field of specialization. The three main components addressed are (1) governance, including legal and institutional reforms, strengthening municipal governance and the role of civil society; (2) urban management, including strategic planning and development control, land management, municipal finance, delivery of basic services and local economic development; and (3) the implementation of local projects by local consortia, building on the two capacity-building elements already mentioned.
The programme is funded by the European Commission, and co-funded by UNDP, Government of Italy, Government of Japan, UNICEF and DFID. The programme receives support from WFP through Food-For-Work schemes.

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GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source*:* World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future.* Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

5 GREEN GUIDE TO

MATERIALS AND THE SUPPLY CHAIN

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT)
is dedicated to the resilient spirit of people around the world
who are recovering from disasters. We hope that the GRRT
has successfully drawn upon your experiences in order to
ensure a safe and sustainable future for us all.

5
GREEN
GUIDE TO

MATERIALS AND THE SUPPLY CHAIN

James Good, InterWorks LLC

A NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster recovery and reconstruction approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on environmentally sustainable approaches to material selection and the supply chain.

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MODULE 5: GREEN GUIDE TO MATERIALS AND THE SUPPLY CHAIN

Table of Contents

1 INTRODUCTION

1.1 Module Objectives

This module is concerned with two key aspects of sustainable construction: 1) identifying the most appropriate building materials for post-disaster construction projects that will both protect people and offer environmental sustainability; and 2) identifying procurement policies and practices that help achieve environmental sustainability.

Specific learning objectives for this module are as follows:

1. Identify the typical environmental impacts of building material choices in order to minimize impacts to people and communities recovering from disaster.
2. Use environmentally aware approaches in the design of buildings and selection of materials for post-disaster housing reconstruction.
3. Identify the typical environmental impacts of material procurement options.
4. Describe strategies for procuring materials for post-disaster housing reconstruction that have the least negative impact on human welfare and the environment.
5. Explain the benefits and limits of environmentally conscious decision making in the selection and procurement of building materials after disasters.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 5 in a series of ten modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment and creating opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction to help to make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4, 5, and 6 pertain specifically to building construction, with Module 4 focusing on site planning and development, Module 5 on building materials and the supply chain, and Module 6 on building design and construction management. GRRT Modules 7 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

The primary audience for Module 5 is the people who decide which construction materials are procured and incorporated into post-disaster construction projects. These decision makers include the building project manager, project designer, and the staff responsible for procurement and logistics. Additional audiences for this module include others in the post-disaster construction industry, such as contractors, construction supervisors, government officials, and other technicians responsible for planning and implementing post-disaster building construction and reconstruction efforts.

1.4 Module Key Concepts

This module builds on the following key concepts:

1. **Only support sustainable and legal sourcing of materials.** In large-scale, post-disaster rebuilding campaigns, the demand for raw materials can quickly outstrip the supply of sustainably produced natural resources, such as clay for bricks, sand for cement, and wood for timber. This situation produces collateral devastation that was not directly created by the disaster. For example, unsustainable excavation of clay from hillsides to rebuild hundreds or thousands of houses increases the risk of landslides and topsoil erosion, which can lead to the pollution of waterways and negatively impact livelihoods and human health. Such environmental damage can increase risk and jeopardize the success of the overall recovery effort. Project managers should be aware of the sources of their building materials and make sure that they establish contract specifications for the use of sustainably sourced materials. Using materials that have been officially certified is one strategy for ensuring that materials have been sourced sustainably.
2. **Design to use fewer materials.** In designing structures such as houses, project managers should consider ways to effectively meet humanitarian needs with fewer materials. This can be done with design strategies such as using cavity walls in place of solid masonry walls or ribbed slabs in place of solid concrete slabs where feasible. Designing structures with standard material sizes can also help to prevent waste of materials during the construction phase.
3. **Use local sources – where this can be done in a sustainable way.** Local procurement of materials can be a more environmentally sound strategy than the procurement of distant materials because of the savings in transportation costs and packaging. When using local materials, however, project managers should make sure that extraction, processing, and use do not put people's health or environment at risk. The Sphere Humanitarian Charter and Minimum Standards specify that "Natural resources are managed to meet the ongoing needs of the displaced and host populations."[1]
4. **Use disaster debris as a reconstruction material.** One of the most environmentally sustainable options for construction projects in a post-disaster setting is the reuse of building materials found in disaster debris. If using disaster debris, project managers must ensure that the debris meets applicable specifications for strength and safety.
5. **Use materials with recycled content.** Recent technological innovations have led to the availability of building materials that contain recycled content. For example, fly ash from coal-fired power plants can be incorporated into cement production. Project managers should consider using building materials with recycled content where practical to reduce demand on natural resources and lower the project's human and environmental impacts.

1 The Sphere Project. 2004. *Minimum Standards in Shelter, Settlement, and Non-food Items.* Sphere Handbook. Geneva: Oxfam Publishing.

1.5 Module Assumptions

This module assumes that users are familiar with the project management cycle for humanitarian assistance or development projects; have a basic understanding of building design, planning, materials procurement, and construction; and are interested in learning how to integrate environmental considerations into this process. The module recognizes a continuum of activities in support of disaster survivors, from the earliest hours of emergency lifesaving functions through the permanent re-establishment of communities. The principles of this module are intended to apply to recovery and reconstruction projects being developed after immediate lifesaving activities have been completed.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Embodied Energy: The total amount of energy used to create a product, including energy expended in raw materials extraction, processing, manufacturing and transportation.

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles).

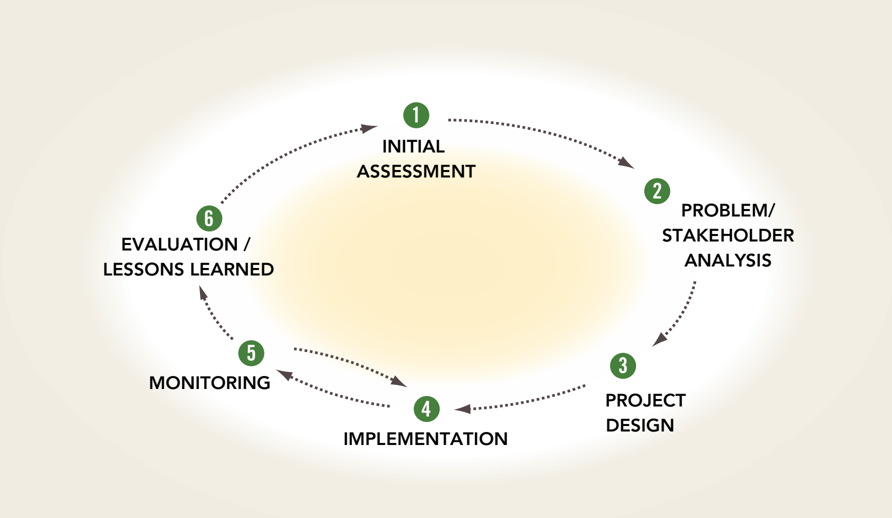
Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted.

After the 2004 Indian Ocean tsunami, WWF, Conservation International, and the U.S. Agency for International Development worked with international timber suppliers to transport environmentally sustainable wood to help rebuild houses in Aceh Province, Indonesia. The wood was certified by the Forest Stewardship Council. This is one strategy for procuring materials that have a lower impact on the environment and the communities that depend on it.
© WWF-US/Jill Hatzai

2 PROJECT CYCLE, BUILDING MATERIALS, AND THE SUPPLY CHAIN

In planning and carrying out disaster-response activities, many humanitarian agencies follow a standard project management cycle (Figure 1).

FIGURE 1: STANDARD PROJECT MANAGEMENT CYCLE



As indicated by the cycle, a well-managed project is by definition a set of logically sequenced, related activities undertaken to produce a planned output. The standard project management cycle pictured here identifies a sequence of activities – assessment, analysis, design, implementation, monitoring, and evaluation. This figure stresses the importance of learning lessons at each stage of the cycle and building those lessons back into future activities to improve future outputs.

Project designers and procurement officers should consider the environmental impacts of building materials at the earliest stages of the project cycle and throughout the entire project cycle, as indicated in Figure 2.

In the initial assessment stage, project planners can consider what the demand will be for building materials for their project as well as the larger context of materials demand for the post-disaster recovery and reconstruction. If the majority of building reconstruction will involve the use of timber, for example, then the initial assessment should include a specific analysis of whether local timber supplies are able to meet the demand in an environmentally sustainable way. If they are not, then project designers should consider what alternate sources are available for sustainable timber or what alternative building materials are available in supply markets (e.g., non-timber materials).

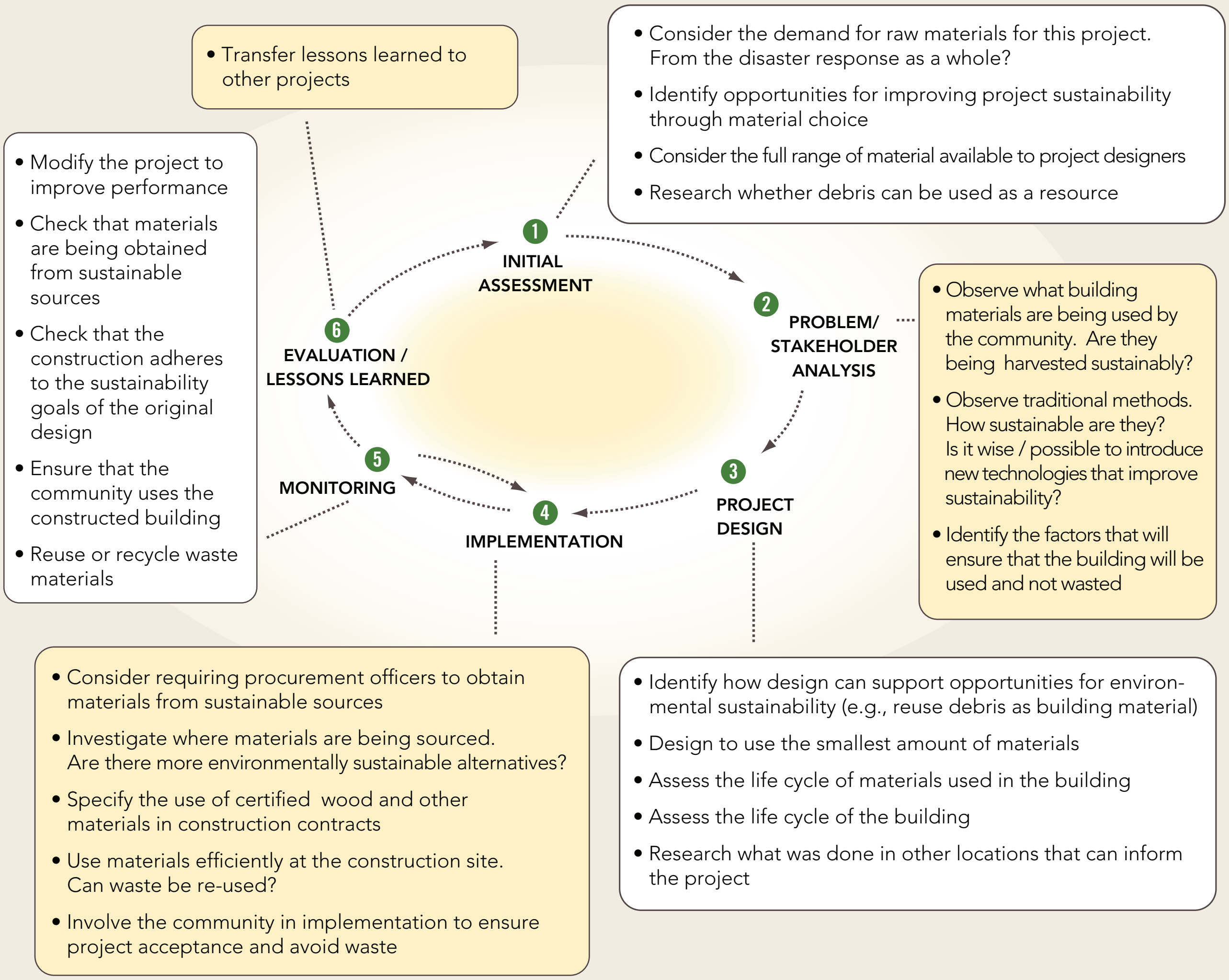
At the problem/stakeholder analysis phase, project planners will consider what building materials are being used by the community and whether it would be wise to introduce new approaches or advocate for the use of traditional methods. Part of this analysis should include specific consideration of which approaches are more environmentally sustainable. Ensuring that the community is fully committed to the project through ongoing participation will also help prevent situations in which newly constructed buildings go unused, resulting in wasted construction materials.

At the design stage, the project planners can consider how their material choices can optimize environmental sustainability, such as through the use of materials that include recycled content or the reuse of disaster debris. Consideration of the life cycle of the materials should also be a part of the design considerations (e.g., understanding how long materials will last before needing to be replaced or how households may use the materials in the future). If construction materials are not fit for the local conditions (e.g., untreated timber in a humid climate), they will require more frequent replacement. This results in the ongoing demand for raw materials, not to mention added financial burden on the household.

During the implementation stage, those responsible for procuring materials will be able to research the sources and markets that are available, and take steps to ensure that materials come from known sources that are environmentally sustainable. A more detailed description of key action points for building materials is contained in Figure 2 below and further elaborated on in the rest of this technical content paper.

These houses built after Cyclone Sidr in Bangladesh (2007) were considered both transitional and permanent because the structure was concrete but the walls were made of local thatch matting that allowed for easy repair in the event of another cyclone. The houses could be lived in as built or added to by families. This project demonstrates a number of successful strategies including: the use of local building materials, proper consideration of community needs, consideration of the life cycle of the building, and designs that reduce future disaster risk. © Kate Akhtar/CARE.

FIGURE 2: PROJECT MANAGEMENT CYCLE AND BUILDING MATERIALS CONSIDERATIONS



3 BUILDING MATERIALS, PEOPLE, AND THE ENVIRONMENT

3.1 Introduction

The appetite for raw resources in the building industry is enormous. According to the author of *The Ecology of Building Materials*, the building industry is, after food production, the largest consumer of raw materials in the world today.[2] Whether constructing a temporary shelter to house displaced people, rebuilding a health center or school, or installing sanitation systems, humanitarian aid staff involved in building construction require a wide range of building materials to complete the job.

All building materials have their origins in raw, natural resources. These raw materials consist of minerals, stone, soil materials, fossil oils, plants, animal products, and water. Minerals, for example, provide the raw materials for a suite of metal products. **Aluminum** (used in structural elements, wall cladding, gutters, doors, and windows), **iron** (processed into steel and used in structural elements, floors, walls, roofs, doors/windows, and nails/bolts), **zinc** (used in zinc galvanizing of steel), **lead** (used as an addition in concrete), **copper** (ingredient in roofing materials as well as pigments for paints and glass), **nickel** (used in steel and as a pigment in paint and tiles), and **silicone dioxide** (quartz sand used for glass) are a few examples of commonly used metals derived from the earth's minerals.

In addition to minerals, **stone rock** is used in its many different forms including blocks (used for structures and walls), crushed stone, sheets and slabs, **limestone** (ground to lime flour and used in cement), and **granite** (crushed as aggregate in concretes).

Soil materials are fine-particled materials from mineral or organic sources and include **clay** and **silt** (used in earth construction, plasters, brick production, cladding, and flooring), **sand** (used in plasters, mortars, and as insulation in flooring and aggregate in concrete), and **gravel** (used as aggregate in concrete).

Fossil oil is another source of building materials. Once it has been refined, it can be used for **tar** and **asphalt** for making roofs watertight. More refined products include **glues**, **waxes**, and **solvents** for paint. Fossil oil is also the raw material for most **plastics**.

Plants are another source of building materials and include **hardwoods** and **softwoods**, such as pine trees and mangrove wood (used in structures, doors/windows, and insulation), as well as **straws**, **grasses**, and **thatch** (used in roof covering and wall cladding).

The raw materials that go into building materials come from finite reserves. The demand for scrap for steel exceeds the maximum possible supply by a factor of around two. According to current statistical predictions, world iron reserves will last 95 years, aluminum 141 years, copper 31 years, and zinc 22 years.[3] These estimates do not take into account expected increases in consumption.

The massive rebuilding effort that occurs after a disaster requires any number of these building materials, and is therefore a part of the global demand for raw materials. The fact that communities need to rebuild the infrastructure that took decades or even centuries to build, and must do so within a much shorter recovery timeframe, means that there will be a rapid and intense demand for raw materials. The extraction of minerals, sand, or clay is likely to increase to an unsustainable rate in the years immediately following a disaster, particularly if the goal is to rebuild to the same level infrastructure that had previously existed.

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2 Bjørn, Berge. 2009. *The Ecology of Building Materials.* 2nd Ed. Oxford: Architectural Press.

3 U.S. Geological Survey. 2007. *Mineral Commodity Summaries.*

For example, in Mozambique in 2008, it was reported that "in the two weeks following Cyclone Jokwe, the entire stock of the mangrove timber market was sold out every two days, indicating that the post-cyclone housing reconstruction effort increased the rate of mangrove consumption 14 times over nonemergency situations." [4] See the case study on page 9 for more information.

The intensive demand for raw materials in reconstruction ultimately impacts the environment and the people who depend on it. In order to ensure that the recovery effort following a disaster does not make communities more vulnerable, staff involved in building design and materials procurement should ensure that their material choices take advantage of opportunities to maximize environmental performance.

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4 Randall, Jonathan. 2008. *Cyclone Jokwe Rapid Environmental Assessment Nampula Province, Mozambique*. Washington, DC: CARE-Mozambique and WWF.

In a post-disaster situation, the demand for raw materials is often far greater than the demand for materials before the disaster. This demand can put strain on already depleted ecosystems which can impact the long-term sustainability of communities recovering from disaster. © Bonnie Gillespie/American Red Cross

BUILDING MATERIAL DEMAND FOLLOWING THE 2008 MOZAMBIQUE CYCLONE JOKWE

On March 7, 2008, Cyclone Jokwe, a Category 3 cyclone with peak winds of 195 km/h (120 mph), made landfall in Nampula Province in northeastern Mozambique, affecting approximately 200,000 people and causing at least sixteen deaths. The cyclone destroyed or damaged over 10,000 houses, with the heaviest damage in the cities of Angoche and Moma and the Island of Mozambique in Nampula Province. The majority of the damage occurred in Nampula Province, where approximately 9,000 people were reported to have suffered damage or destruction to their homes.

From an environmental perspective, the most significant building material concern was the use of mangrove wood in the roofing beams for coastal homes. Although cutting mangroves is illegal in Mozambique, the practice is common. In Angoche, there is a well-established mangrove wood market that the operator reports has been in operation for at least the past 35 years. A second mangrove wood market acts as a satellite operation and is located further inland for easier access to homes. The price of a mangrove pole was reported to be 7.50 metical (MT), and an average home was expected to use 50 to 100 mangrove poles. Ironwood, another wood used in home construction primarily for beams, was also marketed for sale at a reported cost of 100 MT per pole.

Angoche Mangrove Market
© Jonathan Randall/WWF

According to the mangrove market operator, the entire stock of the market typically lasts about 30 days. However, in the two weeks following Cyclone Jokwe, the entire stock of the mangrove market was sold out every two days, indicating that the post-cyclone housing reconstruction effort increased the rate of mangrove consumption 14 times over nonemergency situations. Given that cyclones and severe flooding have been increasing in frequency and intensity in Mozambique over the past decade, the demand for mangrove wood is expected to increase in the future. Additionally, there has been a reported increase in the number of people collecting mangrove wood, as well as a steady rise in the number of people moving from central Mozambique to Angoche, putting added pressure on mangrove wood supplies.

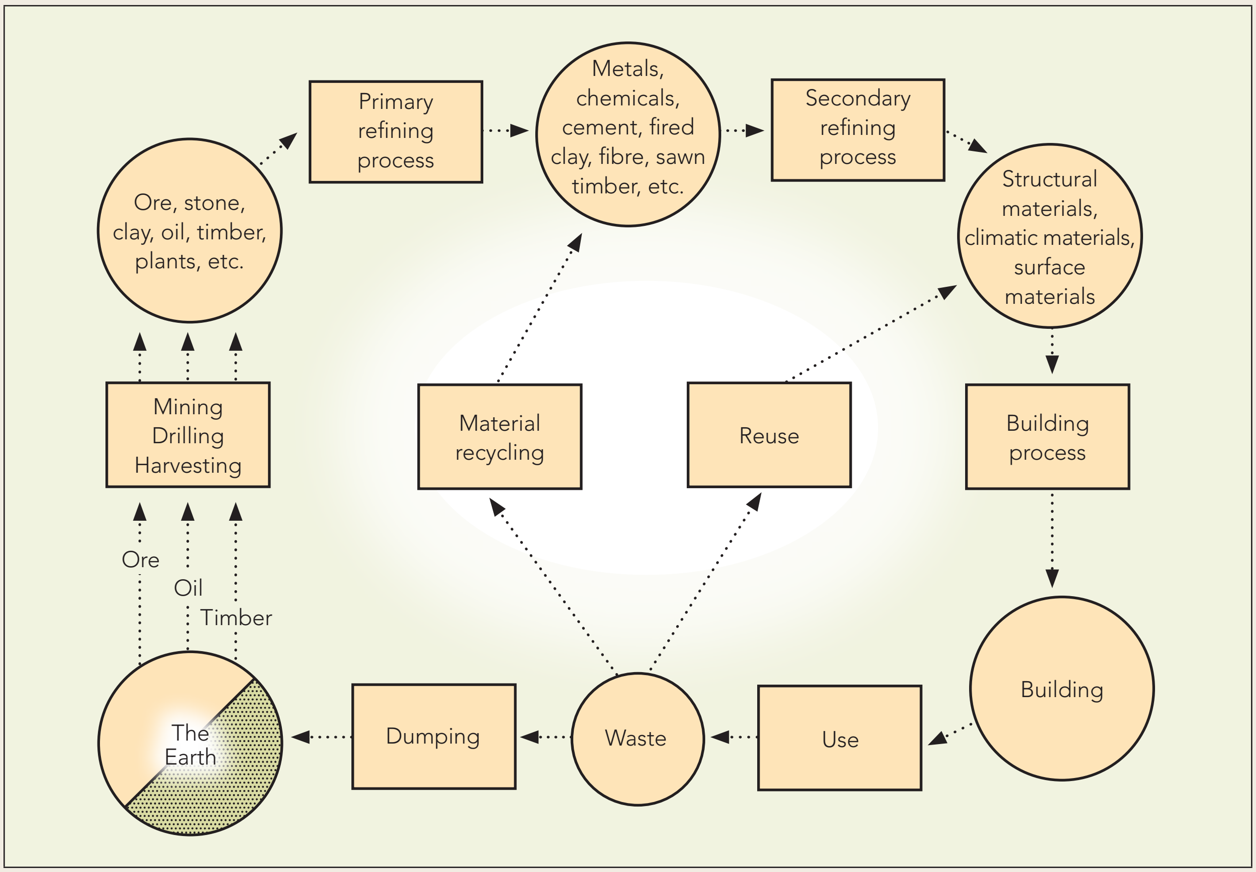
Because the harvesting of mangrove wood is illegal, local informants report that it is not harvested along the continental coast. Wood collectors sail to the islands of Eata Namacate and Larde in the Primeiras and Segundas archipelagos. These archipelagos are recognized as unique areas of high biological richness and diversity, and the mangrove habitat provides important nursery areas for juvenile fish and shrimp, which are important livelihoods resources.

Source: Randall, Jonathan. 2008. *Cyclone Jokwe Rapid Environmental Assessment Nampula Province, Mozambique*. Washington, DC: CARE-Mozambique and WWF.

3.2 Environmental Effects of the Materials Life Cycle

The life cycle of a building material refers to the various stages of a material from extraction or harvesting to reuse, recycling, or disposal. Understanding the life cycle of a building material is key to understanding the environmental implications of material choice and making decisions that will increase a building's environmental performance. Figure 3 is a schematic of a typical material life cycle.

FIGURE 3: LIFE CYCLE OF BUILDING MATERIALS



There are several different measures that can be used to determine the environmental effects of a building material. The amount of **pollution** that is generated by the various life stages of the building material is one measure. Pollution can come in the form of chemical toxins such as ammonia, arsenic, asbestos, or cyanide emitted during the material extraction and processing phases. These pollutants contaminate air, surface water, groundwater, and soil, and cause adverse human health effects. Greenhouse gases, such as carbon dioxide, are another form of pollution that is directly linked with climate change. It has been estimated that about 30 to 40 percent of the Earth's total global greenhouse gas emissions come from the construction sector. [5] Dust and particulate matter is another type of pollutant and byproduct of the manufacturing of construction materials.

5 UNEP. 2009. *UNEP Year Book: New Science and Developments in Our Changing Environment.*

A second measure of the environmental impact of building materials is **embodied energy**. Embodied energy is the sum total of the energy spent in the life cycle of a building material or component. This sum includes all of the energy required for the existence of that component, including extraction or harvest, transport, manufacture, assembly, installation, maintenance, and destruction and disposal.

A third measurement of the environmental impact of building materials is the **quantity of habitat destroyed or damaged** as a result of the material's use, where habitat is commonly defined as the natural home of an animal or plant. Raw material extraction and harvesting can destroy or alter the habitat for plants and wildlife that humans depend on for their survival and livelihoods. It can also displace people that have traditionally used a given area for their own homes, such as the displacement of people from their land for the mining of minerals used in metal production, stone, or granite.

In order to best understand the environmental effects of a given type of building material, it is useful to think about how each stage of the building material life cycle impacts the environment and the people that rely on it. A brief analysis is provided below.

3.2.1 Raw-Material Extraction and Harvesting

The life cycle of a building material starts with the extraction or harvesting of the raw material that will be used to produce the finished building material. Materials such as gravel, stone, and wood are primarily single-material building products, although other materials may be used in their manufacture. The term extraction refers to removal from the earth of a raw material that cannot be replenished (e.g., iron for steel or limestone for cement). Harvesting refers to the acquisition of raw materials such as wood, bamboo, or thatch that are typically plant-based materials and can be replenished over time.

Extraction of raw materials can lead to the pollution of water sources, increase the potential for natural hazards (e.g., landslides, erosion, and flooding), or result in air quality impacts from dust and particulates that can affect human health. When dust, soil, and other particulates enter into streams and rivers, the passage of light through the water is reduced, negatively affecting the photosynthetic microorganisms that fish and other species depend on for food. This suspension and eventual sedimentation of particulates can also increase water temperature and fill habitat in streambeds that fish use for foraging and shelter. Snails, worms, and other invertebrates that fish species depend on for food can be buried by the influxes of deposited sediment that is caused by sand mining. Figure 4 is a picture of river mining in Tambopata Province, Peru, and suspended sediment can be seen in the river. The sand is used for the production of cement for building construction. Extraction of clay from hillsides (Figure 5) can also create a landslide hazard for residents living in areas adjacent to the clay quarry.

Harvesting has its own set of impacts on people and the environment. The removal of timber from hillsides can result in the loss of habitat for food species, erosion of topsoil, and pollution of streams and rivers, as shown in Figure 6. The production of plants for building materials, such as reeds or bamboo, may also result in pesticide or chemical pollution of water and land, putting people at risk if not done sustainably. Workers involved in material extraction or harvesting may also experience health problems from working with toxic chemicals, such as mercury used in mineral extraction or pesticides or fertilizers used in plant production, especially in areas where safety standards are not well enforced.

Figure 4: River mining operation in Tambopata Province, Peru © Sylvia Jane Yorath/WWF

Figure 5: Clay Mining in Aceh, Indonesia © Shinta Sianturi/ American Red Cross

Figure 6: Logging in Aceh, Indonesia © Shinta Sianturi/ American Red Cross

3.2.2 Processing

The processing of building materials involves the conversion of a raw material into a bulk material that can be used to manufacture a building product.

The conversion from iron ore to steel also requires a series of processes, including the breaking up of the ore, cleaning, and sintering (heating). The amount of water needed in steel production at an average-sized plant is the equivalent of what a small town would use. It also takes 440 – 600 tons of coal to produce 1 ton of iron.[6] As a result of steel processing, large amounts of carbon dioxide are emitted, as well as sulfur dioxide, fluoride compounds, dust, and a wide range of heavy metals. Arsenic, a chemical that is toxic to human health, can also be released as iron ore is converted to steel. Additionally, zinc coating and galvanizing, which are common processes that protect steel from humid air, water, acids, and salt that contribute to rust, have an environmental effect. These processes lead to the emission of organic solvents, cyanides, chrome, phosphates, and fluorides, mainly in the cleaning water used in processing.

The kilning of clay bricks requires significant amounts of energy as part of the burning process. It has been estimated that in Aceh, Indonesia, after the 2004 Indian Ocean tsunami, it took twice the amount of wood to make a house out of brick (because of the wood used in the brick kilns) than it did to build the house from timber in the first place (see Figure 7). According to a report by the Food and Agriculture Organization, a typical brickworks in Sumatra, Indonesia, produces approximately 10,000 bricks per week, enough to build one home. It requires approximately 9 cubic meters of wood to fire this number of bricks. By comparison, a house constructed from wood requires about 3 cubic meters of wood. Therefore, roughly twice as much wood is needed to fire the bricks for a brick house than to build a wooden house.[7]

For additional information on the environmental effects of processing aluminum, lime, cements, glasses, stone, and other common building materials, see Berge's *The Ecology of Building Materials*.

Figure 7: Fuel wood used for burning brick in Aceh, Indonesia © Jonathan Randall/WWF

6 Berge, Bjørn. 2009. *The Ecology of Building Materials.* 2nd ed. Oxford: Architectural Press.

7 Kuru, George. 2005. *FAO Assessment of Timber Demand and Supply for Post-Tsunami Reconstruction in Indonesia*. Report prepared for the Food and Agriculture Organization.

3.2.3 Transportation and Packaging

A building material typically goes through several stages of transportation, including transport from the extraction or harvesting site to the processing site where it is manufactured. The manufacturing process itself may require transportation of product between various manufacturing locations. The manufactured building product must also be transported from the manufacturing site to the building construction site, and this may include several intermediate stops at distribution centers, retail outlets, and storage facilities. The transportation of the building material can account for over 50 percent of the energy expended to use the product, and contributes to carbon dioxide emission and demand for oil, gas, and other energy resources.[8] In post-disaster situations, where building materials are often transported long distances because demand exceeds the available local supply, carbon dioxide emissions can be an even higher percentage of the total energy used in the production of the building material.

Packaging also contributes to the environmental impact of building material choice. Much of the packaging used for building materials is not biodegradable and cannot be safely burned (e.g., plastics), and this leads to situations in which the use of the building materials creates a solid waste management issue. Some materials need protective packaging due to moisture sensitivity. However, it is more commonly the case that materials are overpackaged. According to the World Health Organization, "packaging of emergency response provisions (e.g., food, water, medicine, shelter) can produce serious waste problems."[9]

3.2.4 Building and Maintaining

After the building material has been delivered to the site, it becomes incorporated into the building project. The environmental impact at this stage is related to how the materials may affect the construction workers and building occupants. Building products that may be considered harmful include 1) many forms of paint and varnish and 2) formaldehyde in resin-bonded boards including plywood, chipboard, and some foam products (e.g., vinyl products such as flooring tiles). Solvent and paints emit particles and gases that can cause respiratory problems or increase susceptibility to asthma and allergies. For these compounds, emissions will be greatest during the first weeks or months of construction. Additionally, many organic materials as well as mineral materials with organic additives are apt to host fungal growth when exposed to continuous humidity. They can emit mycotoxins (substances produced by a mold or fungus that are toxic to humans and animals) and other serious irritants.

3.2.5 Demolition and Disposal

Building product removal can occur during or after the building's useful life. During a building's life, deconstruction can include removal and replacement of one or more building products. This may be 1) because the product's life is less than that of the overall building, or 2) because of technological obsolescence (i.e., replacing the product with a newer version will be more efficient or cost-effective)

When building materials become obsolete, they need to be properly disposed of, and this places demands on solid-waste management systems. Especially in a post-disaster setting, the capacity of solid-waste management systems can be quickly exceeded. In many developing countries, solid-waste management systems do not function well, and the disposal of building materials places an added burden on these systems.

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8 Halliday, Sandy. 2008. *Sustainable Construction*. Oxford: Elsevier Science & Technology.

9 WHO. 2005. *Solid waste management in emergencies*. Technical Note Number 7.

4 GUIDANCE FOR PROJECT DESIGNERS

As described above, the use of building materials, whether of steel, sand, or thatch, has a range of environmental impacts that ultimately affect human well-being. Fortunately, there are steps that can be taken to reduce these impacts. In the context of post-disaster building reconstruction, there are two key intervention points: 1) **building design** and 2) **materials procurement**. The **building design stage** is important because this is where decisions about the type and size of the building are made, research on traditional building methods and community preferences is conducted, and certain building materials are selected. At the design stage, the decision to build houses out of mud-stick material, stabilized earth brick, or cement block, for example, ultimately results in different environmental impacts.

The **materials procurement stage** is equally important because the choice of supplier for a given building material (e.g., sand for cement) will have an environmental impact depending on where the suppliers are sourcing their materials. If supplier A is sourcing sand from a sustainable and legal source whereas supplier B is illegally sourcing sand in a way that is negatively impacting the community, then procurement staff should ensure that sand is obtained from supplier A. Of course it is essential for project designers and procurement staff to work together, because the availability of building materials will have an impact on the types of designs that are possible, and those designs, in turn, drive the demand for the building materials. The following section provides guidance for project designers. Section 5 contains guidance for procurement staff.

4.1 Design to Minimize Total Raw Material Consumption

Project designers should analyze ways to meet programmatic needs while at the same time minimizing total raw material consumption. At a minimum, project designers should consider at least two different building designs to see what practical options exist for reducing materials consumption. For example, project designers could compare a stabilized earth-block design with a brick-kiln design in terms of the quantity of building materials required. In many instances, it is possible to reduce the material content of buildings without compromising standards: Solid masonry walls can be replaced by cavity walls or buttressed walls, solid concrete slabs by ribbed slabs, and timber beams by lightweight trusses; lightweight insulating materials can be used to help provide climatic protection at low energy cost. Active engagement with the community is also essential so that the constructed building is used and materials do not go to waste. The size of the structure should also meet minimum standards without exceeding the building size necessary to meet the need. This minimizes stresses on resource markets and natural resources. Designers may also consider adapting the design in such a way that additions can be made to the house by the owner at a later date.

- ❑ At least two (2) different building designs are examined, with consideration given to the quantity of building materials needed for each type of design.
- ❑ Design is based on the use of standard material sizes (i.e., modular dimensions) for less waste at the construction site.
- ❑ The building is designed in such a way that its materials can be reused later in the life cycle of the building. The building can be deconstructed so that materials can be reused without being completely demolished and disposed of.
- ❑ The design includes engineering strategies that optimize material strength with lower quantities of materials while still meeting standard building codes and safety considerations (e.g., cavity walls or buttressed walls).
- ❑ The size of the structure meets minimum standards but does not exceed the building size necessary to meet the need.
- ❑ The building design reflects active engagement with the community to ensure that the structure will be used once it has been constructed.
- ❑ Materials are selected based on consideration of long-term durability so that the need for replacement is minimized.
- ❑ Local builders are trained on the construction techniques and materials being used in order to minimize waste during construction.

SWISS RED CROSS AND THE RAT TRAP CONSTRUCTION METHOD AFTER THE INDIAN OCEAN TSUNAMI

The Swiss Red Cross utilized environmentally sustainable housing models in its planning for reconstruction in Pondicherry, India, after the 2004 tsunami. Consideration of the environment informed material selection and construction technology. The "rat trap" method of masonry structure conserved 25% of production materials. All the bricks were laid on their sides instead of flat. The headers (the bricks with the smallest end showing) were laid across the wall to form a similar pattern on the other sides. As a result the stretchers (bricks with the long sides showing) effectively form two parallel walls with a gap between them. It is this gap (about 2 inches) that gives the pattern its name, rat trap. Nonstructural walls were built like this because they used fewer bricks and were therefore cheaper. The project also introduced fly ash (a coal residue) as a resource, recycling a material that would otherwise be wasted.

Source: SKAT Foundation. 2008. *Sustainable Reconstruction Initiative in Tsunami-affected Villages of Karaikal Pondicherry, India.*

STRAW BALE HOUSING IN BELARUS IN THE AFTERMATH OF CHERNOBYL

Straw bale housing was pioneered in Belarus and other countries in the Commonwealth of Independent States (CIS) as a means of providing affordable, environmentally sustainable public housing for groups displaced by the 1986 Chernobyl nuclear accident. It has been estimated that about 60 percent of the nuclear fallout from the Chernobyl incident landed in Belarus. Because of the poor regional economy and the needs of the target groups, it was imperative that the housing be inexpensive. A sustainable approach was also desirable because of the environmental problems caused by Chernobyl and by military activities in the area.

The housing program, undertaken jointly by a Belarusian nongovernmental organization and the government, is today viewed as a success, particularly in its environmentally sustainable use of straw, an annually renewable agricultural waste product, and in its use of solar power for hot water and heating in each house from April to September.

Straw as a construction material has many benefits. Using straw (which would otherwise be burned, as it is difficult to reintegrate into the soil) instead of wood helps to curb deforestation. It is a good soundproofing and insulating material. Inhabitants of straw bale houses report using one-quarter of the fuel they would have used in similar conventional brick houses. Additionally, straw bale homes constructed with simple earth plaster maintain good fire resistance properties and have been shown to meet fire safety building codes. Recognition of straw's merits as a sustainable resource is growing. Indeed, straw burning is now banned in the U.K. and other countries.

Source: Barakat, S. 2003. *Housing reconstruction after conflict and disaster.* London: Overseas Development Institute Humanitarian Practice Network.

4.2 Choose Construction Materials with Lower Embodied Energy

As mentioned in Section 3.2, embodied energy is the sum total of the energy spent in the life cycle of a building material or component. This sum includes all of the energy required for the existence of that component, including extraction or harvest, transport, manufacture, assembly, installation, maintenance, and destruction and disposal. The materials used for small buildings, such as houses and community centers, differ widely in terms of the energy content required for their manufacture, and savings can often be made by an appropriate selection of materials without reducing standards. Unfortunately, the lowest-embodied-energy solutions are generally those involving timber, which is becoming increasingly scarce. However, secondary species of timber available from managed forests, such as rubber and coconut, among other kinds, can provide a sustainable supply. Technologies for protection against biodegradation and preserving the dimensional stability (i.e., the ability of wood to retain its form when exposed to moisture) of these species are already available and are cost effective. Also, new lightweight or hollow blocks, fiber-concrete products, and other composites can save energy compared with more conventional products.

- ❑ Material selected with the goal of reducing the embodied energy of the material. In examining the building materials being used, designers have considered the amount of energy that was required in the following processes:
  - Extraction/harvesting
  - Transportation
  - Processing
  - Building and maintenance
  - Demolition and disposal
- ❑ Materials are chosen based on a preference for local sources.
- ❑ Environmentally sustainable materials, such as lightweight or hollow blocks, fiber-concrete products, other composites, and timber from well-managed forests are considered.

BUILDING WITH LOWER EMBODIED ENERGY IN CUBA FOLLOWING HURRICANE DENNIS

In order to promote the construction of more efficient homes in Cuba in the aftermath of Hurricane Dennis in 2005, CIDEM or the *Centro de Investigación y Desarrollo de Estructuras y Materiales* (Research and Development Center for Structures and Materials) created a training and capacity-building program for local builders on the production and use of "ecomaterials" that feature a low embodied energy. Materials included micro-concrete roofing tiles, pre-cast hollow concrete blocks, clay bricks fired with bio-waste fuels, bamboo, and partially replacing Portland cement with lime-pozzolana cement (CP-40). As a result of this project, over 19 ecomaterials workshops were started in Cuba and over 2,300 homes were renovated or repaired using the new technology. This case illustrates how material selection can contribute to both lower energy use and local capacity building. CIDEM is involved in hurricane-damage-mitigation efforts to implement similar methods of localized production and ecomaterial usage in housing construction.

Source: World Habitat Awards. 2007. *Ecomaterials in Social Housing Projects*.

4.3 Include Reuse Strategies as Part of Building Design and Construction

The most environmentally sustainable option for resourcing construction projects is the reuse of waste building materials in their existing state without downgrading and reprocessing into new products. Massive amounts of materials can come from disaster debris and demolition sites. The potential for using these materials is enormous; they mitigate the need to buy new materials and prevent the consumption of energy in moving debris to landfill areas. The steel, bricks, timber, and tiles that are left after a disaster can often be used to provide transitional shelter to affected families, and can serve as the starting point for reconstruction. In some cases, the salvage of building materials for reuse can be a revenue-generating activity.

Instead of dumping or destroying the damaged materials from storm-damaged housing stock, post-disaster projects can actively pursue reuse strategies where feasible. Many building materials are reusable, even after being exposed to a disaster (e.g., metal roofing blown off of a house in a cyclone). Metal roofing sheets may be reshaped and renailed into place. Lumber damaged in earthquakes and trees blown over in storms can be cut and reused, especially when shorter lengths are needed. Damaged concrete blocks can be used as fill, and stones can be cleaned and reused for masonry construction. If the reuse of materials is an option, special care should be taken to ensure that the materials are of high enough quality to be used for safe and long-lasting construction, as they can become dangerously weakened either by predisaster use or by the disaster itself. A process to assess the quantity of disaster debris that is available, as well as costs for transportation and processing, should be taken into account in project budgeting.

- ❑ The availability and quality of disaster debris for use in building designs has been actively considered (e.g., corrugated steel roofing, timbers, wood framing, doors, windows, masonry units (brick or block), concrete for aggregate as a base for roads.)
- ❑ Building designs and construction methods are selected so that additions and modifications can be made using the same fundamental designs and methods.

THREE LEVELS OF RECYCLING

Reuse: The use of a whole component, in largely unchanged form and for a similar function; for example a brick reused as a brick.

Recycling: The melting or crushing of the component and its separation into its original constituent materials, which then reenter the manufacturing process as raw materials.

Recovery: Burning of the demolished product to produce energy. The use of the raw material as a resource is lost and only its energy content is recovered.

Source: Berge, Bjørn. 2009. *The Ecology of Building Materials*. 2nd Ed. Oxford: Architectural Press.

REUSE AND RECYCLING IN TURKEY

In 1999, two devastating earthquakes in Turkey left 300,000 housing units damaged or destroyed, and emergency shelter was needed for 600,000 people. In the initial phase, a number of temporary houses were constructed. Post-disaster efforts were subsequently made to disassemble a number of unused temporary housing units and reuse or recycle many of the materials to construct longer-term "redesigned" houses. This approach can speed up the recovery process, allowing for a quicker transition to normalcy for affected populations. A study found that disassembly and reuse of materials from temporary houses for the longer-term houses resulted in significant materials and energy savings without compromising structural integrity.

Source: Arslan, Hakan. 2005. Re-design, re-use, and recycle of temporary houses. *Building and Environment* 42:400-406.

MERCY CORPS, THE GREEN PROJECT, AND THE REBUILDING CENTER AFTER HURRICANE KATRINA (2005)

Mercy Corps, The Green Project, and the ReBuilding Center worked together in New Orleans after the devastating effects of Hurricane Katrina in 2005. This group devised a deconstruction method that could help low-income residents salvage materials from disaster-ravaged homes. These materials could in turn be reused in the reconstruction and rebuilding process. The project pilot was implemented on a partially collapsed home and included a six-day salvage operation, nail and debris removal, and full-site cleaning. Working by hand, people managed to salvage roughly 40% of the damaged home, or 150 cubic yards of material.

Source: Mercy Corps. 2006. *The Story of 2118 Dumaine Street*.

4.4 Include Recycling Strategies as Part of Building Design and Construction

One of the greatest technological opportunities available to building-materials industries and reconstruction project designers is the potential to incorporate wastes from agriculture and industry as raw materials and as fuel substitutes, thus simultaneously reducing pollution and the need for the extraction of new raw materials. Waste from coal-fired power stations, such as blast-furnace slag and fly ash, can be incorporated in cement production. The utilization of industrial wastes can reduce the need to dispose of these products and reduce demand for raw materials. Timber wastes and agricultural wastes can be processed and used to form building boards. The residues from rice and palm-nut processing, and from coconut and groundnut, are materials that can be used as fuels in brick burning and lime burning. Many nonhazardous industrial wastes can be used as aggregates in concrete production. In addition, the ash from many agricultural residues has chemical and physical properties (e.g., the ability to set in water) that makes it suitable for incorporation into cements.

Even in cases where materials may be so badly damaged that they are not reusable in their current form, such materials may still be recycled and made into new products at lower cost and with less ecological damage than is incurred in the manufacture of new materials. In addition to recycling materials damaged by the disaster, managers can help the environment by specifying and buying building products that contain recycled materials. Information on reusing and recycling disaster debris is contained in the box below.

- ❑ Designer has consulted with procurement staff on the availability of recycled material that can be used in the building designed.
- ❑ Project designer should select building materials that include a high degree of recycled material when appropriate and available.

REUSING AND RECYCLING DISASTER DEBRIS

How a community manages disaster debris depends on the debris generated and the waste management options available. Many communities are finding effective ways to salvage, reuse, and recycle all kinds of disaster debris. Soil, green waste, and construction and demolition materials can be recycled or composted into useful commodities. For example:

- Green waste, such as trees and shrubs, can be "recycled" into valuable organic material, such as compost or mulch.
- Concrete and asphalt can be crushed and sold for use as a base in road building.
- Metal can be recycled and sold by scrap metal dealers.
- Brick can be sold for reuse or ground for use in landscaping applications.
- Dirt can be used as landfill cover or as a soil amendment for farmers.

Benefits of recycling disaster debris include:

- Recovering large amounts of materials for reuse
- Reducing the burden of large volumes of material on local landfills
- Saving money by avoiding disposal costs and through resale of materials

Source: U.S. Environmental Protection Agency. Disaster Debris. www.epa.gov/osw/conserve/rrr/imr/cdm/debris.htm (Accessed March, 31 2010)

5 GUIDANCE FOR PROCUREMENT MANAGERS AND LOGISTICIANS

Once the project designer has chosen the building materials, it is the responsibility of the procurement manager or logistician to procure the materials. The material procurement phase is an important opportunity to reduce the environmental impact of building materials. The following section provides guidance on ways that procurement managers and logisticians can investigate the source of building materials, integrate environmental criteria into bidding documents, and work with the producers on building materials to reduce the longer-term impacts of building material use.

5.1 Investigate the Source of Materials

The primary responsibility of a procurement officer/logistician is to deliver the appropriate supplies, in good condition and in the quantities required, to the right places and the people who need them, on time and cost effectively. To this fundamental job description, this module adds the description of "appropriate supplies," meaning that they meet the criteria of minimizing pollution, embodied energy, and negative impact on the environment. Procurement should not be based only on cost, timeliness, and availability criteria, but also on verification that the source of material is legal and sustainable, while simultaneously seeking to minimize energy used for the transportation.

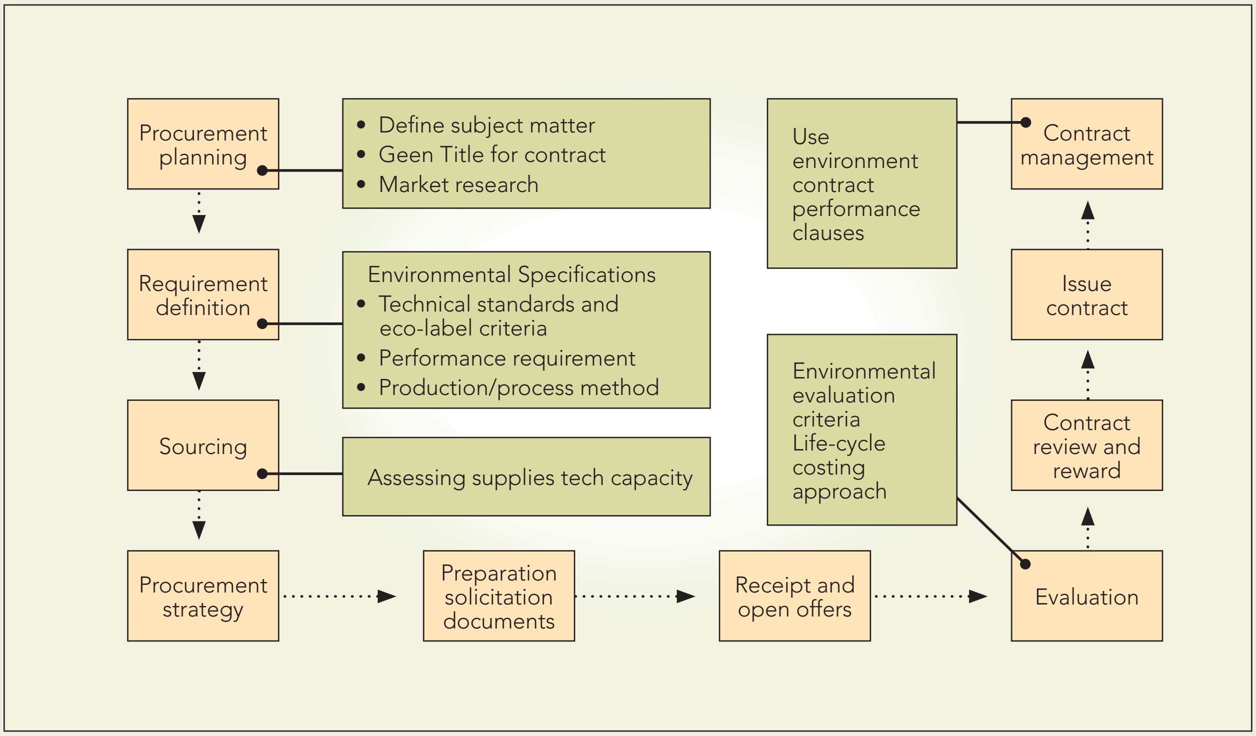
- ❑ Procurement managers have investigated at least two or three different suppliers for a given building material and asked the suppliers where they source their materials and if they are aware of any environmental impacts associated with the extraction, processing, or transportation of the materials. Environmental impacts to ask about include pollution of waterways, negative health impacts, impacts on air quality, and loss of habitat.
- ❑ Procurement managers have visited the locations where raw materials are being extracted for use in the project where practical (e.g., source of sand for cement is investigated to see if it is legal and sustainable).
- ❑ Procurement managers have consulted with government officials to determine if there are any environmental concerns with respect to the use of certain types of building materials in the project area.

5.2 Integrate Environmental Criteria into Bidding Documents

Building materials often must be procured through a bidding process, either because the quantities are very large and not available locally or because the organization has established policies requiring the use of bidding processes in order to control quality, cost, and management oversight. The bidding process then provides an excellent opportunity to integrate sustainable environmental objectives with the process of procurement. The below diagram illustrates the many opportunities to "green" procurement. For more detailed guidance on these mechanisms, see *Environmental Procurement Practice Guide,* by UNDP, on the resource CD for this module.

- ❑ Bidding documents, Terms of Reference, and other contracting documents specify that building contractors will procure building materials from sources that are environmentally sustainable.
- ❑ The specifications include requirements for the use of verifiable, certified building products (e.g., FSC-certified timber) where possible. For more information on certified building materials see Section 6 below.

FIGURE 8: ENVIRONMENTAL INTERVENTIONS IN THE PROCUREMENT CYCLE



Source: UNDP. 2008. *Environmental Procurement Practice Guide*. UNDP Practice Series.

5.3 Work Directly with Material Producers to Green Their Operations

If large quantities of building materials are going to be used, procurement managers should consider working directly with material producers to ensure that their operations are environmentally sustainable. For example, if brick is being kiln-dried for a housing reconstruction project, procurement managers can work with the brick producers to ensure that fuel wood is obtained from environmentally sustainable sources and that the air pollution from the kilns does not negatively impact local residents. The procurement officer can inform suppliers of different methods they can use to reduce pollution, sustainably harvest materials, and lower embodied energy requirements in the process of producing and furnishing the materials. Building material suppliers may be interested in how they can reduce the environmental footprint of their operations but may be unaware of the best methods to do so. Procurement managers can help play a role in greening the supply chain of a local community.

❑ Procurement managers have taken proactive steps to assist their suppliers in making the material supply chains more environmentally sustainable.

WORKING WITH BRICK PRODUCERS IN SUDAN AFTER DROUGHT

Drought is a recurrent concern for humanitarian workers in much of eastern and southern Africa and finding sustainable sources of local fuel wood can be a challenge. The Shambob Brick Producers Co-operative Society in Sudan won the United Nations Best Practices award in 2000 for assisting poorer workers with better methods for brick production that use less fuel wood. Assisted by the Intermediate Technology Development Group (ITDG) of Sudan, workers integrated more environmentally appropriate production methods into their brick-making processes, including the use of new energy-efficient kilns. Firing kilns with cheaper alternative fuels, chiefly cow dung and bagasse residues (fibrous leftovers from the juice extraction of sugarcane and sorghum stalks), had a positive effect on economic viability as well as environmental sustainability. Up to 80% of wood fuel was ultimately substituted with bagasse. More uniform finished products created with improved molding and drying methods led to a savings in overall construction time and costs. Reduction of transportation costs to benefit both the local people and environment was also a consideration. This case illustrates the innovation of using locally produced and environmentally conscious materials to benefit communities and livelihoods while creating a platform for economic and environmental sustainability.

Source: Intermediate Technology Development Group Ltd. 2001. *Building in Partnership: The Story of Shambob.*

6 CERTIFICATION AND STANDARDS

Over the past few decades, a number of international initiatives have been started in order to streamline the evaluation process used for identifying environmentally sustainable buildings and materials. As a general rule, project designers and procurement staff and logisticians should research and use certified building materials where available and practical. The building materials will typically be marked with the symbol of the certification. National governments may also have their own standards and certifications for buildings materials, so it is useful to consult government officials in the building sector to see if there are certified materials available that have a lower environmental impact. The following section discusses a few of the international certifications and standards. Even if a building material has a symbol, it is still worth enquiring about the source, because false claims about the environmental sustainability of a building product are common (i.e., "greenwashing").

FSC

Forest Stewardship Council (FSC)

The FSC is an independent, nongovernmental, not-for-profit organization established to promote the responsible management of the world's forests. The FSC was established in 1993 as a response to global deforestation. Currently FSC offers, among other initiatives and services, a certification system that provides internationally recognized standard-setting, certification, and trademark assurance related to responsible and sustainable forestry.

The FSC label is shown on certified timber products by producers to indicate to buyers that their products have been managed and harvested in accordance with FSC's set of Principles and Criteria for forest management. There are 10 Principles and 57 Criteria that address legal issues, indigenous rights, labor rights, and environmental impacts surrounding forest management on a global scale.

The FSC Web site – available at www.fsc.org – includes a comprehensive, international database of certified timber suppliers that can be consulted. The database is under "Find FSC products." By accessing the FSC database (use the "Find FSC Products" option at www.fsc.org), managers can identify names and addresses of materials suppliers whose products bear FSC certification.

NSF

NSF International

NSF International is an independent, not-for-profit organization that specializes in the certification of food, water, and consumer goods, including many building materials and components (for more complete information, please see www.nsf.org). NSF was originally founded in 1944 as the National Sanitation Foundation, and is a World Health Organization Collaborating Centre for Food and Water Safety and Indoor Environment.

NSF has developed numerous standards and protocols, and annually tests and certifies over 225,000 products in 100 countries. NSF's standards are accredited by the International Accreditation Service (IAS), the International Standardization Organization (ISO), and Standards Council of Canada (SCC), among other organizations. NSF provides a solution both for those who need to "prove" green claims amidst the growing number of false claims or greenwashing in this area, and for those who wish to be sure about what it is they are buying. NSF can verify the following types of product claims:

- Compostability
- Recyclability
- Constituent analysis
- Contaminant analysis
- Indoor air testing
- Custom-designed testing

Managers planning post-disaster reconstruction responses should consider procuring NSF-certified products.

International Organization for Standardization

The International Organization for Standardization (ISO) is a voluntary, nongovernmental certification institution that helps set industrial standards. Among other services, the ISO deals with the issues of sustainability in building construction and environmental assessment methods.

ISO 14001 is the standard for environmental management systems to be incorporated into a business, process, or initiative. The aim of the promotion of the standard is to reduce the environmental harm of a business and to decrease the pollution and waste a business produces. One of the core components of this certification is the Life Cycle Assessment process, or LCA. The most recent version of ISO 14001 was released in 2004. This standard is similar in structure and process to the widely recognized ISO 9000 quality management standard. The standards, once published, become a market-driven requirement rather than a legal requirement. The ISO itself underscores this voluntary and market-driven relationship.

As of 2008, ISO 15392 establishes internationally recognized principles for sustainability in building construction. It thus provides a common basis for communication between stakeholders such as builders and architects, product manufacturers and designers, building owners, policy makers and regulators, housing authorities, and consumers. ISO 15392 is based on the concept of sustainable development as it applies to buildings and other construction works, "from cradle to grave." Over their life cycle, construction works – including post-disaster reconstruction works – have considerable economic consequences and impacts on the environment and human health.

Project managers should try to ensure that the materials they procure are from companies that have an Environmental Management System in place that complies with the ISO 14000 family of standards.

Leadership in Energy and Environmental Design

LEED Certification – Leadership in Energy and Environmental Design (LEED) is a third-party certification program that is becoming an internationally accepted benchmark for the design, construction, and operation of high-performance "green" buildings. It is important to note that, generally speaking, whole projects – not individual building products or materials – are LEED certified.

In the United States and in a number of other countries around the world, LEED certification is the most recognized standard for measuring building sustainability. LEED certification is one way for designers to demonstrate that their building projects are truly green. Project planners and architects should consider researching how their projects can incorporate some of the LEED principles in post-disaster recovery and reconstruction settings, even if there is not time to go through the entire LEED certification process.

THE COST OF INTEGRATING GREEN FEATURES

A 2004 study by Davis Langdon Adamson, a construction cost-planning and management company, found that the first costs of constructing a sustainable building tend to match or only slightly exceed those of comparable non-green buildings. The study, *Costing Green: A Comprehensive Cost Database and Budgeting Methodology*, measured the square-foot construction costs of 61 buildings requiring certification under the LEED green building rating system against those of buildings of similar type that did not aim for sustainability. Taking into account a range of construction factors including climate, location, market conditions, and local standards, the results showed that for many of the green projects, pursuing LEED certification had little or no budgetary impact. The study's findings also underline the idea that incorporating and integrating green features into a project early is critical to the success of any green building project. "It is the choices made during design which will ultimately determine whether a building can be sustainable, not the budget set," the report concluded.

Source: Adamson, Davis Langdon. 2004. *Costing Green: A Comprehensive Cost Database and Budgeting Methodology.*

The LEED building certification infrastructure is based on ISO standards (described above), and is administered by the Green Building Certification Institute (GBCI) and 10 other third-party certification bodies with experience in certifying organizations, processes, and products to ISO and other standards. There are four levels of certification: certified (the lowest), silver, gold, and platinum (the highest). Each level is defined by a set number of points from a LEED rating system that offers 7 prerequisite points and 69 optional points. To achieve any certification a project must comply with the 7 prerequisite points. These optional points determine the LEED rating as follows:

1. Certified: between 26 and 32 points
2. Silver: from 33 to 38 points
3. Gold: from 39 to 51 points
4. Platinum: from 52 to 69 points

ANNEX 1: ADDITIONAL RESOURCES

The following organizations and publications provide a variety of tools, resources, and information that elaborate on the concepts presented in this module.

Organizations

Green Building Certification Institute: The Green Building Certification Institute (GBCI) provides third-party project certification and professional credentials recognizing excellence in green building performance and practice. GBCI administers project certification for commercial and institutional buildings and tenant spaces under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Green Building Rating Systems. GBCI also manages the professional credentialing programs based upon the LEED Rating Systems, including the LEED Green Associate and LEED AP credentials. While the LEED Green Building Rating System is a common standard for green building in the United States, it is now also recognized internationally as a tool for the design, construction, and operations of high-performance, sustainable buildings. LEED buildings can now be found throughout the world, and there are currently projects in more than 100 countries working toward LEED certification. *www.gbci.org*

International Organization for Standardization (ISO): ISO standards are often cited in the development of many other standards and certification processes, including LEED certification. As such they are a touchstone and ultimate resource for specifications and for the process of certifying that materials and processes meet certification standards. In particular, ISO's 14000 series of standards address various aspects of environmental management. The first two standards, ISO 14001:2004 and ISO 14004:2004, deal with environmental management systems (EMS). The other standards and guidelines in the series address specific environmental aspects, including labeling, performance evaluation, life cycle analysis, communication, and auditing. *www.iso.org*

NSF International: The letters NSF originally stood for the National Sanitation Foundation, although they no longer carry that specific meaning after the merger of the National Sanitation Foundation and NSF Testing Labs. NSF supplies listings of certified products free to anyone visiting their website. These listings are updated daily. Published Listing Books may be obtained free of charge for public health officials. New certifications for novel processes, or for innovative designs and products, may be achieved by application to the NSF. *www.nsf.org*

The Shelter Centre: The Shelter Centre is a nongovernmental organization supporting humanitarian operations. Its focus spans the transitional settlement and reconstruction needs of populations affected by conflicts and natural disasters, from the emergency phase until durable solutions are reached. Shelter Centre partners in the sector include United Nations bodies, the Red Cross Movement, international organizations, nongovernmental organizations, and academic and research groups, as well as donors The Shelter Centre supports environmentally sound reconstruction by developing and maintaining strategic or policy guidelines, technical guidelines, and technical training. *www.sheltercentre.org*

United Nations Environment Program (UNEP): Functional organization within the United Nations system that focuses on environment and global sustainability issues. UNEP has a dedicated Disasters and Conflicts section. Sustainable construction guidelines and information can be accessed through their online resources. *www.unep.org*

UN-HABITAT: UN-HABITAT's mission is to "promote socially and environmentally sustainable human settlements development and the achievement of adequate shelter for all." UN-HABITAT focuses on sustainability issues for urban populations and provides many useful studies and publications on economic as well as environmental sustainability of human settlements around the globe. It provides guidelines, case studies, trainings, and workshops related to human populations and the built environment. *www.unhabitat.org*

World Green Building Council (WGBC): The WGBC's mission is to:

- Ensure that Green Building Councils are successful and have the tools necessary to advance
- Stand as the premier international voice for green building design and development
- Foster effective communications and collaboration between councils, countries, and industry leaders
- Support effective green building rating systems
- Share best practices globally

The WGBC provides publications, trainings, and workshops in this field and promotes sustainable building practices through trade fairs, local and international initiatives, and an annual green building festival, among other activities. *www.wgbc.org*

World Wildlife Fund (WWF): Nongovernment organization offering a broad array of resources on environmental issues. WWF is involved in a number of materials certification and market transformation programs, including the Forest Stewardship Council. National level WWF offices can provide insight into sustainable materials sources at a local level. *www.wwf.org*

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GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source*:* World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future*. Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

6

GREEN

GUIDE TO

CONSTRUCTION

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

6 GREEN GUIDE TO

CONSTRUCTION

Jeffrey Klenk, InterWorks LLC

A NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster recovery and reconstruction approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on environmentally sustainable design, architecture, and construction management.

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MODULE 6: GREEN GUIDE TO CONSTRUCTION

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INTRODUCTION

1.1 Module Objectives

This training module is concerned with two key aspects of sustainable construction: 1) *sustainability principles of design and architecture*, focusing on architectural design, building materials, and the lifecycle of the building; and 2) *construction management*, with a focus on the principles and practices that seek to minimize, through environmental protection, the impact of the construction process on people and communities recovering from disaster.

Specific learning objectives for this module are as follows:

1. Describe the key principles of environmentally sustainable building design and architecture to protect people and communities recovering from disaster.
2. Describe the key principles of environmentally sustainable on-site construction management.
3. Demonstrate how to apply the key principles of sustainable building design and construction management to a community-based project.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 6 in a series of ten modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment and taking advantage of opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction to help make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4, 5, and 6 pertain specifically to building construction, with Module 4 focusing on site planning and development, Module 5 on building materials and the supply chain, and Module 6 on building design and construction management. GRRT Modules 7 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

Module 6 is intended for construction supervisors, field engineers, contractors, housing project managers, humanitarian shelter delegates or program managers, spatial planners, and other technicians responsible for planning and implementing post-disaster long-term housing construction and reconstruction efforts.

1.4 Module Key Concepts

1. Sustainable construction is the application of the principles of sustainable development to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure to their final deconstruction and waste management.
2. Strategies for achieving sustainable construction include 1) refuse to build (i.e., elect not to build if alternatives are available), 2) reduce resource use, 3) reuse materials, 4) recycle materials, 5) repair existing infrastructure, and 6) recover the energy of the materials.
3. Environmentally sustainable construction should actively account for and address flexibility of use, building and material life span, local climate variability, energy efficiency, solid-waste management, and waste and wastewater systems.
4. On-site construction management should include attention to the handling of materials, equipment, and waste; pollution prevention; workforce education; and environmentally aware construction site planning and layout.
5. In order to minimize the waste of construction materials and resources, project designers should consider building with standard material dimensions.
6. During a recovery and reconstruction response, the community must actively participate in decision making and, ideally, should undertake most of the activities to gain a sense of ownership of the project. Community participation is not only essential to the long-term success of a project but also helps to reduce the waste of limited financial and natural resources.

1.5 Module Assumptions

This training module assumes that participants are familiar with the design, construction, operation, and/or management of building or other construction projects. As this module focuses on how to integrate environmental issues into these processes in a disaster-recovery and reconstruction setting, it is also assumed that participants are committed to the goals of this integration and will continue learning about and advocating for such integration after the close of the training. The technical content of this module highlights many key issues of environmental sustainability.

The module recognizes that there is a continuum of activities to support disaster survivors, from their initial need for emergency shelter until they achieve permanent housing. The module does not directly address the disaster response needs or environmental impact of the emergency phase, although many of the same principles apply to that initial phase, including those related to camp management. Sustainable disaster response is especially relevant for transitional shelter and permanent buildings, such as houses, schools, markets, and health centers.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Construction: Construction in this module is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

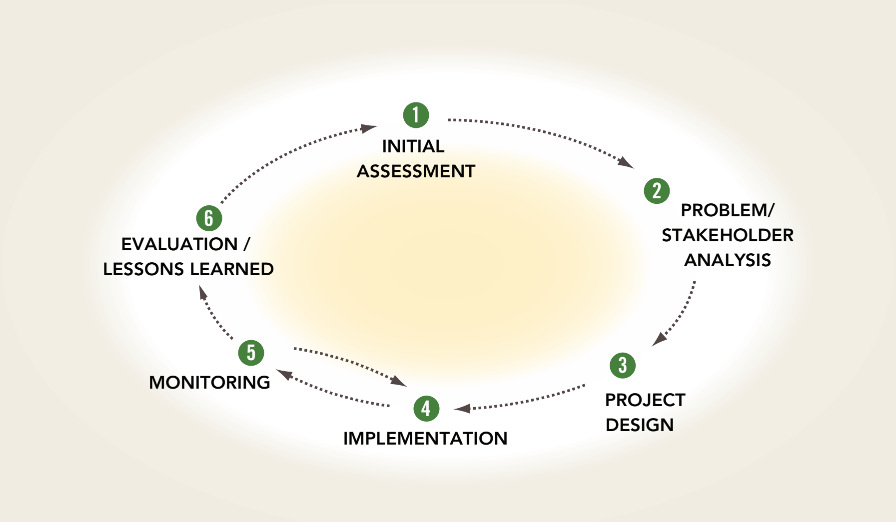
Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity.

2 PROJECT CYCLE AND SUSTAINABLE CONSTRUCTION

In planning and carrying out disaster-response activities, many humanitarian agencies follow a standard project management cycle as depicted in Figure 1:

FIGURE 1: STANDARD PROJECT MANAGEMENT CYCLE

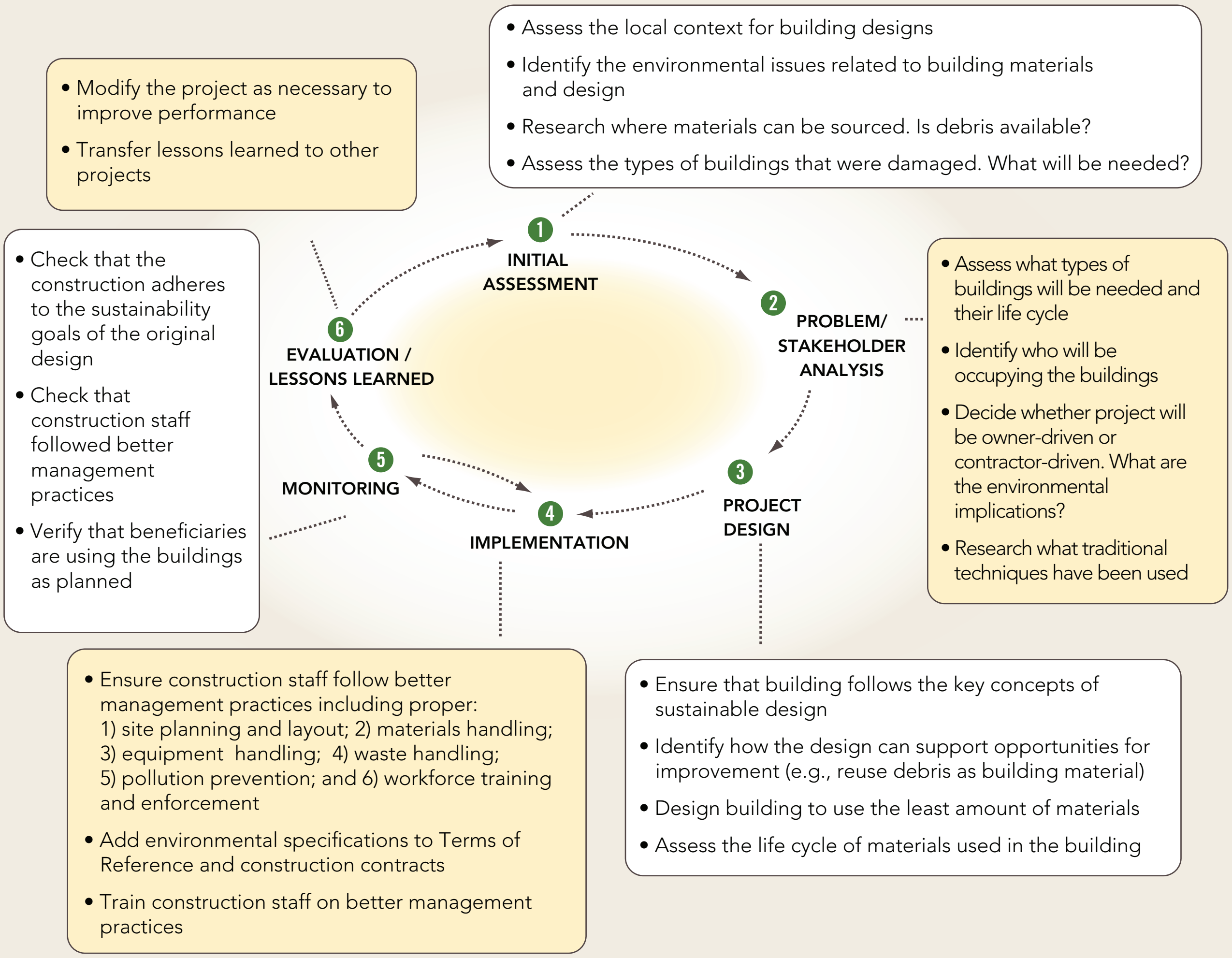


As indicated by the cycle, a well-managed project is by definition a set of logically sequenced, related activities undertaken to produce a planned output. The standard project management cycle pictured here identifies a sequence of activities – assessment, analysis, design, implementation, monitoring, and evaluation. A clear aim of this representation is to stress the importance of learning lessons at each stage of the cycle and building those lessons back into future activities to improve future outputs.

Project designers and procurement officers should consider the environmental impacts of building materials at the earliest stages of the project cycle and throughout the entire project cycle, as indicated in Figure 2.

The majority of the technical content in this training module falls under Step 3 of the project management cycle (project design) as further discussed in Section 3, and Step 4 (implementation) as further discussed in Sections 3 and 4.

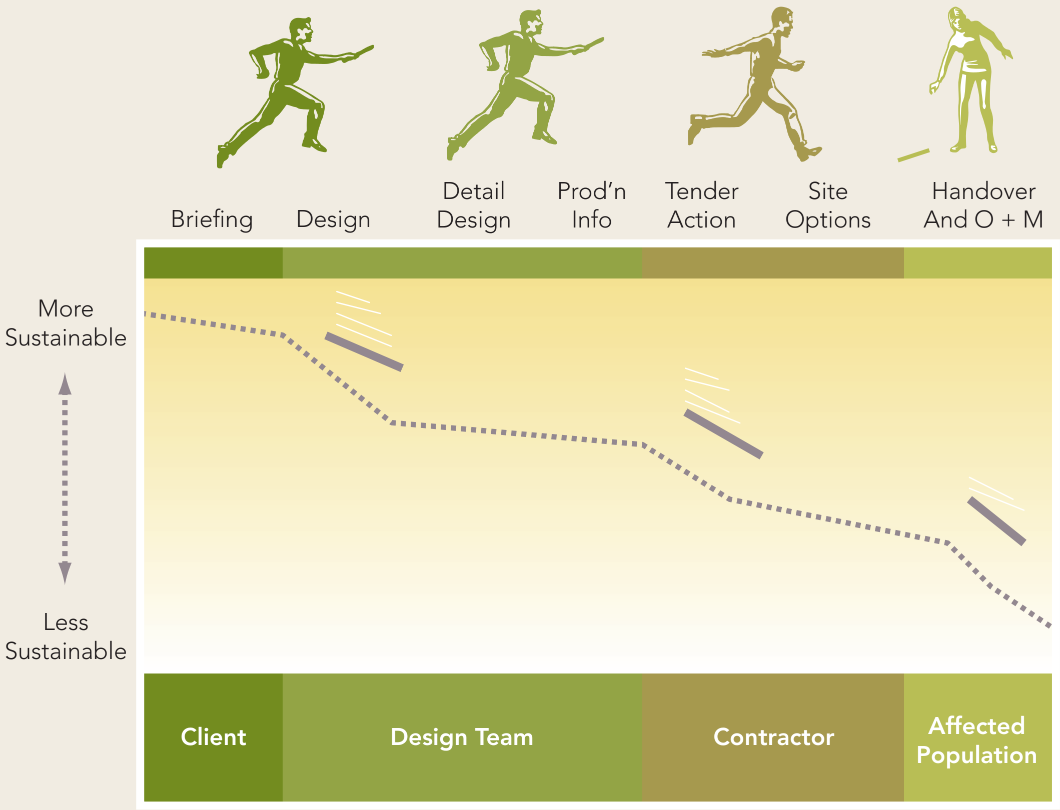
FIGURE 2: PROJECT MANAGEMENT CYCLE AND SUSTAINABLE CONSTRUCTION CONSIDERATIONS



In the aftermath of a disaster, it is all too common that planning decisions are based purely on building "something" to accommodate affected populations, resulting in unintended environmental impacts that harm communities over both the short and long terms. These impacts can include the pollution or destruction of environmental assets such as forests, fishing grounds, agricultural lands, coastal sand dunes, or mangroves that people depend on for their livelihoods. Poorly designed or constructed infrastructure can also lead to a costly waste of building materials, not to mention the toll on the social and cultural assets of the affected populations that the response was originally intended to assist.

The importance of careful and thorough planning throughout the project cycle is illustrated by Howard Liddell's concept of the "green baton," pictured in Figure 3. This concept compares the construction process to a relay race in which the responsibility for construction of the building passes between the various people involved, from the donor to the designer (in consultation with the community) and then to the contractor and so on. Each member of the construction team must ensure that his or her part in the construction process achieves its environmental objectives before he or she can transfer responsibility to the next member of the project team. For example, the **donor** can require that the project framework have a specific indicator to measure environmental performance. The **design team** can take steps to ensure that its building design includes energy efficiency. Similarly, the construction **contractor** should take steps to ensure that he or she minimizes the production of solid waste at the construction site. Each member of the project team has a role to play. At each stage of the construction process, there is the risk that a project will not fulfill its potential in achieving sustainability objectives. The sustainability "baton" could be dropped, particularly as responsibilities are transferred from the community to the design team to the contractor (or project implementer) and back to the community.[1]

FIGURE 3: SHARING RESPONSIBILITY AT EVERY STAGE IN THE PROJECT CYCLE



It should be noted that while the green baton concept stresses the importance of taking action to address environmental sustainability at every stage of the project cycle, it is never too late to improve project performance. For example, if the opportunity to design a building with sustainable building materials has been missed, there may still be an opportunity to site the building in a more environmentally sustainable location or to institute better construction management practices during the construction phase.

1 Halliday, Sandy. 2008. *Sustainable Construction*. Oxford: Elsevier.

3 CONCEPTS IN SUSTAINABLE DESIGN

Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle from the extraction and processing of raw materials, through the planning, design and construction of buildings and infrastructure, until their final deconstruction and management of the resultant waste. It is a holistic process aiming to restore and maintain harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity.[2] In essence, sustainable construction seeks to "Do No Harm" by supporting human dignity while minimizing negative impacts on the natural environment.[3]

Because there are several different components to sustainable construction, the GRRT presents the materials through a series of three different modules. This module covers sustainable design and architecture, as well as construction management at the field level. Module 4, Green Guide to Strategic Site Selection and Development, focuses on spatial planning, and Module 5, Green Guide to Materials and the Supply Chain, focuses on the material selection and procurement process.

3.1 The Need for Environmentally Sustainable Design

While the construction industry is of primary importance to humankind as a provider of shelter, it has also been inextricably linked to environmental degradation and ecosystem destruction. Construction activity is one of the most serious contributors to global CO_2 emissions, and has caused many other negative effects throughout the world, such as land degradation, air and water pollution, intensive energy consumption, waste, and deforestation. The WorldWatch Institute estimates that 40 percent of the world's raw materials and energy consumption is by buildings, and that 55 percent of the wood cut for nonfuel purposes is for construction. This situation contributes to environmental problems such as acid rain, air pollution, species biodiversity and habitat loss, deforestation, and toxic runoff from mines and mine wastes.[4] The massive rebuilding effort that occurs after a disaster requires an enormous amount of building materials, and is therefore a part of the global demand for raw materials. Communities need to rebuild the infrastructure that took decades or even centuries to build within a much shorter recovery timeframe, meaning that there will be a rapid and intense demand for materials as well as for land if homes are being relocated. What may have been sustainable rates of extraction for minerals, sand, or clay before the disaster are likely to become unsustainable in the years immediately following a disaster, particularly if the goal is to rebuild the same level of infrastructure as previously existed.

According to a humanitarian worker familiar with efforts to rebuild after the 2004 tsunami in Sri Lanka:

> "[W]e are witnessing greater damage from the reconstruction efforts than from the tsunami itself, especially haphazard clearing of mangroves, mining of sand dunes, and inappropriate dumping of debris, causing water contamination and blocked drainage canals."[5]

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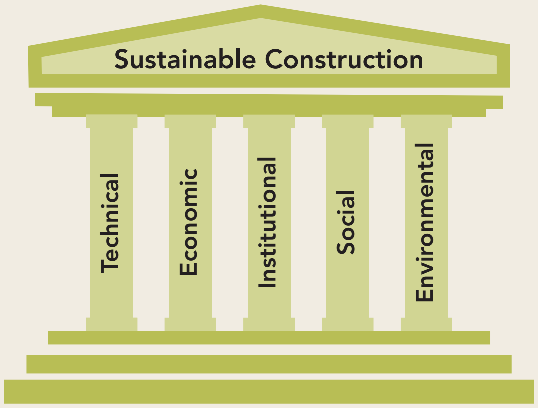
2 du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries. Pretoria*, South Africa: CSIR Building and Construction Technology.

3 Kennedy, Joseph E., ed. 2004. *Building Without Borders: Sustainable Construction for the Global Village*. Gabriola Island, British Columbia: New Society Publishers.

4 Roodman, David M., and Nicholas Lenssen. 1995. *A Building Revolution: How Ecology and Health Concerns Are Transforming Construction*. Worldwatch Paper #124, Washington, D.C.

5 Channa Banbaradeniya, IUCN Sri Lanka. Personal Communication. As cited in : Sudmeier-Rieux, K., H. Masundire, A. Rizvi, S. Rietbergern. 2006. *Ecosystems, Livelihoods and Disasters: An integrated approach to disaster risk management.* Gland, Switzerland: IUCN.



Some of the numerous challenges confronting project managers in sustainable construction may include selecting and procuring appropriate building materials, achieving cost-effective designs, identifying and applying environmentally appropriate construction practices, and gaining community acceptance and ownership. In addition, project managers in post-disaster settings often face considerable time and spending pressures as donors and the public look for quick and tangible results. The pressure to move quickly can be perceived as being in conflict with sustainable construction considerations; however, as described in this module, better planning does not have to take more time or resources. In fact, environmentally sustainable construction will save resources and protect people over the long term.

A common framework for considering the various components that make up sustainable construction is the "five pillars" approach[6], which includes the following:

Technical. Technical issues of sustainable construction call for practical, robust, and technically feasible solutions that aim to construct durable, reliable, and functional structures and seek to ensure quality in creating the built environment.

Economic. Economic concerns of sustainable construction efforts include the need for cost-effective solutions that ensure financial affordability for beneficiaries, the promotion of employment to support livelihoods, the selection of environmentally responsible suppliers and contractors, and the investment of social and human-made capital to maximize knowledge transfer.

Institutional. Institutional concerns include ensuring that laws and regulations are designed – and enforced – to promote sustainability, and that the institutions responsible for protecting the environment are supported, engaged, capable, and funded.

Social. Social concerns of sustainable construction include improving the quality of human life, facilitating culturally specific construction planning, and seeking the fair distribution of the social costs and benefits of construction (including long-term, intergenerational equity concerns).

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6 Adapted from:

Roseberry, Rachel. 2008. *A Balancing Act: An assessment of the environmental sustainability of permanent housing constructed by the international development community in post-disaster Aceh*. University of Sussex.

United Nations Environment Programme (UNEP) and Swiss Resource and Consultancies for Development (SKAT). 2007. *After the Tsunami: Sustainable Building Guidelines.*

Environmental. Environmental concerns of sustainable construction include ensuring that the following occur:

- Environmental considerations – including environmental impact assessments – are incorporated into all aspects of construction.
- The construction decision-making process supports actions that minimize environmental impact and resource extraction; reduce the use of energy, water, materials, and land; and prefer renewable resources to nonrenewable. The construction process also minimizes the use of potentially harmful materials (e.g., asbestos), and other nonreusable and/or nondegradable materials that can have negative effects on the environment following a disaster.
- Ecological diversity is maintained and/or restored.

The concepts mentioned here apply equally to all types of buildings, including schools, health centers, community centers, religious buildings, markets, and (most applicable in a disaster-recovery scenario) shelters. Depending on their specific requirements and function, different types of buildings may present different challenges when it comes to achieving environmental sustainability. For instance, health centers must deal with medical waste during their operation and maintenance. Although most of the concepts covered in this training module can also apply to the construction of other types of infrastructure, such as water and sanitation systems and roads, the focus here is on buildings. While we acknowledge that a full understanding of sustainable construction requires the full consideration of all five pillars of concern, this training module focuses on the environmental pillar.

The following section discusses the principles of environmentally sustainable construction in further detail. The key points are summarized in the box below.

KEY PRINCIPLES OF ENVIRONMENTALLY SUSTAINABLE CONSTRUCTION

- Actively consider the full life cycle of building materials, including the economic and environmental cost (also see Module 5, Green Guide to Materials and the Supply Chain, for additional information).
- Use existing materials and resources where possible.
- Sourcing and procurement decisions must consider the local appropriateness of the material, legality, cost, transport distance, and impact on the environment (also see Module 5 for additional information).
- The life span of the building, its various uses, and its flexibility should be actively considered in building design.
- Building designs should address local climatic variability and energy efficiency.
- The use of buildings typically produces solid waste, and this should be factored into building design and maintenance.
- Site selection should take into account the availability of freshwater resources. Designs should consider ways to reduce building waste and minimize water pollution.
- Community participation and analysis of existing building practices are essential for successful building construction and the minimizing of environmental impact and wastage.

CASE STUDY: ENVIRONMENTALLY SUSTAINABLE RECONSTRUCTION BENEFITS SURVIVORS OF 1999 COLOMBIA EARTHQUAKE

In the aftermath of a major earthquake in Colombia in 1999, a significant reconstruction effort was required in economically vital coffee-growing regions. As part of this effort and with the assistance of NGOs working on the recovery, the World Bank used a community participatory framework to develop a comprehensive environmental management plan (EMP) to guide the reconstruction process. Columbia-based project staff drafted a plan that focused on five main areas of impact: demolition, erosion control, transport of construction materials, waste management, and public safety. The EMP was intended to ensure that all phases of the reconstruction process supported sustainable natural resources use. The project provided several key lessons on the importance of sustainable construction:

- Proper debris removal at an early stage allows for the recycling of construction materials into the rebuilding effort, eliminating both the need for an abundance of costly new materials and the potential for serious impact on the surrounding natural environment.
- Reconstruction can be used to improve environmental conditions over the long term, lowering the risk of future damage. For example, attention given to the repair and upgrade of water and sewage lines to eliminate leaks provides for long-term sustainability of water supplies that benefit both communities and the environment.
- The EMP was also used for mainstreaming disaster-risk reduction into land-use planning. Under the new land-use plans created by the project, over 13,226 homes and other infrastructure were relocated from areas of high disaster risk.
- The adoption of the EMP allowed for the consideration of sustainability throughout the entire reconstruction process, from siting through project completion.

In recognition of the role that the environmental management plan played in reducing human exposure to disaster, the project was awarded the United Nations Sasakawa Award for Disaster Reduction. The success of this project demonstrates how a reconstruction process guided from start to finish by a firm commitment to sustainable values can yield positive results for both people and the environment.

Source: The World Bank. 2000. *Colombia Earthquake Recovery Project*.

3.2 Design to Increase Material Efficiency

The intensive demand for raw materials in reconstruction ultimately leads to impacts on the environment and the people who depend on it. According to the author of *The Ecology of Building Materials* the building industry is, after food production, the largest consumer of raw materials in the world today. Whether constructing a temporary shelter to house displaced people, rebuilding a health center or school, or installing sanitation systems, humanitarian aid staff involved in building construction require a wide range of building materials to complete the job. Some of these materials are **aluminum** for roofs and structural elements; **stone** for structures and walls; **fossil oils** for tars, waxes, paints, and plastics; and **plants** (e.g., thatch and timber) for structures, walls, and doors; there are many others as well. In order to ensure that the recovery effort following a disaster does not lead to communities that are even more vulnerable, staff involved in building design should take steps to ensure that their material choices take advantage of opportunities to maximize the environmental performance of their projects.

Sustainable design should consider not only the immediate impact of a particular material but the potential longer-term impacts at each stage of the material's life cycle. The life cycle of a building material refers to its various stages, from raw material extraction or harvesting to processing, transportation, and packaging and then to its reuse, recycling, or disposal. Understanding the life cycle of a building material is a key part of understanding the environmental implications of material choice and being able to make decisions that will increase a building's environmental performance. A detailed discussion of this topic is included in Module 5, Green Guide to Materials and the Supply Chain. A brief discussion is provided below, because material choice is a key aspect of sustainable design, alongside the other concepts such as designing for climate, energy efficiency, and water and waste systems.

The creative use and reuse of existing materials is still a largely untapped resource that offers much potential – especially in a post-disaster context. As building designers seek to implement sustainable construction practices, it becomes critical right from the outset to make fundamental design decisions about whether or not – and how – existing materials will be used or reused.[7] The decisions to make use of existing resources should be based on 1) structural integrity, 2) whether or not the materials constitute a potential health hazard, 3) the economic value, and 4) cultural acceptance. Additional information on reusing and recycling building materials is contained in Module 5, Green Guide to Materials and the Supply Chain. As noted in The Sphere Project:[8]

> *Customary users, extraction and regeneration rates, and the ownership or control of these resources should be identified. Alternative or complementary sources of supply may…reduce any long-term adverse impact on the local environment. Multiple sources and the reuse of salvaged materials, alternative materials and production processes (such as the use of stabilised earth blocks) should be specified, together with the adoption of sustainable practices such as complementary replanting or regeneration programmes.*

PROBLEMS AND SOLUTIONS IN ACEH, INDONESIA AFTER THE 2004 TSUNAMI

Following the 2004 Indian Ocean tsunami the demand for raw materials in Aceh, Indonesia was extremely high. Timber and other locally procured natural resources (such as sand, gravel, mountain stone, clay, and limestone) were extracted at an unprecedented rate. In order to minimize over extraction of one resource, several agencies changed housing design and diversified material use.

In a housing project funded by the German Red Cross, local women produced and used batako blocks (bricks made of limestone, sand, and some cement, mixed and then pressed together to dry in the sun) through an enterprise development project set up by partner organizations. Project stakeholders stopped using timber in their housing projects, and switched to batako bricks to avoid using clay and the wood fuel needed in manufacturing clay bricks.

It is important to note however that when switching between different types of building materials, in addition to being environmentally sustainable, it is crucial to ensure that the new building material meets all of the essential characteristics that are necessary for long term use, for example local acceptance, hazard resistance, durability, and cost-effectiveness. In some instances, timber may have advantages over blocks in areas with a high seismic hazard.

Additionally, it is also important to ensure that the builders have proper knowledge and skills in the use of the new material; the use of blocks, or reinforced concrete, requires specific techniques to control material quality and construction practices if the resulting buildings are to be seismic resistant.

Source: Roseberry, Rachel. 2008. *A Balancing Act: An assessment of the environmental sustainability of permanent housing constructed by the international development community in post-disaster Aceh.* University of Sussex.

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7 Halliday, Sandy. 2008. *Sustainable Construction*. Oxford: Elsevier.

8 The Sphere Project. 2004. *Minimum Standards in Shelter, Settlement and Non-food Items*. Sphere Handbook. Geneva: Oxfam Publishing.

From a design perspective, there are various options that project managers can consider to maximize the efficiency of materials selection. These include:

3.2.1 Refuse to Build

This refers to a design decision not to build; i.e., the construction activity is deemed by the project managers to be unnecessary or, for whatever reasons, undesirable. As an alternative, project managers could create projects that leverage the use of existing buildings, such as locating a new training center inside an existing government building or supporting the relocation of people to the homes of family members.

3.2.2 Reduce Resource Use

A design decision to reduce the amount of resources in the construction project, based on the understanding that the reduction will not detract from a good design solution, should be considered. Opportunities to reduce space requirements, material requirements, or other specific building elements should be weighed.

3.2.3 Build with Standard Material Dimensions

Building with standard material dimensions wherever possible reduces both the waste stream and material costs, as the need for cutting, altering, or fabricating materials by construction crews will be much reduced. Building with standard material dimensions has its roots in the building planning and design.[9]

3.2.4 Reuse Materials

A design decision to reuse an existing component in largely unchanged form and for a similar function should be considered. An example would be a brick reused as a brick or a blue tarp reused for roofing. A key concept of industrial ecology is that "waste" is seen not as garbage but as a resource in the wrong place that has not achieved its full potential. Designing for reuse involves consideration of the material and the technique for assembly of the material so as to enable reuse and replacement of components, either in part or in whole. Decision factors include ease and profitability: that is, components have to be worth reusing to enable a market for reused goods to develop, and easy enough to reuse to make it profitable to do so. A good example is the use of lime mortar, which enables bricks to be reused, whereas reuse of bricks joined by cement mortar is often extremely difficult and not cost effective.

In post-disaster settings, reuse of debris is common: e.g., damaged wood boats can be used for timber building material, and broken cement blocks can be used for fill. By supporting the reuse of materials in building construction, project managers can also provide economic opportunities for disaster-affected people by creating a market for the deconstruction of existing structures and reuse of materials. Use of local materials and vernacular architecture (methods of construction that use locally available resources and traditions) are often the norm. As a result, buildings are often constructed with an inherent capacity to be dismantled and their components reused. Building deconstruction practices may offer a source of high-quality materials to assist in improving quality of life. If the reuse of materials is an option, special care should be taken to ensure that the materials are of high enough quality to be used for safe and long-lasting construction, as they can become dangerously weakened either by normal, everyday use or by the effects of the disaster. A process to assess the quantity of disaster debris that is available, as well as transportation and any processing costs for these materials, should be taken into account in project budgeting.

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9 Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Recycling and reuse can be greatly facilitated if emergency shelter or transition planners design for easy disassembly of shelters. Transitional housing structures should be designed in such a way that existing materials can be reused in permanent housing construction projects. Charles Kibert proposes the following "principles of design for disassembly"[10]:

- ❑ Use recycled and recyclable materials
- ❑ Minimize the number of types of materials
- ❑ Avoid toxic and hazardous materials
- ❑ Avoid composite materials, and make inseparable products from the same material
- ❑ Avoid secondary finishes to materials
- ❑ Provide standard and permanent identification of material types
- ❑ Minimize the number of different types of components
- ❑ Use mechanical rather than chemical connections
- ❑ Use an open building system with interchangeable parts
- ❑ Use modular design
- ❑ Use assembly technologies compatible with standard building practice
- ❑ Separate the structure from the cladding
- ❑ Provide access to all building components
- ❑ Design components sized to suit handling at all stages
- ❑ Provide for handling components during assembly and disassembly
- ❑ Provide adequate tolerance to allow for disassembly
- ❑ Minimize the number of fasteners and connectors
- ❑ Minimize the types of connectors
- ❑ Design joints and connectors to withstand repeated assembly and disassembly
- ❑ Allow for parallel disassembly
- ❑ Provide permanent identification for each component
- ❑ Use a standard structural grid
- ❑ Use prefabricated sub-assemblies
- ❑ Use lightweight materials and components
- ❑ Identify points of disassembly permanently
- ❑ Provide spare parts and storage for them
- ❑ Retain information on the building and its assembly process

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10 Kibert, Charles J. 2003. Deconstruction: the start of a sustainable materials strategy for the built environment. *UNEP Industry and Environment*, April-June: 84-89.

3.2.5 Recycle Materials

Recycling means melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally manufactured. The component then re-enters the manufacturing process as a raw material. Examples include crushing lightweight concrete blocks into aggregate, turning high-quality plastics into recycled-content flowerpots, or recycling metals. Project managers should consider using building materials with recycled content where practical to reduce demand on natural resources and to lower the project's human and environmental impact. For example, fly ash from coal-fired power plants can be incorporated into cement production. When selecting building materials, project designers may also want to consider how their designs can support the future recycling of the building's materials once the need for the building has ended. A design decision to recycle a building component in whole or in part should be considered if it cannot be easily reused.

THREE LEVELS OF RECYCLING

Reuse: The use of a whole component, in largely unchanged form and for a similar function; for example a brick reused as a brick.

Recycling: The melting or crushing of the component and its separation into its original constituent materials, which then reenter the manufacturing process as a raw material.

Recovery: Burning of the demolished product to produce energy. The use of the raw material as a resource is lost and only its energy content is recovered.

Source: Berge, Bjørn. 2009. *The Ecology of Building Materials, 2nd Edition*. Oxford: Architectural Press.

RECYCLING DISASTER DEBRIS

How a community manages disaster debris depends on the types of debris generated and the waste management options available. Many communities are finding effective ways to salvage, reuse, and recycle all kinds of disaster debris. Soil, green waste, and construction and demolition materials can be recycled or composted into useful commodities. For example:

- Green waste, such as trees and shrubs, can be "recycled" into valuable organic material, such as compost or mulch.
- Concrete and asphalt can be crushed and sold for use as sub-base in road building.
- Metal can be recycled and sold by scrap metal dealers.
- Brick can be sold for reuse or ground for use in landscaping applications.
- Dirt can be used as landfill cover or as a soil amendment for farmers.

Benefits of recycling disaster debris include:

- Recovering large amounts of materials for reuse.
- Reducing the burden of large volumes of material on local landfills.
- Saving money by avoiding disposal costs and through resale of materials.

Source: U.S. Environmental Protection Agency. 2008. *Planning for Natural Disaster Debris.*

3.2.6 Repair Existing Infrastructure

A common consequence of disaster is a large number of damaged but existing buildings. Decisions about whether and how to repair preexisting infrastructure should be made. Many residents will repair their houses on their own without assistance. Key decision factors include structural safety, ease, and cost. A strategy to conserve resources and reduce demand on natural resources is to repair existing infrastructure, where practical, instead of rebuilding with all new materials.

3.2.7 Recover Energy

The costs and benefits of any decision to burn demolished products to produce energy should be carefully weighed. This is a form of "low-grade" recycling, because raw materials are lost and only the energy stored within them is recovered. Burning materials in energy plants to produce electricity is one example; burning waste wood in stoves is another. Decision factors include transport costs and toxicity.

3.2.8 Consider Sourcing and Procurement

Design decisions around the use of new materials should include consideration of where the materials are coming from and whether those sources are environmentally sustainable. The realities of a post-disaster setting can make sourcing materials difficult. However, project managers should make an effort to procure materials in a way that does not degrade the environment or negatively impact local communities. This will help project designers meet the humaitarian imperative of "Do No Harm." Sourcing and procurement decisions must be weighed in light of the local appropriateness of the material, legality, cost, transport distance, and impact on the environment. As explained in The Sphere Project: *"Multiple sources, alternative materials and production processes, or the provision of regionally or internationally sourced materials or proprietary shelter systems are required if the local harvesting and supply of materials is likely to have a significant adverse impact on the local economy or the environment"*.[11] See Module 5, Green Guide to Materials and the Supply Chain, for further information on sourcing and procurement.

3.3 Design for Flexibility and Life Span

Sustainable construction should consider the use of preexisting structures in construction design. This includes, for example, the incorporation of materials from emergency or transitional shelters in the construction of permanent housing. From the onset of a disaster, project managers should consider shelter and transitional housing designs that employ components that can be reused, reducing future waste from construction modifications. See The Sphere Project (2004) Shelter and Settlement Standard 6.

A key factor in this use of preexisting structures is the expected life cycle of the project. If, for example, the homes being constructed are expected to be used for many generations, then designers should make use of resources that promote durability, reduce maintenance concerns, and are locally accessible. In some situations, durability may need to be considered in terms of the ability to repair or replace certain materials or elements, rather than the simple longevity of the initial construction. This failure to consider the home's life cycle has proved costly in a number of post-disaster responses. In the 2004 Indian Ocean tsunami response, for example:

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11 The Sphere Project. 2004. *Minimum Standards in Shelter, Settlement and Non-food Items.* Sphere Handbook. Geneva: Oxfam Publishing.

[O]rganisations built houses consisting mostly of timber, which they originally considered to be the permanent home for the tsunami victims. Within a year, many issues, including termite damage, splitting and buckling of the timber structures, as well as other quality control issues were constant features of a majority of the homes.[12] [AUTHOR'S NOTE: The issue was not whether timber is a "durable" or "permanent" material – consider the longevity of Fourteenth-Century Japanese temples or surviving English Tudor houses – but the quality of the wood that was used. The main problems were that many aid organizations did not fully control for quality or fully preserve the timber they were using, and that the Indonesian Bureau of Recovery and Reconstruction subsequently decided that all reconstruction had to be done in masonry.]

3.4 Design for Climate

Most buildings and cities up to the beginning of twentieth century evolved in a manner that was responsive to climate; they were designed to be spatially efficient. Traditional cold-climate settlements avoid windy hilltops and cold valleys in order to reduce energy demands and increase comfort, and the reverse occurs in warm climates. Traditional buildings tend to be responsive to climate, protecting from sun or wind where necessary and opening up to sun where this is a benefit. Shaded areas, courtyards, openings, and trees and shrubs were typically part of building strategies to passively adapt to microclimates and airflow. In more recent times, there has been increasing reliance on artificial energy inputs, and typical strategies for designing for climate have been underemphasized. Designing for climate can be an important strategy for post-disaster building designers in order to reduce energy demands and increase the comfort level of their buildings as further described below.

3.4.1 Solar Orientation

Solar orientation is concerned with the annual changes in the sun's path. Most traditional designers understand that these seasonal changes make it possible to build a house that is more naturally cool in the summer and warm in the winter. A house with good orientation can lower costs while increasing comfort and reducing demand on natural resources.

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12 Roseberry, Rachel. 2008. *A Balancing Act: An assessment of the environmental sustainability of permanent housing constructed by the international development community in post-disaster Aceh*. University of Sussex.

DESIGNING FOR CLIMATIC VARIATIONS IN TAMIL NADU, INDIA

A study published by the Institute for Applied Sustainability to the Built Environment (ISAAC) reveals the importance of integrating both environmental and cultural considerations into post-disaster reconstruction. After the 2004 tsunami, settlements in Tamil Nadu, India, sustained critical damage to their housing units. Widespread replacement of damaged traditional structures with industrially produced reinforced concrete cement (RCC) was determined by this study to have been an ill-advised choice in reconstruction. The study affirms that the use of modern construction technologies, such as the use of RCC, while often touted as being the only choice for multi-hazard-resistant housing, may not be the best choice for sustainable reconstruction. Considerations of cost analysis, design elements for **climatic adaptation** (roof design, ventilation, etc.), and the environmental impact of materials are all critical variables in reconstruction. Based on this study, it was recommended that in Tamil Nadu traditional coconut and straw thatched houses would have been the best building choice for producing economic viability, **sustaining climatic comfort**, and lessening environmental impact.

Source: Barenstein, Jennifer and Daniel Pittet. 2007. *Post-disaster Housing Reconstruction: Current Trends and Sustainable Alternatives for Tsunami-affected Communities in Coastal Tamil Nadu.* Institute for Applied Sustainability to the Built Environment (ISAAC).

3.4.2 Site Modification

A building should be sited where it will have good winter sun, summer shade, mild breezes, and protection from severe winter winds. If a less-than-ideal site must be used for the construction, the site can often be improved by landscaping. Big shade trees to the east and west are most important. Windbreaks can be used to block severe winds and channel cooling breezes. Additional information about site modification, planning, and development is in GRRT Module 4, Green Guide to Strategic Site Selection and Development.

ECO-HOUSING IN SRI LANKA: SOIL AND VEGETATION CONCERNS

A main priority of the Damniyangama Eco-Housing Demonstration Project was to reestablish vegetation cover, which had largely been destroyed. Landscaping was planned to maximize indoor ventilation, provide shading, and promote evaporative cooling. Plants were also used as windbreaks.

Other considerations included reduction of soil erosion and the provision for subsistence farming. Multipurpose tree species were selected that had economic value. The trees were selected in cooperation with the community to avoid potential conflicts. Drainage canals were constructed according to the existing drainage pattern to prevent soil erosion. The existing drainage pattern was not disturbed. Runoff from the construction area was diverted through drainage canals with a minor negative impact on the environment.

Source: UNEP. 2006. *Eco-housing Guidelines for Tropical Regions.* Bangkok.

3.4.3 Insulation

Although spatial orientation is the first step of proper design, insulation is also necessary to save the heat from sunny winter days for cold nights. Thick mud walls, for example, are well suited to arid desert climates with high daytime temperatures and low nighttime temperatures because of the slowness in their thermal-transfer qualities. The walls of straw-clay and straw buildings also provide excellent insulation and allow for exceptional comfort and performance in extreme environments. Fuel use for heating in Ulaan Bator, Mongolia, for example, was cut by 50-70 percent in straw bale buildings as compared with conventional structures.[13] In poorer or

13 UNDP. *Energy-Efficient Straw-Bale Housing. East Asia: Mongolia.* UNDP Fact Sheet 8.

nonindustrial areas, the use of two single-pane windows together, approximating a double-pane installation, can provide added insulation. Insulated shutters and drapes can also improve window performance.

Insulated attics or roofs are particularly important. For buildings in hot climates that are not air conditioned, thermal insulation should not be used on the walls, as this will trap heat inside the building. Use insulation only for roofs exposed to direct solar radiation. Protect structures from excessive heat gain by using appropriate insulation materials. For example, bonded mineral wool can be used for under-deck roof insulation. Resin-bonded mineral wool is available in the form of slabs and rolls. These materials are available with or without the lamination of aluminum foil. Or, instead of roof insulation, a roof garden on the exposed roof area, or a shaded roof, helps to reduce heat ingress.[14]

3.4.4 Weatherization

Weatherization or weatherproofing is the practice of protecting a building and its interior from the elements, particularly from sunlight, precipitation, and wind, and of modifying a building to reduce energy consumption and optimize energy efficiency. Airflow can account for half of the heat loss in a well-insulated but leaky building. The idea is to design a house with controlled airflow – when and where it is wanted. Air quality must be considered to ensure adequate air exchange, e.g., if cooking with gas or wood occurs inside or near the house, measures must be taken to ensure proper ventilation.

3.4.5 Thermal Mass

Thermal mass is the mass in a building (including the structure and the furnishings) that is used to absorb heat during the day and then to release the heat as the building cools in the evening. Materials with a high thermal mass are energy efficient. As mentioned above, heat from sunny winter days can be saved for nighttime. To do so requires using thermal mass inside a well-insulated shell. For example, a thick plaster layer on straw bale walls provides considerable mass, which can then be augmented with an exposed concrete, adobe, or other high-mass floor; adobe seating (bancos); masonry; or water tanks. Doubled plasterboard helps retain heat in frame houses, while in traditional homes stone wall facings or partitions increase working thermal mass. The more thermal mass, the more stable the temperature of the building. This is why the same thermal mass also helps save the coolness of a summer night for the following hot day. However, exterior insulation is still needed to prevent overheating in the summer and chilling in the winter.

3.4.6 Ventilation

Adequate ventilation is important to ensure fresh air, cooling for comfort, and heat removal from the building structure. A well-ventilated building design must consider climate, adjacent topography, and vegetation, as well as local wind and airflow patterns, all of which impact building ventilation. Natural ventilation can be of two types. One is caused by wind pressure, and the impact depends on wind direction and speed as well as on the building's shape. Wind-pressure ventilation can provide either single-sided or cross ventilation. Another type of natural ventilation is caused by the density difference of air that results from the difference in temperature between the inside (warmer) and outside air. This is also called the "stack effect." If the inside air is colder, then a reverse stack effect can also be produced, which will bring in warm air from outside.[15]

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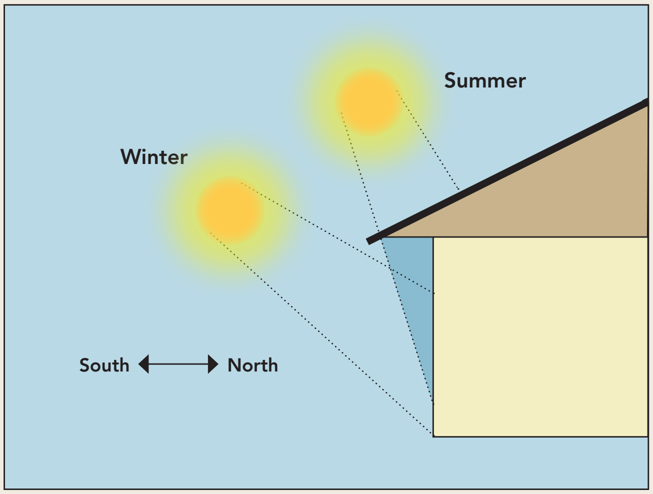
14 UNEP. 2006. *Eco-housing Guidelines for Tropical Regions.* Bangkok.

15 UNEP. 2006. *Eco-housing Guidelines for Tropical Regions.* Bangkok.

Proper window placement and interior design can capture cool breezes in the summer and increase comfort significantly. Insulated screened vents can be more economical than operable windows. Doors and windows placed at the front and rear of each home make use of natural through-draft cooling. Inlet openings in buildings should be well distributed and should be located on the windward side at a low level. Outlet openings should be located on the leeward side. Interior airflow can be improved if the doors are cut one or two inches above the floor level, and if vents and windows are placed above the doors. In hot climates, raised floors and high ceilings increase ventilation and improve comfort. Cool air for ventilation can be drawn from shaded areas near the ground and from landscaping, which tends to stay cooler in hot climates.



3.4.7 Shading

Orientation and shading are the keys to keeping a house cool in the summer. Properly sized overhangs and/or arbors will keep out hot summer sun but let in desirable winter sun. Arbors, vertical fins, shutters, shades, or trees can be used to shade windows. Design matters: A large window in the wrong place can make a home uncomfortable without air conditioning, and if residents are forced to use air conditioning the cost of operating the home will be increased.

Additional information on site selection and development is contained in Module 4, Green Guide to Strategic Site Selection and Development.

3.4.8 Climate-Specific Issues

Different types of designs are appropriate for different climates, because housing and shelter needs vary depending on the climate. Homes, shelters, and other constructions should be designed and supported to withstand the worst local weather conditions. Seasonal variations have a considerable impact on the type and cost of structure that is needed.

Consider the following climate-specific issues:

Hot, dry climate

Settlements: In hot dry climates, shade from the sun is a primary consideration during the day. Cold is also a concern in hot dry climates, because the nights can be surprisingly chilly, especially in arid areas. Dust is also a problem, so shelters should be designed to be closed during sandstorms. Narrow streets and enclosed settlements maximize the shade created by buildings; they use the thermal mass of buildings to keep the settlement cool, and can reduce the dust blown by wind. If, however, buildings are sited too closely together, fire can spread more easily, especially if the buildings are made from easily flammable materials.

Buildings: Thermal mass in buildings should be ensured by constructing thick walls and insulating roofs, making them cool in the day and not too cold at night. If building with plastic sheeting, provide double-skinned roofs with ventilation between the two layers to minimize heat radiation. Doors and window should be positioned away from the direction of the prevailing winds, which are likely to be very hot. Traditional houses are often placed in compounds, which offer protection, shade, and fencing for livestock. Consider the possibility of providing external shade for outdoor activities, depending on the climatic and cultural contexts.

Hot, humid climate

Settlements: In wet environments, the chosen site should be above the flood plain and out of the way of seasonal rivers or the highest annual tide. The ideal slope for a site should provide adequate drainage during the wet season, but should not be so steep as to threaten the stability of the buildings. In hot and humid climates, settlements should be open, with individual dwellings sited far apart from each other, to increase airflow. Trees and foliage should be kept wherever possible, to provide shade.

Buildings: Roofs should have a sufficient pitch for rainwater drainage: above 30° for normal tiles and thatch and above 20° for well-lapped corrugated iron sheeting. Generous overhangs help to protect the openings from water penetration during rainy seasons. Sufficient openings for good ventilation and air convection both in the walls and on the roof should be provided. Care should be taken to ensure that materials do not suffer from dampness and rot. Large openings, doors, and windows are advantageous in a warm-wet climate, provided they are effectively protected from the penetration of solar radiation, rain, and insects.[16] Raising buildings on stilts, at least 30 cm above ground, enables cooling of the floor from below and helps prevent moisture problems. It also gives flood protection in flood-prone areas.

Cold climates

Settlements: Local climatic variations should be considered when siting a settlement. For example, wind may be funneled through gaps in mountains, or the site may be shaded from the sun in deep valleys. Particularly at high altitudes, it can be significantly colder in the shade than in the sun. Wind and moisture increase cooling.

Buildings: In cold climates, insulation and draft reduction are key to keeping houses warm. Designing a warm room with a thermal buffer zone is a common approach to the problem. Some level of air infiltration must be permitted, which means that the infiltrating air must be warmed, possibly by body heat or by artificial sources. Ventilation is necessary to prevent respiratory diseases caused by cooking or heating smoke. Houses with thick walls and insulated roofs can be very cold if they have leaky or broken windows or doors. Plastic sheeting can be used to create thermal buffer zones. In the case of windows, two sheets are significantly better than one because they approximate the effect of double glazing. Stoves and heaters are an essential part of the heating strategy for a shelter in a cold climate. Big rooms should be partitioned to reduce air volume to be heated. Once the room has been heated, it is important to ensure that the heat does not escape. Insulation from the ground using mattresses is another effective measure; heat conducts quickly from the body into the cold ground, and warm air in the transitional shelter will rise, making the floor area the coldest.

16 UNEP. 2006. *Eco-housing Guidelines for Tropical Regions.* Bangkok.

For additional information on the use of post-disaster tents in cold climates, see "Design of Humanitarian Tents for Use in Cold Climates" by Pete Manfield, Joseph Ashmore, and Tom Corsellis in the journal *Building Research and Information* 32: 368–378.

ADAPTING TO CLIMATE IN SRI LANKA

In the Damniyangama Eco-Housing Demonstration Project, a number of passive cooling measures were implemented to reduce energy demand over the long term, which benefited the community. These included:

- Situating buildings according to wind patterns to ensure adequate natural ventilation inside the houses
- Creating inlet and outlet openings of nearly equal areas at the same level in the buildings, with inlets placed on the windward side and outlets on the leeward side
- Ensuring that inlet openings were not obstructed by adjoining buildings or trees
- Placing windows in living rooms to open directly to an open space, and building in two windows in each room
- Using roof tiles as roofing material to minimize heat gain
- Using trees and vegetation to increase humidity levels, improve shading, and cool the immediate environment
- Installing efficient lighting systems for energy conservation

Source: UNEP. 2006. *Eco-housing Guidelines for Tropical Regions.* Bangkok.

3.5 Energy Efficiency

3.5.1 Building

Fossil fuels supply 80 percent of the world's primary energy at present,[17] but resource depletion and long-term environmental impacts may limit their use in the future. As a large consumer of energy, the construction industry can play a great role in achieving energy efficiencies. Sustainable construction designers must aim to provide long-lasting, healthful, and useful buildings while conserving ever-decreasing resources and using energy-efficient designs and environmentally neutral energy sources and mechanisms. Due to the expected long life of permanent housing, the operating phase will consume the largest proportion of energy resources compared to the overall life cycle of the structures. Optimizing the use of energy, therefore, is crucial in sustainable construction efforts.

Good passive solar design will reduce the demand for fuel wood or other forms of energy inputs required for heating. Almost half of the wood used in the world is used as firewood, the collection of which is often a full-time task for one or more family members. The removal, first of trees and then of stumps, shrubs, and anything else that can be burned, creates rings of devastation around urban areas. More than a billion people are harvesting firewood faster than it grows, and 100 million people are chronically short of energy sources.

The energy usage of a building can be improved by reducing energy demand, increasing energy efficiency, and/or using renewable sources of energy. Maximizing energy efficiencies, reducing the use of fossil fuels, and increasing the use of renewable energy sources will all be permanent features of sustainable development – and essential aims of any sustainable construction design.

17 UNEP. 2006. *Eco-housing Guidelines for Tropical Regions.* Bangkok.

When seeking to maximize energy efficiencies, project managers should avoid decreasing the quality of life. For example, these efficiencies should not lead to reduced ventilation and higher concentrations of pollutants inside a dwelling. Care should also be taken to avoid increasing the hours of usage of energy-efficient equipment. This could cancel out any benefits from energy efficiency.

The use of renewable forms of energy, based on solar, wind, and biomass energy, can help reduce the demand for polluting fossil-fuel or fire-wood-based energy sources. The most likely application of renewable energy in the housing sector would be based on solar, wind, or biomass energy. Before installing renewable technologies, attempt to reduce energy consumption and increase energy efficiency. This could considerably reduce the initial investment.

BIOGAS IN NEPAL REDUCES ENERGY COSTS AND WASTE DISPOSAL REQUIREMENTS

"One fine day I told my husband that I wasn't going to risk my life by collecting wood from the forest anymore and that we were going to get a biogas stove, even if we had to take a loan," says Jari Maya Tamang, 41, as she stands proudly next to the first biogas plant in her village.

Jari Maya took a microcredit loan and became the first to install a toilet-attached biogas plant in Badreni, a small village on the edge of Chitwan National Park in Nepal's Terai. Today, 80 percent of the 82 households in Badreni have installed toilet-attached biogas plants with the support of WWF. The Terai has a dense population, high biodiversity, and fragile ecosystems. Deforestation is a major issue. Sixty-one percent of all households in the Terai rely on firewood for cooking, and 49 percent source their wood from nearby government-managed forests. A typical family uses an average of between 1.3kg and 2.5kg wood every day, and evidence suggests that this is not sustainable. With a population of more than 6.7 million in the Nepal Terai, the problem of deforestation will become acute without environmentally sound interventions.

Alternate waste management and energy promotion is an important strategy to deal with farm and household solid waste, reduce pressure on the forests, and improve local livelihoods in the Terai. In Nepal, the locally designed and developed fixed-dome biogas plant design is popular. This model is considered to be reliable, functional, and simple; it has a low maintenance cost and a durable design.

In Nepal, one medium-sized biogas plant (the most popular one) costs around US$500. Biogas technology is still out of reach for the majority of people in the region who are poor; however, local NGOs have funded microfinance schemes through grassroots partners like Community Forest User Groups. This arrangement has made it easier for poor and disadvantaged communities to easily access loans at lower interest rates to construct the biogas plants. The household latrine is situated by design to feed the biogas plant, which also uses barnyard wastes.

Source: Gurung, Trishna. 2007. Biogas: saving nature naturally in Nepal. wwf.panda.org (Accessed on June 28, 2010)

3.5.2 Lighting and Pumps

Photovoltaic solar power (converting light to energy) can be used for lighting and to satisfy low power requirements. To operate pumps, grain mills, and (for example) village welding, more powerful generators are needed, particularly those with engines of between 5hp and 10hp, which most African villages are already importing from India.[18] These generators are currently petrol-based, but could also operate on liquid, solid, or gaseous biofuel if sufficient research were carried out.

18 UNEP. 2006. *Eco-housing Guidelines for Tropical Regions.* Bangkok.

3.5.3 Cooking Fuel

As fuel shortages intensify, the price of firewood and charcoal increases, often costing as much as the food it cooks. Lack of wood makes it hard to cook food properly, to purify water, and to bathe and clean clothes in areas with certain waterborne parasites – all of which increase health risks. As firewood consumption increases and all trees and shrubs are removed and burned, it is harder to maintain agricultural productivity. Deforestation also leads to an increase in erosion and landslides. Eventually dung and crop residues are burned, leading to a gradual decline in agricultural productivity because nutrients are not returned to the soil.

COORDINATING FUEL STRATEGIES IN HUMANITARIAN CRISES

A number of organizations working on humanitarian crisis response are actively promoting fuel-efficiency and alternative energy sources and technologies. In April 2009, an interagency task force co-chaired by the World Food Programme (WFP), the UN High Commissioner for Refugees and the Women's Refugee Commission launched new guidelines for addressing this issue in humanitarian crises.

The guidelines define agency roles and responsibilities needed for developing coordinated fuel strategies in humanitarian crises and help humanitarian workers choose the most appropriate fuel strategies for their particular setting. These tools have been distributed to field offices of major UN agencies and nongovernmental organizations worldwide. The International Network on Household Energy in Humanitarian Settings (Fuel Network) established in 2007 provides a forum for sharing of information, initiatives and technological innovations regarding household energy related issues.

Source: van Dorp, Mark. 2009. *Dealing with energy needs in humanitarian crisis response operations.* IUCN and Institute for Environmental Security.

Some suggested resources on how sustainable energy can be integrated into project design may be found by consulting the Global Network on Energy for Sustainable Development sponsored by UNEP (www.gnesd.org) or reviewing "Access to Energy for the Base of the Pyramid" by Hystra (2009) or www.hystra.com.

GUIDANCE FOR INTEGRATING CLIMATE ADAPTATION INTO CONSTRUCTION

The recovery and reconstruction period after disasters is an important opportunity for project planners to incorporate **climate adaptation** into their recovery activities to make projects more resilient to a changing climate and reduce future disaster risk. There are two main categories of climate adaptation: **facilitating transitions to new conditions**, and **building resilience and buying time** to adapt to extreme weather events. Facilitating transitions to new conditions is needed when what people once knew as 'normal' is no longer the norm, such as changes in freshwater systems due to melting of snow packs, and sea level rise. Building resilience to extreme weather events helps people and nature withstand shocks and get back to normal after extreme events such as severe storms, drought or flood. In practice one or both of these approaches may be needed in a particular part of the world; building resilience can be a short-term measure while in the longer term a transition is needed to a new state – buying time in order to facilitate change.

Many of the measures proposed in this module can be applied to help with climate extremes once it is known how people and ecosystems are vulnerable to climate change and climate variability: for example, ventilation and shading for people in extreme heat; strengthening structures to withstand storms; and avoiding construction in flood-prone areas. If sites are likely to become more vulnerable in the future, greater margins of safety may be introduced: for example, coastal setbacks to allow for sea level rise, including space for beaches and mangroves to migrate upwards if the topography permits. In valleys below glaciers, there may be special risk from glacial lake outburst floods which occur when lakes formed by melting glaciers breach their unstable retaining banks, and vulnerable sites should be avoided for reconstruction. If a natural resource species used in construction or for fuel is declining in an area, try to reduce pressure and dependency on it by finding alternative materials, or promoting renewable energy or fuel efficiency.

Consider this climate adaption checklist when designing building construction projects:

- Project planners have contacted local government officials or experts to determine the predicted impacts from climate change within the project area.
- The project includes specific measures to address predicted changes in climate extremes in the next 5-10 years (e.g., worsening drought, greater frequency of flooding, more intense cyclones)?
- The project design incorporates the consequences of longer term, regional climate change effects (e.g., heat stress from rising temperatures, reduced stream flow due to loss of snow pack, sea level rise from melting ice caps)
- Alternative activities have been considered in terms of their ability to account for future climate risks.

For more information on the role of climate adaptation in disaster risk reduction see Module 9, Green Guide to Disaster Risk Reduction.

3.6 Solid Waste

Settlements produce solid waste. The inclusion of home gardens and compost areas within home designs can be one technique for addressing solid waste in a community. However, where communities are using more plastic and moving away from organic waste production, the problem of nonbiodegradable waste is a new issue that needs to be considered in the building design process. Additional information on this topic is contained in Module 7, Green Guide to Water and Sanitation.

3.7 Waste and Wastewater Systems

Site selection needs to take into account the availability of freshwater sources for cooking, drinking, and bathing, as well as whether these freshwater sources are sustainable and protected from polluting sources over the long term. Upstream mining or logging, for example, can contaminate gravity-fed systems. Building design should incorporate roof catchment and rain tanks to reduce dependence on centralized systems and groundwater resources, which can be limited in some areas.

Designers should consider ways to reduce household water demand, such as the use of dry composting toilets or of systems that separate wastewater. "Black" water is heavily contaminated wastewater, such as toilet wastewater. Black water is difficult to treat because of high concentrations of mostly organic pollution. "Grey" water is wastewater that is generated from processes such as washing dishes, laundry, and bathing. Grey water can be reused for watering plants or crops, reducing demand and increasing the efficiency of water use.

Black water must be treated sufficiently to ensure that neighboring water sources are not contaminated. People often use nearby streams and rivers for bathing, water collection, fishing, and other livelihood activities. It is crucial that wastewater treatment systems be operational. The use of septic tanks and treatment wetlands can be successful solutions. See Module 7, Green Guide to Water and Sanitation, for more information on this topic.

3.8 Local Community and Cultural Acceptance

The vast majority of buildings in the world are not "designed" or built by architects or qualified professionals. This implies that in every community there is a wealth of local knowledge and skill – not only with regard to building traditions and techniques but also with regard to strategies for coping with the particular settings and hazards of each area. In many parts of the world, techniques have been developed over many years to deal with differences in local climate and to resist and recover from natural disasters. In a reconstruction effort, then, it is important to recognize and evaluate local traditions, skills, and knowledge.

3.8.1 Local Acceptance

It is clear that architecture is one way in which communities express their common cultural or religious beliefs. In many cases, the construction process itself may be imbued with meaning. Therefore, for a design to be sustainable – not simply from an ecological standpoint but from a socioeconomic perspective as well – the layout and planning of a construction project must be considered in response to the local community's needs and desires.

Vernacular architecture can be ecologically sensitive, as it often uses natural local materials – assuming that these local materials are not under threat and their extraction can be sustained. As the builders are often members of the community, the construction process can itself support economic and social sustainability through livelihood support and networking.

At the same time, there may be communities who have abandoned traditional disaster-resistant construction techniques because of the unsustainability of building materials, or have rejected the "old ways" in favor of modern methods of construction, which may carry higher status. An assessment of the local community's views concerning traditional versus modern techniques is critical before attempting to propose solutions that may be rejected for reasons that may be unclear to outsiders. In many cases, the eventual designs will contain some tradeoffs between what is best from an environmental point of view and what is acceptable to the affected community in terms of culture or aspirations. In some cultures, for example, doors or apertures may only open in certain compass directions, regardless of the path of the sun or optimum directions for passive heating or passive ventilation. In other cultures, privacy or separation of space for women is the deciding factor in the placement and orientation of buildings.

EARTH BLOCKS IN SOUTH AFRICA

One major success story in sustainable construction efforts is the development of modern versions of earth block. Earth block is a traditional material made by compressing soil into block forms. Through the use of simple modern machinery and techniques, a stronger version of the traditional earth block can be created that is both environmentally friendly and affordable. Earth block can be made almost entirely from local materials, eliminates the costs and environmental effects of transporting building materials from off site locations, and serves as a source of livelihoods for local communities.

Earth block construction has been a highly successful enterprise in several developing countries. Several pilot projects in South Africa have used earth block made with simple machinery that can use human or motor power to produce high-quality stabilized earth block. Both traditional and modern houses are being built from earth blocks in South Africa. This technology is attracting significant attention from developed-country sustainable building movements, which are attempting to find more natural, ecologically friendly building materials and methods.

Source: Kibert, Charles J. 2003. Deconstruction: the start of a sustainable materials strategy for the built environment. *UNEP Industry and Environment April-June: 84-89.*

Using building techniques that are clearly understood by the community can help to ensure the longevity of the project. Through training programs, project managers can ensure that knowledge of construction methods remains with the community even after the intervention has ended. © Daniel Cima/American Red Cross

3.8.2 Community Participation and Analysis of Existing Practice

As communities begin to see housing options that meet their real needs, the opportunities for participation increase and entry points for introducing environmentally sound solutions expand. The best source of local knowledge and examples of existing practices will be found in the community itself. To best inform the design, from interior layout to site location, the end user should be included in each step of the reconstruction process. Poor practice resulting in abandoned or misused housing is an enormous waste of resources and can have major negative environmental impacts.

CASE STUDY: INTEGRATING TRADITIONAL PRACTICES IN NORTHERN IRAQ (1991)

In northern Iraq in 1991, the International Rescue Committee (IRC) conducted interviews of villagers to determine several aspects of the reconstruction process, including the division of labor, the bill of quantity, and the support families required to rebuild their own homes. The project adopted a standard design for construction of traditional stone housing. Compressed flat roofs used by locals for drying food supplies were included in this design. Villagers provided the labor for rebuilding their own homes, while the logistics and key procurement items (e.g., tools, windows, doors, and roofing) were provided by the IRC. When villagers complained of erosion resulting from rain on mud joints in the masonry, a component of cement was added to the mixture. This example clearly illustrates the integration of traditional practices and community involvement with new methodologies for long-term building solutions.

Source: Richard Jacquot, Global Emergency Operations Team Leader, Mercy Corps, October 12 2009. Personal communication.

3.8.3 Construction Techniques and Knowledge Sharing

Wherever possible, project managers should attempt to adapt and improve existing construction methods instead of introducing new techniques that may be difficult to understand. Improved methods will then be easier to teach to the local community and the builders within it, and are more likely to be sustainably adopted. Using building techniques that are clearly understood by the community can help to ensure the longevity of the project. To achieve this, it is critical that knowledge of these methods remain with the community; as part of the process project managers should include training to ensure knowledge transfer to the local construction sector. It is important that the construction be easy to maintain and that building components be easily sourced or repaired by the local community at a relatively low cost.

STRAW BALE CONSTRUCTION IN CHINA

In northwestern China, the Adventist Development and Relief Agency (ADRA) introduced straw bale construction in 1998, and the technique has grown steadily. ADRA's success is directly related to its intensive training program and successful partnerships with local partners in an effort to increase the capacity of the local community and make sure the techniques are well understood. All buildings are designed by local builders or architects who have been mentored by a specialist working with the program since its beginnings. ADRA has focused its efforts on developing local talent; the project's goal is to transfer the straw-bale technology to Chinese builders, who will then build architecturally sound structures without external technical assistance.

Source: Kennedy, Joseph E., ed. 2004. *Building Without Borders: Sustainable Construction for the Global Village.* Gabriola Island, British Columbia: New Society Publishers.

4 CONCEPTS IN CONSTRUCTION MANAGEMENT

4.1 Background

Management of the construction process can be one of the most critical determinants of sustainability. Indeed, long-term sustainability will depend on whether sustainable design features are effectively implemented during the construction stage. A poorly conceptualized or executed construction phase can result in buildings that are expensive to build and difficult or expensive for the family or community to maintain.[19] Even worse, poor planning of the construction process and/or inadequate preparation of the construction site can lead to profound and long-lasting negative impacts on the communities who have to deal with a degraded environment. Poorly managed construction sites are notorious for polluting air, land, and water resources. It is, therefore, essential to minimize the environmental impact of the construction by considering the entire process – from site layout and preparation to waste disposal or reuse – before the construction begins.

The management of construction sites can impact environmental quality through wastes, runoff, the tracking of sediments off-site, improper disposal of wastes and hazardous materials, dumping, leaks, and spills. Proper care in these areas will reduce the exposure of polluting substances on water sources, public and occupational health, and ecosystems. Whether the construction project uses heavy earth-moving equipment or handheld tools, steps should be taken to incorporate environmental sustainability into the management of the work site.

> Better management practices involve being aware of the environmental impacts of construction. This should not require more effort, more cost, or more time at the construction site.

In the post-disaster humanitarian aid setting it can be hard to control construction management because construction activities may be undertaken by homeowners themselves through owner-driven construction projects or cash-for-work activities with relatively little technical oversight or on-going monitoring. In these cases, it is recommended that organizations conduct specific training sessions on environmentally sound construction management practices with homeowners and other individuals involved in the construction process.

INSTITUTING CONTROLS FOR MORE ENVIRONMENTALLY SOUND CONSTRUCTION MANAGEMENT

The physical construction of a building is often undertaken by a large team of people from one or more contracting companies as well as by homeowners themselves. In the post-disaster humanitarian setting, there may be an even larger number of people involved in construction, including donors, technical staff at aid agencies, and government representatives. With so many different people involved in construction at different stages in the process, it can be difficult to ensure that environmental construction management practices are well understood by the construction team. Project managers can ensure these practices are being followed by:

- Including specifications for environmental practices in the Terms of Reference for contractors and aid beneficiaries
- Conducting regular training sessions on the material contained in this module at field sites with construction staff and monitoring
- Including environmental indicators into monitoring plans for on-site construction (e.g., verifying that all paint containers are covered and located in washout areas)
- Assigning someone to serve as an environmental monitor
- Developing checklists to ensure that construction management meets environmental performance objectives

19 United Nations Environment Programme (UNEP) and Swiss Resource and Consultancies for Development (SKAT). 2007. *After the Tsunami: Sustainable Building Guidelines*

4.2 Construction Site Planning and Layout

A goal of sustainable construction is to reduce the negative impact on the site during construction to preserve the natural setting and habitat.[20] Environmentally sensitive construction planning can minimize construction waste, resource use, and potentially negative site impacts. Project managers should seek to ensure that:

- ❑ Potential health hazards and responses are identified in advance and environmental guidelines are written into project documents.
- ❑ Construction boundaries are established and measures taken to cordon off construction sites from residential zones.
- ❑ Trailer, storage, and laydown areas are identified and established.
- ❑ All subcontractors are informed of the areas in which they will need to work.
- ❑ Vehicle and equipment movement is restricted.
- ❑ Construction debris is recycled or reused wherever possible.
- ❑ Measures are enacted to minimize contamination of air and water resources on the site, including the use of recycled grey water for construction purposes and proper management of storm water and wastewater.
- ❑ Site erosion and sediment runoff is prevented with effective perimeter sediment control measures.
- ❑ Plans are drawn up for restoring affected areas to their natural states after the construction.

4.3 Materials Handling

4.3.1 Storage

Liquid materials such as paints, solvents, and fuel should be contained and covered. Materials and equipment should be stored in such a way that they are protected from public access and do not interfere with public spaces, streets, rights of way, or private property. Where necessary, plastic sheeting or other covers need to be made available to protect stockpiles.

4.3.2 Wet Materials and Liquids

"Wet" materials such as concrete, paint, stucco, and other liquids should be handled in a designated washout area. Concrete washouts are self-contained troughs used to capture and temporarily store concrete and liquids when the chutes of concrete mixers and hoppers of concrete pumps are rinsed out after delivery. Washout facilities consolidate solids for easier disposal and prevent liquid runoff.

This wash water is alkaline and contains high levels of chromium, which can leach into the ground and contaminate groundwater. It can also migrate to a storm drain, increasing the pH levels of area waters and harming aquatic life. The washout area should use a barrier such as a plastic lining to prevent runoff into the

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20 Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

street and gutter. Arrangements should be made for the safe and appropriate disposal of washout material. Tarps should be placed under concrete mixers, wheelbarrows, or mixing trucks to prevent spills. Residual materials should be cleaned and disposed of properly. Spillages into the street or public spaces should be prevented; solids that are improperly disposed of can clog storm drainpipes and cause flooding. Installing concrete washout facilities prevents pollution and is a matter of good housekeeping at the construction site.

SELF-INSTALLED CONCRETE WASHOUTS

There are many design options for concrete washouts, but they are preferably built below-grade to prevent breaches and reduce the likelihood of runoff. Above-grade structures can also be used if they are sized and constructed correctly and are diligently maintained. One of the most common problems with self-installed concrete washout facilities is that they can leak or be breached as a result of constant use. Care should be taken to use quality materials and inspect the facilities on a daily basis.

Concrete washout facilities should never be placed within 50 feet (15 meters) of storm drains, open ditches, or water bodies. They should be placed in a location that allows convenient access for concrete trucks, preferably near the area where the concrete is being poured. Appropriate gravel or rock should cover paths to concrete washout facilities if the facilities are located on undeveloped property. These areas should be far enough away from other construction traffic to reduce the likelihood of accidental damage and spills. The number of facilities installed should depend on the expected demand for storage capacity. On large sites with extensive concrete work, washouts should be placed in multiple locations for ease of use by concrete-truck drivers.

For additional guidance on concrete washouts, refer to:

U.S. Environmental Protection Agency. Concrete Washout. www.cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=117. (Accessed on March 31, 2010)

4.3.3 Water and Wind Protection

All materials should be covered and securely protected from wind and rain with a water-repellent covering during the entire construction process. This will prevent the spreading, mixing, wetting, contamination, or loss of materials. During the rainy season, extra tarps or bags should be kept on hand to prevent these materials from getting wet or washing off.

4.4 Equipment Handling

4.4.1 Storage

Construction equipment should, if possible, be kept on-site to reduce the transport of sediment, hazardous materials, or other contaminants to and from the site. In particular, all earthmoving equipment should be stored on-site. Drip pans should be placed under equipment not in use.

4.4.2 Maintenance

Maintenance of construction equipment should also be conducted on-site to avoid safety issues in public spaces and to avoid spills or leaks from discharging outside of the perimeter controls. Tarps should be placed beneath vehicles during maintenance to control spills.

4.4.3 Vehicles

If vehicles or other equipment are stored on-site, tarps should be placed beneath them overnight or during periods when they are not being operated. Pumpers should be surrounded by perimeter controls such as gravel bags, sandbags, or straw wattles. Effective tracking controls (shaker plate and/or gravel) should be in place at the job site entrance to prevent construction traffic from tracking mud and debris into the street.

4.4.4 Cleanup

Construction equipment should be cleaned in designated washout areas with controls in place to prevent untreated nutrient-enriched wastewater or hazardous wastes from being discharged to surface or ground waters.

4.5 Waste Handling

One of the goals of sustainable construction is minimizing waste. Waste management is a vital function that must be planned and implemented with care throughout the construction phase. Even with the most careful construction planning, some degree of construction waste will inevitably be produced. Project managers should, therefore, consider the overall impact of the project and its aims with regard to waste management and minimization. Measures must be taken to properly handle and dispose of waste.

4.5.1 Waste Cleanup

Waste receptacles such as dumpsters or trashcans should be used to contain construction waste. Alternatively, labor can be regularly employed to remove waste from the site to appropriate disposal facilities during the workday. Waste receptacles should be covered with tarps after the workday and the area around the receptacles should be kept clean. Waste receptacles must be kept on-site.

4.5.2 Disposal

Construction waste should be disposed of properly. No dumping of materials either on- or off-site should be allowed. Used oil, antifreeze, solvents, and other automotive-related chemicals are wastes that require special handling and disposal. Some can be recycled at designated facilities, but other chemicals must be disposed of at a hazardous waste disposal site. Local government agencies can sometimes help identify such facilities. See Module 4, Green Guide to Strategic Site Selection and Development, for further information on proper waste disposal procedures.

4.5.3 Sanitation Facilities

Construction worker sanitation facilities (e.g., portable toilets/latrines) should be made available on-site. Portable toilets should not be allowed to leak. Drip pans or other measures should be put into place to ensure that spills are controlled.

4.6 Pollution Prevention

Much pollution from construction sites can be prevented by carefully controlling runoff and the tracking of dust and other materials from the construction site. When material is tracked off-site by shoes or vehicles, it is no longer in the controlled environment of the construction site and creates risks for public health and environmental degradation, especially through water quality. Construction materials and sediments will enter the water system if cleaning, rain, and wind transport are not controlled. Degradation of water quality can affect the health of water-based ecosystems such as rivers, lakes, coastal zones, and oceans, and can in turn affect the livelihoods of the communities that depend on these ecosystems and water sources.

4.6.1 Hazardous Materials

Toxic materials, including liquid wastes such as paints and solvents, should be contained in hazardous-material drums. Drums should not be dumped in drains, sewers, or streets, but should be taken to an appropriate disposal facility. Liquids should be disposed of properly and should not be allowed to wash into drains, streets, or sewers.

4.6.2 Runoff

Perimeter sediment controls should be established to prevent materials and washed-out residues from running into drains or streets or from entering the water table. Examples of controls can be sand or gravel bags, silt fences, or straw wattles.

Wattles are made from straw that is bound into a tight tubular roll. When straw wattles are placed on the face of slopes, they intercept stormwater runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff. By interrupting the length of a slope, straw wattles can reduce erosion.

Water drains should be protected; materials from the construction site should not be allowed into drains, as this will pollute water systems. Of special protection concern are downstream drains and inlets; perimeter controls should be used to protect these drains and remove debris and residue daily.

4.6.3 Cleanup

Maintenance and cleaning of equipment and vehicles should be done on-site, in designated areas with controls for runoff and the tracking of dust. Equipment and vehicles should be washed in designated washout areas, not in the street. The washout areas should be cleaned regularly and wastes should be disposed of properly. Disposal of "wet" construction materials should be handled in the washout area. This includes paint, stucco, and concrete. Plastic-lined pits should be used to collect and contain liquids, and to prevent runoff into the street and gutter.

4.6.4 Dirt and Grading

Stockpiled dirt and gravel must be stored on-site and covered. Dust control should be maintained throughout all phases of construction. During the rainy season, additional gravel, bags, tarps, and polyethylene sheeting must be stored on-site for emergency repair.

4.6.5 Tracking Controls

Tracking controls, such as a coarse gravel bed, should be used at each entrance to the construction site to limit off-site sediment tracking. Hand or mechanical sweeping should be used to clean up any materials that get tracked off-site. Any material that is tracked off-site or into the street should be cleaned up and disposed of using brooms or other handheld or mechanical sweeping equipment. If possible, a wet/dry vacuum should be kept on-site to clean up spills.

4.7.6 Training and Enforcement

It is crucial that the workforce understand the importance of a clean site, and the connections between improper material handling, improper waste disposal, and the consequences of environmental degradation for the quality of life in the community. Best management practices must be enforced on-site by the appropriate personnel.

Whether the construction project uses heavy earth-moving equipment or handheld tools (such as a trowel shown in the photo above), steps should be taken to incorporate environmental sustainability into the management of the work site. Workers must be trained on proper handling and disposal of construction materials in order to protect human and environmental health. © Daniel Cima/American Red Cross

ANNEX 1: ADDITIONAL RESOURCES

The following organizations and publications provide a variety of tools, resources, and information that elaborate on the concepts presented in this module.

Organizations

Association for Environment Conscious Building (AECB): Nonprofit professional organization that provides sustainable construction standards and guidelines. *www.aecb.net*

Builders Without Borders: Nongovernmental organization that provides information on sustainable construction with an emphasis on straw, earth, and other local and affordable materials. *www.builderswithoutborders.org*

Earthquake Engineering Research Institute: Nonprofit organization that provides in-depth information on housing construction methods and earthquake-resistant construction through its world housing encyclopedia. *www.world-housing.net*

iREC Information and Research for Reconstruction: Academic institution that provides a variety of papers, publications, and conference proceedings related to sustainable building and reconstruction. *www.grif.umontreal.ca/pages/irecpublicns.html*

Practical Action, formerly the Intermediate Technology Development Group: Nongovernmental organization that provides materials on disaster mitigation, disaster-risk reduction, and earthquake-resistant housing construction. *www.practicalaction.org*

ProAct Network: Nongovernmental organization that provides resources on waste management and asbestos hazards in post-disaster situations. *www.proactnetwork.org*

Shelter Centre: Nongovernmental organization supporting the humanitarian community in post-conflict and disaster shelter and housing. Provides information on transitional shelter construction and best practices. *www.sheltercentre.org*

Women's Refugee Commission: The Women's Refugee Commission is an expert resource and advocacy organization that monitors the care and protection of refugee women and children. The organization provides guidelines for fuelwood at *www.womensrefugeecommission.org/programs/firewood* and *www.fuelnetwork.org*.

Publications

Barenstein, Jennifer D., and Daniel Pittet. 2007. *Post-disaster Housing Reconstruction: Current Trends and Sustainable Alternatives for Tsunami-affected Communities in Coastal Tamil Nadu*. Institute for Applied Sustainability to the Built Environment (ISAAC).

Berge, Bjørn. 2009. *The Ecology of Building Materials, 2nd Edition*. Oxford: Architectural Press.

du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries*. Pretoria, South Africa: CSIR Building and Construction Technology.

Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Halliday, Sandy. 2008. *Sustainable Construction.* Oxford: Elsevier.

Aron, Jean-Elie, Olivier Kayser, Laurent Liautaund and Aileen Nowlan. 2009. *Access to Energy for the Base of the Pyramid*. Hystra/Ashoka. *www.hystra.com/opensource/energy.html*

Kennedy, Joseph E., ed. 2004. *Building Without Borders :Sustainable Construction for the Global Village*. Gabriola Island, British Columbia: New Society Publishers.

Kibert, Charles J. 2003. Deconstruction: the start of a sustainable materials strategy for the built environment. *UNEP Industry and Environment April-June: 84-89.*

The Sphere Project. 2004. *Minimum Standards in Shelter, Settlement and Non-food Items.* Sphere Handbook. Geneva: Oxfam Publishing.

Roseberry, Rachel. 2008. *A Balancing Act: An assessment of the environmental sustainability of permanent housing constructed by the international development community in post-disaster Aceh.* University of Sussex.

UNEP. 2006. *Eco-housing Guidelines for Tropical Regions*. Bangkok.

United Nations Environment Programme (UNEP) and Swiss Resource and Consultancies for Development (SKAT). 2007. *After the Tsunami: Sustainable Building Guidelines*.

U.S. Environmental Protection Agency. National Menu of Stormwater Best Management Practices. www.cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source: World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future.* Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

7

GREEN

GUIDE TO

WATER AND SANITATION

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

7

GREEN

GUIDE TO

WATER AND SANITATION

Achala Navaratne, Consultant

Toni Tomasek, Consultant

Emily Rand, Mercy Corps

A NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster recovery and reconstruction approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on integrating environmentally sustainable approaches into water and sanitation.

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The development of the GRRT has truly been a collaborative process and could not have been done without an extraordinary team of international experts from the humanitarian and environmental sectors. Over the course of a two-year development process, the GRRT was built on the diverse experiences of over 15 technical authors and training specialists, over 30 expert reviewers, and a dedicated team of graphic designers and copy editors. Special thanks go to Paul Thompson whose depth of experience in humanitarian training helped to shape this project and whose commitment made it a reality. Thanks to Anita van Breda, Robert Laprade, and Ilisa Gertner for their insight, ideas, and time spent reviewing many rounds of drafts. Special acknowledgement goes to the participants of the GRRT pilot workshops in Sri Lanka and Indonesia for all of their excellent feedback. Special thanks also goes to Gerald Anderson, Marcia Marsh, Alicia Fairfield, Achala Navaratne, Julia Choi, Bethany Shaffer, Owen Williams, Brad Dubik, Leah Kintner, Tri Agung Rooswiadji, Tom Corsellis, Eric Porterfield, Brittany Smith, Sri Eko Susilawati, Jan Hanus and Manishka de Mel. *–Jonathan Randall, WWF*

MODULE 7: GREEN GUIDE TO WATER AND SANITATION

Table of Contents

1 INTRODUCTION

1.1 Module Objectives

Specific learning objectives for this module are as follows:

1. Promote and implement water and sanitation systems that improve community well-being by enhancing environmental sustainability.
2. Explain to stakeholders why water supply project infrastructure should include watershed protection to ensure sustainability, and identify ways to achieve sustainability.
3. Demonstrate how water and sanitation projects can be made more sustainable for communities through initial technology choice, project design, and community consultation.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 7 in a series of 10 modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment and taking advantage of opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction in helping to make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4, 5, and 6 pertain specifically to building construction, with Module 4 focusing on site planning and development, Module 5 on building materials and the supply chain, and Module 6 on building design and construction management. GRRT Modules 7 through 10 provide sector-specific information to complement Modules 2 and 3. They provide more detailed technical information, action items, and practical techniques for integrating environmental issues within a given sector.

1.3 Intended Audience

This training module aims to increase awareness of the need for innovative water and sanitation programs that can make communities more resilient to future disasters and reduce long-term ecosystem impacts. Trainees will be exposed to practical strategies and techniques to make water and sanitation interventions more environmentally sustainable. The module is aimed at water and sanitation project managers and supervisors, engineers, contractors, housing project managers, community leaders, and other people responsible for planning and implementing water and sanitation systems as part of post-disaster recovery and reconstruction efforts.

1.4 Module Key Concepts

This module builds on the following key concepts:

1. **Using watershed management.** A typical approach to water and sanitation usually includes 1) infrastructure development, 2) hygiene training, and 3) local community groups (i.e., user committees) and/or capacity building in local governance. To ensure the long-term sustainability of water and sanitation intervention, activities should be accompanied by a watershed management component. Protecting the watershed can help sustain the water source, and provide other services such as water retention and filtration.
2. **Technology choice.** In recent decades, there has been an increase in the types of technologies that are available to humanitarian water and sanitation project planners. By selecting certain technologies, project planners can reduce demand on water supplies, decrease the inflow of harmful nutrients to water bodies, provide communities with higher water quality and quantity, and decrease maintenance effort and costs.
3. **Community and cross-sectoral participation.** The recovery and reconstruction phase following a natural disaster or conflict represents an opportunity for water and sanitation specialists, hygiene specialists, and governmental officials to help affected communities move beyond pre-disaster conditions toward long-term resilience and an improved natural environment. Consultation with affected communities as well as other recovery and reconstruction sectors that affect water and sanitation projects (e.g., road construction, shelter, and livelihoods) is necessary as part of strategic planning in order to prevent unintended negative impacts on the long-term sustainability of water and sanitation projects.
4. **Include environmental factors when conducting benefit-cost analyses for various water and sanitation options.** Even when specific costs cannot be easily assigned to environmental harm related to a specific reconstruction project, the question should be raised and made transparent in the overall decision-making process. Do not avoid analysis of environmental impact simply because the effects are difficult to quantify. Good design decisions are made using a balance of quantitative as well as qualitative considerations. In investigating the environmental effects of their programs, planners can also learn about the economic and social issues related to their project.

1.5 Module Assumptions

This training module assumes that participants are familiar with the design, planning, development, operation, and/or management of water and sanitation systems. As this module focuses on how to integrate environmental issues into these processes in a disaster-recovery and reconstruction setting, it is also assumed that participants are committed to the goals of this integration and will continue learning about and advocating for such integration after the close of the training.

The module recognizes that there is a continuum of activities to support disaster survivors, from providing emergency pit latrines to more permanent water and sanitation systems such as septic tanks. The focus of this module is on the recovery and reconstruction phases. However, the principles can also apply to the emergency life-saving period after a disaster; addressing environmental issues need not delay project activities. It is especially relevant for water and sanitation associated with transitional shelter and permanent buildings, such as housing, schools, markets, and health centers.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater.

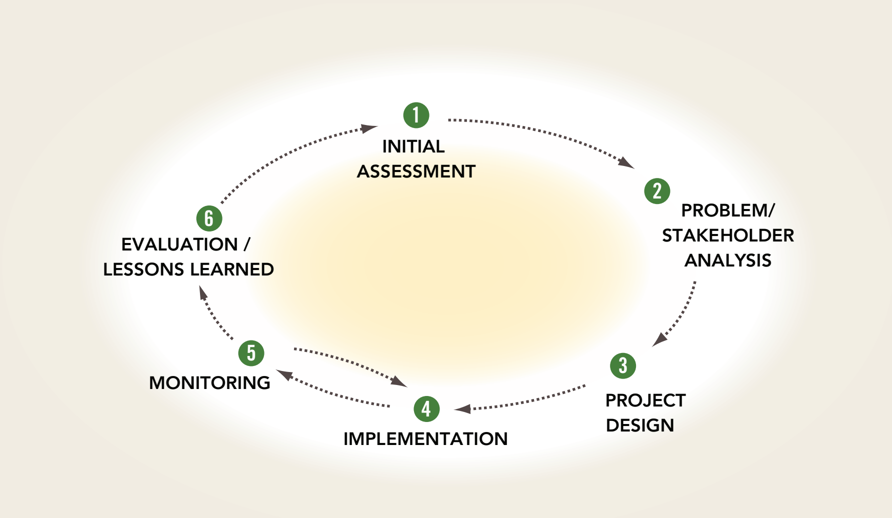
Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean).

2 PROJECT CYCLE AND SUSTAINABLE WATER AND SANITATION

In planning and carrying out disaster response activities, many humanitarian agencies follow a standard project management cycle as depicted in Figure 1:

FIGURE 1: STANDARD PROJECT MANAGEMENT CYCLE



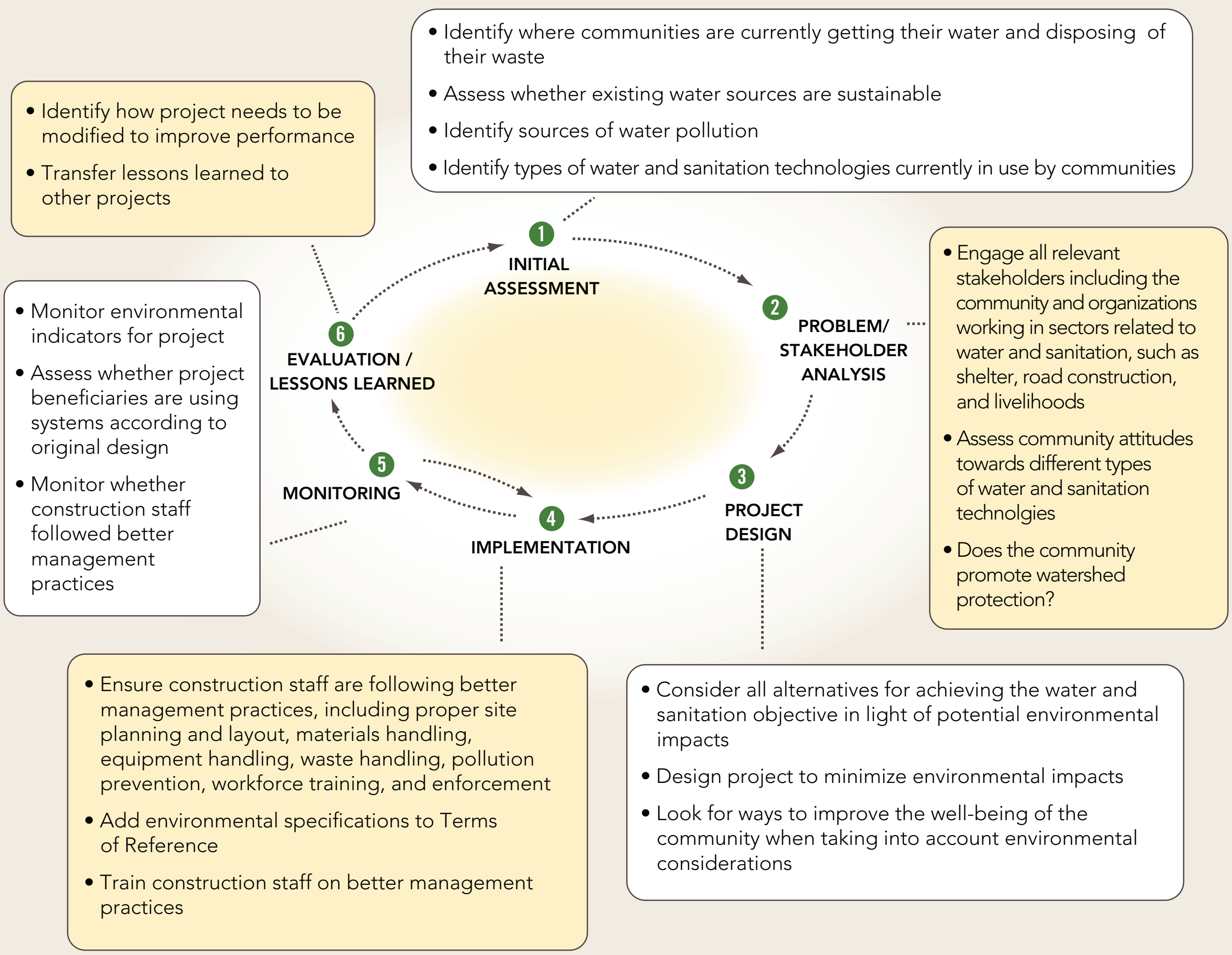
Throughout the project cycle there are opportunities to introduce and reinforce the principles of sustainable water and sanitation as shown in Figure 2. At the initial assessment phase, it is important to understand the environmental setting of the proposed intervention. This includes determining where communities obtain their water, the major sources of contamination and pollution, and the locations of household or community waste disposal systems (if any exist).

During the problem/stakeholder analysis phase, it is important to engage all of the relevant stakeholders to better understand the environmental context and the major actors in the project area. This will also help with buy-in for the long-term success of the project. Communities should be consulted as to how they construct, operate, and maintain water and sanitation systems. Organizations working in sectors outside of, but impacting, water and sanitation should also be consulted to ensure that there are no indirect negative impacts to the sustainability of a water and sanitation intervention. For example, the construction of a road upstream of a river or spring used for water supply has the potential to lead to negative environmental impacts such as erosion and sedimentation. Similarly, the construction of shelter in areas without a sustainable water supply may lead to increased costs, hardship to residents, and potentially wasted construction materials.

During the project design and implementation phases, the project designers should be sure to consider all of the alternatives for achieving water and sanitation objectives, including environmentally beneficial technologies (e.g., treatment wetlands) and watershed management activities. The environmental impacts of implementing a water and sanitation project (such as building septic tanks or dams) should be considered and minimized.

During the monitoring phase, the project should be reviewed to ensure that it meets the original specifications of the design and is meeting the project performance objectives. The results of the monitoring phase should inform the evaluation phase so that modifications that are needed to improve project performance can be identified. For example, if a groundwater supply system is withdrawing water from the aquifer at a rate faster than the recharge, then the project should be adapted as necessary. Project managers may decide to install surface-water withdrawal or rain tanks to supplement the groundwater, may decide to reduce the pumping rate, or may decide to promote water conservation measures within the community. Development of specific indicators in the project logframe and/or monitoring and evaluation plan related to environmental sustainability will help the project achieve its sustainability objectives.

FIGURE 2: PROJECT MANAGEMENT CYCLE AND WATER AND SANITATION CONSIDERATIONS



3 ENVIRONMENTAL IMPLICATIONS OF WATER AND SANITATION ACTIVITIES

Water and sanitation projects have an impact on the environment and the people who depend on it for their well-being. The construction of a spring catchment, for example, diverts water from natural watercourses to alternate locations and uses (e.g., village water supply). Removing water from the natural watercourses makes it unavailable to areas such as fish breeding grounds. This, in turn, can affect people's livelihoods. Upstream spring catchments can also impact downstream residents that may use river water for drinking, cooking, and washing. Similarly, the installation of wastewater systems, such as pit latrines or cesspits, can result in the pollution of groundwater, streams, and rivers with fecal coliform and excess nutrients, which may negatively impact the people who depend on that water.

Water and sanitation project staff also have the potential to create positive environmental impacts through their activities. For example, if wastewater systems are designed to remove a range of pollutants, including microorganisms and nutrients, they can improve water quality. Solid waste management programs can also improve environmental conditions if they are designed to minimize environmental impacts (e.g., design landfills with linings and treatment systems for contaminated storm water runoff) and maximize opportunities (e.g., integrate composting and recycling elements into solid-waste management plans).

Additionally, there is a wide range of activities that occur outside of the immediate water and sanitation project (e.g., logging, road construction, mining, etc.) that can jeopardize the environmental conditions necessary for the success of water and sanitation projects. For example, unsustainable logging can lead to increases in erosion and sedimentation that can contaminate spring catchments. Similarly, mining activities may use chemicals like mercury that can contaminate water supplies, creating a human health issue.

The following is a list of challenges for achieving sustainability and success in water and sanitation projects.

1. **Overextracting a water resource by exceeding available groundwater or surface water supplies.** If many new groundwater wells draw from the same aquifer, overpumping can reduce the groundwater resource. If several government programs or organizations are working in the same aquifer (or watershed) and do not coordinate, this can lead to overuse and unsustainability. This also applies to surface water (streams and rivers) withdrawal and spring catchments.
2. **Selecting technologies that are not accepted by the community.** Systems may not be effective without proper socialization. The selection of locally inappropriate wastewater technologies that are not well maintained or sufficiently understood by the community can exacerbate problems. An example of a locally inappropriate technology would be dry composting toilets installed without adequate public education in their use.
3. **Inadequate consideration is given to other activities (e.g., road building, timber harvesting, agriculture, mining, urbanization, etc.) within the project area.** For example, the harvesting of trees for timber in a watershed and the subsequent conversion of land to agriculture can have a direct impact on the spring catchments that are constructed by significantly reducing water quality and quantity. The gathering of wood for charcoal or fuelwood can lead to desertification. Erosion from such activities can result in sedimentation that pollutes water resources.

4. **Ground and water pollution from improperly designed and built latrines.** Pit latrines that are built too close to surface waters and/or directly into a low water table can contaminate local water sources and those downstream of the latrine site. As a result, waterborne diseases can quickly spread.
5. **Inadequate solid-waste disposal plans or systems,** including medical and household waste. Improper segregation and disposal of medical and nonmedical waste increase the chances of transmission of infectious diseases. Pollution of soil, air (burning), and water from improper trash disposal can also lead to serious human health and environmental effects.

Addressing the environment is vital to ensuring the long-term sustainability of water and sanitation interventions. Children at this elementary school in Thailand benefit from newly installed rain tanks that provide water for improved health and hygiene. The use of rain tanks can reduce pressure on groundwater supplies.
© Daniel Cima/American Red Cross

4 USING THE WATERSHED MANAGEMENT APPROACH

A typical approach to water and sanitation includes 1) infrastructure development, 2) hygiene training, and 3) local community groups (i.e., user committees) and capacity building in local governance. To ensure the long-term sustainability of a water and sanitation intervention, these activities should be accompanied by a fourth component: 4) watershed management. This can help ensure long-term sustainability of the water source, and can provide other ecosystem services such as water storage and treatment.

The term watershed describes an area of land that drains downslope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers, which become progressively larger as the water moves downstream, eventually reaching an estuary and the ocean.

Watersheds can be large or small. Every stream, tributary, or river has an associated watershed, and small watersheds join to become larger watersheds. It is relatively easy to delineate watersheds using a topographic map that shows stream channels. Watershed boundaries follow major ridgelines around channels and meet at the lowest point, where water flows out of the watershed, a point commonly referred to as a stream or river. Because water moves downstream, any activity that affects the water quality, quantity, or rate of movement at one location can affect locations downstream.

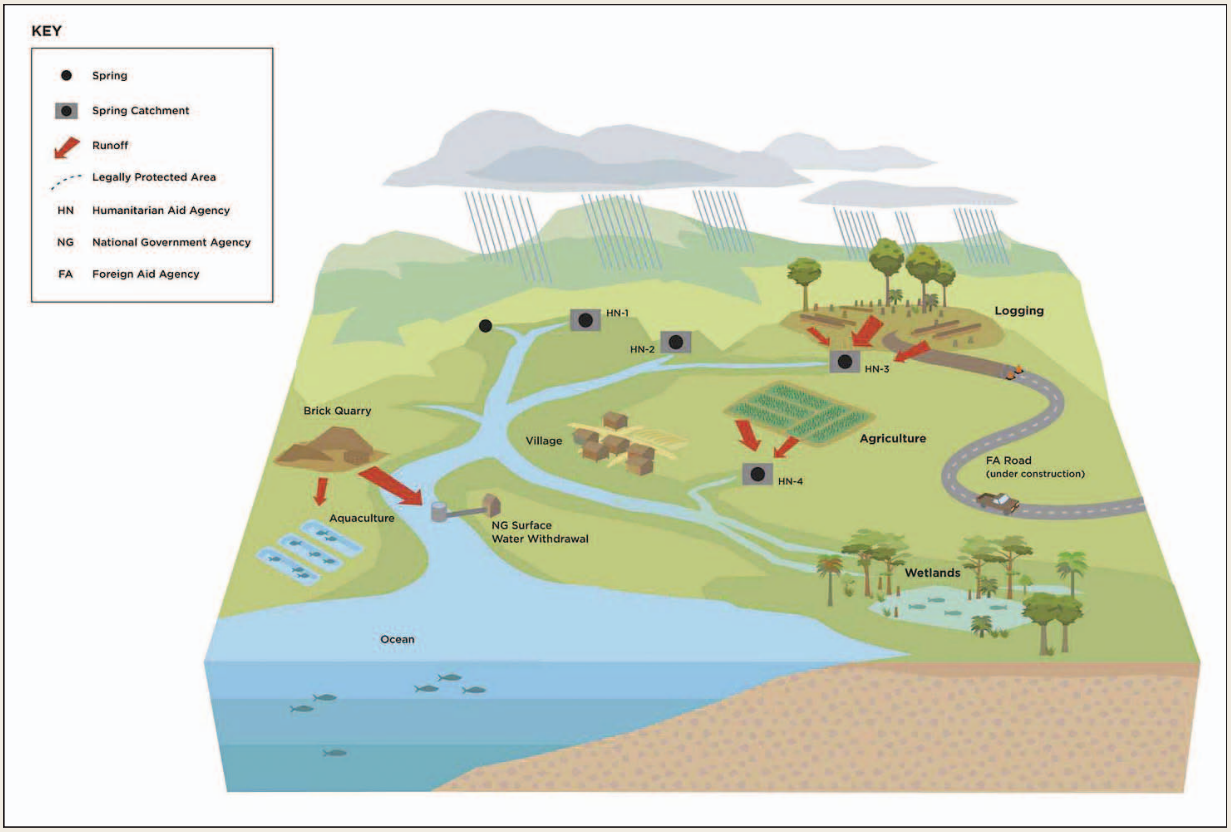
Humanitarian agencies often focus on communities rather than regions. However, given that watersheds extend over multiple hectares and encompass dynamic hydrogeologic processes, they may be impacted by many different activities in the region. Activities that impact a watershed, which may in turn affect multiple communities in the region, include the following:

- Upslope timber harvesting leads to soil erosion, which leads to siltation and obstruction of spring catchments further downslope.
- Construction of buildings, roads, and parking areas leads to permanent covering and compaction of soil, which prevents water from percolating through the topsoil and recharging groundwater.
- The creation of new boreholes or spring catchments without protecting associated groundwater recharge zones.

As shown in this photo in Indonesia, upslope timber harvesting can lead to soil erosion, which leads to siltation and obstruction of spring catchments further downslope. This is one example of why project planners must be aware of activities taking place in the watershed that might adversely impact water and sanitation interventions. In this case, a project planner may consider implementing a watershed protection plan and awareness-raising program to reduce the negative impacts from upslope logging. © Shinta Sianturi/American Red Cross

Related to the watershed management approach is the concept of Integrated Water Resources Management (IWRM), which is defined as a systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. The basis of IWRM is that the many different uses of finite water resources are interdependent and that they should be considered together. Humanitarian aid agencies should consider taking a watershed-scale approach to their water and sanitation interventions in order to address external threats to the long-term sustainability of a project. In the figure on page 10 (Figure 3), for example, project designers might consider setting up a watershed management plan or practicing IWRM in conjunction with the spring catchments that are being developed upstream.

FIGURE 3: INTEGRATED WATER RESOURCE MANAGEMENT ILLUSTRATION

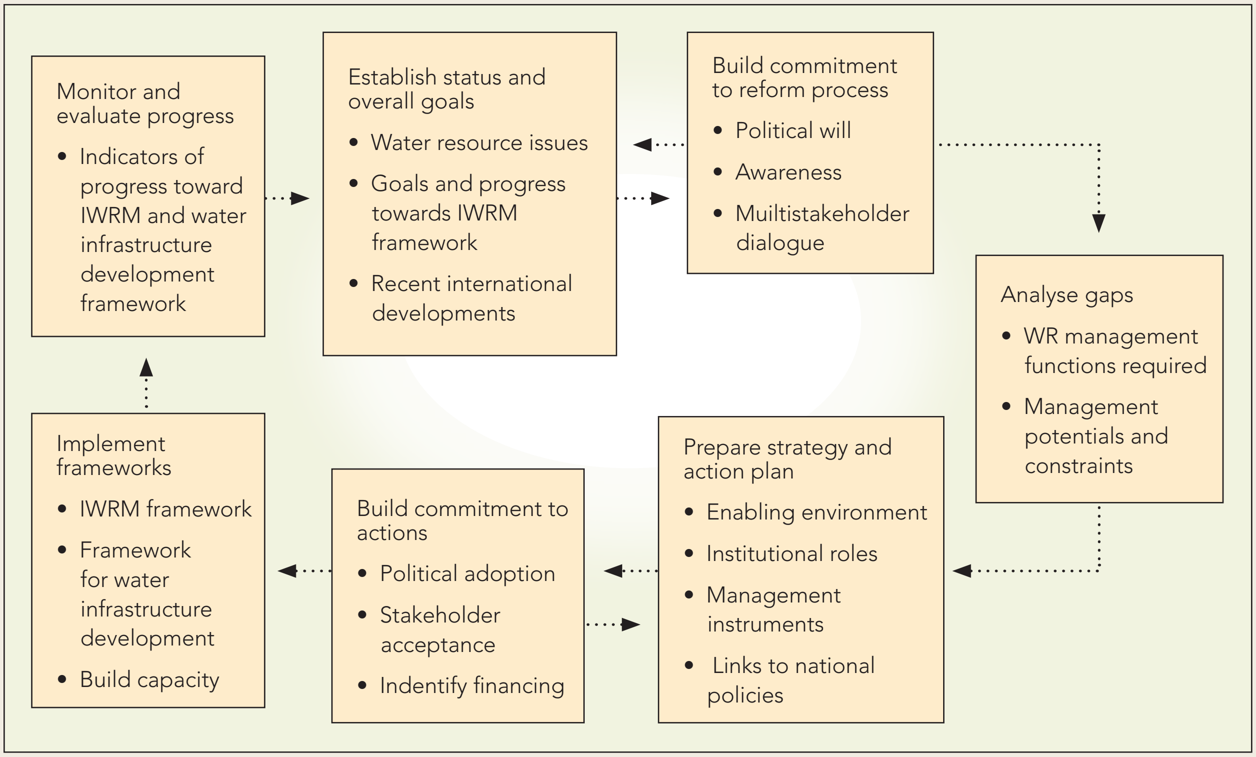


IWRM is based on the fact that water is a natural resource, a social and economic good, and an integral part of the ecosystem, whose quantity and quality determine the nature of its utilization. In attempting to balance these competing needs, IWRM seeks to integrate the "three Es":

- *Environmental and ecological sustainability:* The present use of water should be managed in a way that does not undermine its essential life-support functions and compromise use by future generations of the same resource.
- *Economic efficiency in water use:* Because of the increasing scarcity of water and financial resources, the finite and vulnerable nature of water as a resource, and the increasing demands for it, water must be used with maximum possible efficiency.
- *Equity:* The basic right of all people to have access to water of adequate quantity and quality for the sustenance of human well-being must be universally recognized.

The following figure displays a framework for implementing IWRM and the following case studies provide examples of how IWRM has been used after disasters in Indonesia and Latin America. For more information on the IWRM framework, see the Global Watershed Partnership for Integrated Water Resource Management.

FIGURE 4: INTEGRATED WATER RESOURCE MANAGEMENT FRAMEWORK FOR IMPLEMENTATION



Source: Global Watershed Partnership for Integrated Water Resource Management

FROM DISASTER TO OPPORTUNITY: THE INDONESIA WATERSHED FORUM

In 2007, the WWF-American Red Cross Green Recovery Partnership seized an opportunity to improve and protect a valuable watershed with the help of the local community. In conjunction with a water supply project being built by the American Red Cross and the Indonesian Red Cross Society (PMI) following the 2004 Indian Ocean tsunami, WWF instigated the Krueng Sabee Watershed Forum (krueng means "river" in Bahasa) in order to build capacity within communities to sustainably manage and protect the ecological functions of the Krueng Sabee watershed.

The Krueng Sabee flows through the Aceh Jaya district of the province of Aceh on Sumatra, Indonesia. The river provides water for 20,000 Acehnese who use it for washing, drinking, irrigation, transportation, livelihoods, and ecotourism. Some important crops in the Krueng Sabee watershed include coffee, durian, and nutmeg.

Like many previously untouched ecosystems, the watershed now faces modern threats from mining and illegal logging industries, and from cultivation of commodities like palm oil and patchouli. The area has also been endangered by well-meaning agencies that unwittingly damaged the river's water and banks by building a dam too far upstream, tearing down hillsides for sand and silting the water. The watershed forum is an opportunity for WWF, the American Red Cross, and PMI to inform communities about the dangers facing the watershed and to offer them a chance to get involved.

Members of the 10 participating villages gathered in June 2008 for the Maulid Nabi, the birthday of the Islamic prophet Mohammed, which doubled as the day of opening ceremonies for the forum. The community is now working with local and provincial government officials to develop a program that will mitigate damage to water supplies caused by gold mining.

RESPONDING TO TROPICAL STORMS AND FLOODING IN GUATEMALA/MEXICO

In the high-altitude upper watersheds of the Coatán and Suchiate Rivers, straddling the borders of Guatemala and Mexico and flowing off the slopes of the Tacaná volcano to the Pacific Ocean, environmental degradation and climate change are increasing the risk of devastating flash floods. These watersheds have been deforested and are badly degraded in many places. Severe erosion of formerly deep soils has reduced their capacity to hold water. Population density is high and degradation of the environment has limited people's livelihood options. Communities are therefore increasingly vulnerable to flooding caused by tropical storms and hurricanes. In 2005 tropical storm Stan dropped torrential rains on the region, causing flooding and mudslides that led to an estimated 2,000 deaths and damage of up to US$40 million. Roads, bridges, water supply systems, crops, and local economies were destroyed. This disaster propelled communities to take action and find ways to reduce the risks of flooding. With the support of IUCN's Water and Nature Initiative and other organizations, local communities organized themselves into "micro-watershed councils" to coordinate watershed management among groups of villages. People have become aware of the effects of unsustainable environmental management. They have identified the different demands on water and defined priorities for managing and restoring watersheds that respond to their development needs. Driven by the need to expand livelihood options to reduce poverty, these community councils have led to diversification of farming systems, including terracing of degraded slopes and reforestation through the introduction of agroforestry. Communities are investing their labor and capital in restoration of natural infrastructure. As self-organization expands, communities are becoming better equipped to reduce their vulnerability and increase their resiliency to severe storms expected to increase with climate change.

Source: Smith, D.M., and S. Barchiesi. 2009. *Environment as infrastructure – Resilience to climate change impacts on water through investments in nature*. Perspectives on water and climate change adaptation. The Hague, Netherlands: CPWC; Marseilles, France: World WaterCouncil; Gland, Switzerland: IUCN; and London, UK: IWA. Cited in Sudmeier-Rieux, Karen, and Neville Ash. 2009. *Environmental Guidance Note for Disaster Risk Reduction: Healthy Ecosystems for Human Security*. Revised Edition. Gland: IUCN.

5 UNDERSTANDING CLIMATE CHANGE AND WATER RESOURCES

According to the Intergovernmental Panel on Climate Change, warming of the climate system in recent decades is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global sea level. The hydrological cycle, which is of particular importance to the planning of water management projects, is intimately linked with changes in atmospheric temperature. Over the 20th century, precipitation has mostly increased over land in high northern latitudes, while decreases have dominated from 10°S to 30°N since the 1970s. The frequency of heavy precipitation events (or proportion of total rainfall from heavy falls) has increased over most areas. Globally, the area of land classified as very dry has more than doubled since the 1970s. By the middle of the 21st century, annual average river runoff and water availability are projected to increase as a result of climate change at high latitudes and in some wet tropical areas, and decrease over some dry regions at mid-latitudes and in the dry tropics. Many semi-arid and arid areas (e.g., the Mediterranean Basin, western USA, southern Africa and northeastern Brazil) are particularly exposed to the impacts of climate change and are projected to suffer a decrease of water resources due to climate change. Globally, the negative impacts of future climate change on freshwater systems are expected to outweigh the benefits. By the 2050s, the area of land subject to increasing water stress due to climate change is projected to be more than double that with decreasing water stress. [1]

Changes in water quantity and quality due to climate change are expected to affect food availability, stability, access and utilisation. This is expected to lead to decreased food security and increased vulnerability of poor rural farmers, especially in the arid and semi-arid tropics and Asian and African megadeltas.[2]

The IPCC predicts that current water management practices may not be robust enough to cope with the impacts of climate change on water supply reliability, flood risk, health, agriculture, energy and aquatic ecosystems. In many locations, water management cannot satisfactorily cope even with current climate variability, so that large flood and drought damages occur. Improved incorporation of information about current climate variability into water-related management would assist adaptation to longer-term climate change impacts.[3]

In planning water and sanitation projects after disasters, project managers can take steps to incorporate climate change adaptation into their projects. See the next box for additional information.

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1 Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds. 2008. Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change. Geneva: IPCC Secretariat.

2 Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds. 2008. Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change. Geneva: IPCC Secretariat.

3 Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds. 2008. Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change. Geneva: IPCC Secretariat.

GUIDANCE FOR INTEGRATING CLIMATE ADAPTATION INTO WATER AND SANITATION PROJECTS

The recovery and reconstruction period after disasters is an important opportunity for project planners to incorporate **climate adaptation** into their recovery activities to make projects more resilient to a changing climate and reduce future disaster risk. There are two main categories of climate adaptation: **facilitating transitions to new conditions**, and **building resilience** to adapt to extreme weather events. Facilitating transitions to new conditions is needed when what people once knew as 'normal' is no longer the norm, such as changes in freshwater systems due to melting of snow packs, and sea level rise. Building resilience to extreme weather events helps people and nature withstand shocks and get back to normal after extreme events such as severe storms, drought or flood. In practice one or both of these approaches may be needed in a particular part of the world; building resilience can be a short-term measure while in the longer term a transition is needed to a new state – buying time in order to facilitate change.

Once you know how local people and ecosystems are vulnerable to climate change and climate variability, many of the measures proposed in this module can be applied to help adapt to climate extremes. For example, rainwater harvesting, household water treatment technologies, and location of sanitation systems. When planning reconstruction projects it is important to take long-term trends affecting the availability of surface or ground water into account. For example, if the overall availability or the timing of water supplies is becoming less reliable, project planners should determine if water supply systems can be made more efficient by using different technologies or selecting the most reliable water source options for the long-term. If water supplies are already scarce and are very likely to fail in the future it may be prudent to consider relocation of settlements now if this is feasible, rather than making further investments in the existing site. Water and sanitation planners should also coordinate with other reconstruction sectors (e.g., livelihoods) to determine if regional water demand can be reduced. By diversifying agricultural production, and using crops and livestock that are more suited to the changing water availability conditions to reduce the overall water footprint.

Consider this climate adaption checklist when designing water and sanitation projects:

- ❑ Project planners have contacted local government officials or experts to determine the predicted impacts from climate change within the project area.
- ❑ The project includes specific measures to address predicted changes in climate extremes in the next 5-10 years (e.g., worsening drought, greater frequency of flooding, more intense cyclones)?
- ❑ The project design incorporates the consequences of longer term, regional climate change effects (e.g., heat stress from rising temperatures, reduced stream flow due to loss of snow pack, sea level rise from melting ice caps)
- ❑ Alternative activities have been considered in terms of their ability to account for future climate risks.

For more information on the role of climate adaptation in disaster risk reduction see Module 9, Green Guide to Disaster Risk Reduction.

6 ENVIRONMENTALLY BENEFICIAL TECHNOLOGIES AND TECHNIQUES

In recent decades, there has been an increase in the types of technologies that are available to humanitarian water and sanitation project planners. By selecting certain technologies, project planners can reduce demand on water supplies, decrease the inflow of nutrients to natural systems, provide communities with higher water quality and quantity, and decrease maintenance effort and costs. The following section discusses different water and sanitation technologies and techniques along with their environmental implications.

Consideration of the environmental impact of a water and sanitation project should begin at the earliest phase of project inception, as soon as project objectives have been determined. If the project objective is to "provide a community of 250 households with a sustainable source of freshwater," the water and sanitation project engineer or planner should consider the different alternatives for meeting this objective and the associated level of environmental impact. Decisions to install an upstream spring catchment or withdraw surface water or pump groundwater will have different types of environmental impacts and thus differing impacts on project success.

It should be noted that introducing any new type of water and sanitation technology or technique into a community requires significant time and effort in capacity building to ensure that the community is committed to these approaches.

6.1 Potable Water Supply

6.1.1 Rainwater Harvesting

Rainwater collection techniques have been used since ancient times throughout the world and have been called one of the "most underappreciated technolog[ies]."[4] Depending on rainfall frequency, roof type, air pollution, dust levels, and collection tanks available, rainwater can be a very healthy drinking water option for local communities. In the humanitarian aid context, the typical rain tank setup includes rooftop collection and a storage chamber.

Rainwater collection is an inexpensive water supply option in comparison with piped water systems, and can be easily installed and maintained by community members. It can be beneficial for the environment in that it reduces the demand on springs and groundwater, and also reduces uneven rain runoff loads that can fall from roofs and cause erosion. Since rainfall varies widely by season and region, it may not be possible to use rain as the main water source, however. Additionally, with the impacts of climate change, there may be shifts in the frequency and severity of extreme weather events such as droughts, and this should be taken into account when planning water supply infrastructure. In some areas, rain can be used as a supplementary source of water. Researchers have found that an increased quantity of water supplied to households can decrease disease burden,[5] and improve health outcomes. Additional water from rain tanks can also be used for irrigation of household gardens and for sanitation (e.g., flushing toilets, cleaning latrines).

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4 Oldfield, John. 2006. Community-Based Approaches to Water and Sanitation: A Survey of Best, Worst, and Emerging Practices. *Water Stories Paper No. 2.* Washington, D.C.: Woodrow Wilson International Center.

5 Esrey, S., J. Potash, L. Roberts, and C. Schiff. 1991. Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. *Bull WHO 69(5):609-21.*

After the 2004 Indian Ocean tsunami in the Maldives, IFRC, UNICEF, and the Maldives Island Development Association installed household rainwater collection tanks in 17,000 homes on 90 different islands. The Maldives was an ideal location for this water supply option, as many groundwater aquifers had saltwater contamination from the tsunami and the islands receive sufficient quantities of rainfall (1,900 mm of rainfall per year or twice the world average). In addition, this type of water supply was already well established and accepted by the local community. The first rain tank, a 96,675-liter tank, was introduced as early as 1906 in the Maldives.

Since monsoon-prone areas regularly experience some of the most severe weather conditions in the world – conditions that are expected to worsen with climate change – a new paradigm in the management of rainwater is being considered.[6] In one monsoon-prone area in Korea, for example, rainwater harvesting is serving as the main source of water. Water is managed on a decentralized basis and controlled near its source. Under future climate-change scenarios, monsoons are likely to continue to increase in severity and perhaps frequency, with changes in timing and variability. Systems that require less physical infrastructure and energy, with multiple water sources, can be more adaptable to changes in climate.

An important note to remember: Asbestos is a common roofing material found in many rural areas, and ***collecting rainwater off of asbestos roofs for drinking is unacceptable for health reasons***. This caution is particularly important in post-disaster situations in which asbestos is often seen as an easily collected and distributed inexpensive construction material. We also note that rainwater harvest in some areas needs to allow for sufficient groundwater recharge.

6.1.2 Groundwater

Groundwater sources are often used as potable water sources. Most often hand-dug wells are used for this purpose, with water collection done through a simple pulley and rope mechanism. During the design phase for a groundwater pump, it is critical that the recharge rate of the aquifer be tested to determine if it has the capacity for sustained pumping. This must be done in coordination with other organizations that are accessing the same aquifer to ensure that the withdrawal rate does not exceed the recharge rate.

6 Mun, J., and J. Han. 2006. *Rainwater Harvesting and Management Spotlighted as a Key Solution for Water Problems in Monsoon Region.* South Korea: Rainwater Research Center in Seoul National University YSW.

WELL REHABILITATION AND CONSTRUCTION IN SRI LANKA

In Sri Lanka following the December 26, 2004, Indian Ocean tsunami, the rush to rehabilitate salt-contaminated drinking water wells was criticized for being "haphazard" and "uncoordinated." The lack of coordination between recovery agencies and the desire to restore wells in a hurry resulted in the overpumping of aquifers, which in turn allowed seawater to enter the aquifers from below. The high rate of pumping also caused many wells to collapse, as their walls were not reinforced. Contaminated water that was pumped out of wells in the hopes of cleaning the wells was often discharged in places that allowed contaminants to seep back into the wells. Ultimately the well-intentioned desire to quickly restore drinking water led to a missed opportunity to use more productive techniques that would have had less impact.

Sources:

Villholth, K.G., P.H. Amerasinghe, P. Jeyakumar, C.R. Panabokke, O. Woolley, M.D. Weerasinghe, N. Amalraj, S. Prathepaan, N. Bürgi, D.M.D.S. Lionelrathne, N.G. Indrajith, and S.R.K. Pathirana. 2005. *Tsunami Impacts on Shallow Groundwater and Associated Water Supply on the East Coast of Sri Lanka: A post-tsunami well recovery support initiative and an assessment of groundwater salinity in three areas of Batticaloa and Ampara Districts.* Colombo, Sri Lanka: International Water Management Institute

Illangasekare, T., S.W. Tyler, T.P. Clement, K. Villholth, A.P.G.R.L. Perera, J. Obeysekera, G. Ananda, C.R. Panabokke, D. Hyndman, K. Cunningham, J. Kaluarachchi, W. Yeh, M.T. van Genuchten, and K. Jensen. 2006. Impacts of the 2004 tsunami on groundwater resources in Sri Lanka. *Water Resources Research 42*, W05201, doi:10.1029/2006WR004876

Depending on the depth of water and the quantity required, pumps may be used for easy delivery of water to ground level or to a water collection tank. The following types of pump technologies use less energy and result in lower operational cost and a lower carbon footprint: manually operated pumps (e.g., hand pumps, rope pumps, carousel pumps), hydraulically operated "ram" pumps, diesel-fueled generators, and solar and wind pumps.

Manually operated pumps use human power to lift water to the surface from a borehole, rainwater tank, or well. There are many different types of hand pumps available, but most use the principle of a reciprocating piston and two check valves. A rope pump is a kind of pump in which the main component uses a length of rope to raise water from a well. Rope pumps are often based on a PVC pipe and a rope with flexible or rigid valves. Rope pumps are cheap to build and easy to maintain.

A hydraulic ram or impulse pump is a device that uses the energy of falling water to lift a lesser amount of water to a higher elevation than the source. There are only two moving parts, and thus less machinery to wear out. Hydraulic rams are relatively economical to purchase and install. They can be built with detailed plans, and if properly installed they are relatively low in maintenance with no pumping costs. For these reasons, the hydraulic ram is an attractive solution where a large gravity flow exists. A ram pump should be considered when there is a source that can provide at least seven times more water than the ram is to pump and where the water is, or can be made, free of trash and sand.[7]

Solar technology is very well suited to pumping water, even more so than the traditional windmill. A typical system includes one or more solar panels, an efficient 12-volt DC pump, a controller (with float switches), and a linear current booster that allows the pump to run even in cloudy conditions. As long as there is sunlight, the float switches show that the water source is not empty, and the cistern/water tank is not overflowing, the pump will run.

7 Water for the World. Designing a Hydraulic Ram Pump. Technical Note: No. RWS.4.D.5. www.lifewater.org/resources/rws4/rws4d5.htm (Accessed on April 7, 2010)

INTRODUCING SOLAR-POWERED WATER PUMP TECHNOLOGY IN DARFUR

In order to increase water supply for internally displaced people's (IDP) camps that housed people displaced by the conflict in Darfur, the local community and Caritas-International implemented an innovative solar-powered water pump program in the town of Kubum. The rainy season in South Darfur typically lasts five or six months of the year. For the remainder, the land is dry, arid, and desolate. With the length of the rainy season becoming increasingly unpredictable in Darfur, water has become a precious commodity.

"Kubum Solar Water Project was initiated by the growing need for sustainable sources of water for IDP communities in Darfur. This is [a] successful example of an aid agency using a solar-powered solution for the benefit of the camp communities," said Osman, the project coordinator of the Caritas water and sanitation team.

If there is one thing that Darfur has in abundance, it is sunlight. Clean technologies like solar energy are proving to be an efficient way of creating sustainable water supplies for communities affected by the ongoing violence in Darfur. The project took three months to implement, including assessing the site and fabricating and installing the water tank, solar panels, and solar submergible pump. The community-level pump provides 15 liters of water per person per day and directly benefits over 2000 people. The maintenance of the pumps is carried out collaboratively with the government. A water committee, consisting of nine men and women selected in the camps, has been trained on the benefits of solar power and they then share the knowledge with family members and the wider community. Some of the committee members are mechanics, some are hygiene workers. These projects offer a community-owned solution to the resource scarcity that can fuel violence between different ethnic tribes.

People from Kubum town and neighboring communities are also collecting water from the solar pump, taking the number of beneficiaries to around 3000 or more. The community members are trained and included from the beginning. Training includes the connection of the panels, connection of the system, and dismantling.

Solar power is frequently criticized for its expense, but it is a long-term solution that has exponential benefits for communities in Darfur. According to Osman, "There are no operation costs except guarding, no pollution, no technical expense, and the environmental benefits are extremely significant when compared to the diesel-powered pumps. The public must be educated. It may seem expensive at the beginning, but the long-term benefits are immense."

The solar-powered water pumps were funded by the Scottish Government through SCIAF/Caritas Scotland.

The success of the first project in Kubum has led to an expansion of the project, with two pumps planned for construction in Zalingei and two more in Garsilla. This project is offering a viable alternative to the diesel-powered, high-maintenance pumps that litter the camps in Darfur. The government has also begun to look at the projects as successful models to be used in other areas of South Darfur.

Source: Caritas International. Bringing Solar Power to the People of Darfur. www.caritas.org/activities/climate_change/SolarPowerForDarfur.html (Accessed on April 7, 2010)

The windmill is useful technology as well, with a pump directly coupled to the wind generator. The main problems with windmills are inconsistent wind for a few days at a time and inadequate maintenance. The leather seals on the pumps tend to wear out and require replacement. Some windmill systems use pressurized air to pump water, and require very little maintenance. These can also be used to generate power. Other systems have been built using an electric wind generator, linear current booster, and pump.

6.1.3 Household Water Treatment Technologies

Household water treatment technologies include ceramic water filters; biosand filters; SODIS; chuli filters; community-level filters such as hand-operated pond sand filters; and low-cost/low-carbon treatment for common water contaminants such as iron, fluoride, and arsenic. Many can be adapted for use with manual or motorized pumps.

Ceramic water filters consist of a porous, pot-shaped filter element made of kiln-fired clay and impregnated with colloidal silver. The ceramic filter element is set in a plastic receptacle tank with a lid and a spigot. Raw, untreated water is poured into the filter element and seeps through the clay, producing potable water at a rate of two to three liters per hour. The filter element holds approximately 10 liters, allowing a family to produce 20 to 30 liters of water per day with two to three fillings. Under laboratory conditions, water quality tests on ceramic water filters have shown 100 percent removal of faecal *E. coli* and total coliforms. Under conditions of household use, 98 to 99 percent of ceramic water filters produced water meeting World Health Organization low-risk guidelines or better (i.e., 10 or fewer *E. coli* per 100mL). This percentage did not depend on the length of time that the ceramic water filter had been used in the household but remained constant over the year-long test period. Nor did the percentage depend on the quality of the input water; ceramic water filters were equally effective at purifying water regardless of the input water quality, within the limits of the water sources tested. Input water sources included rivers, lakes, tube wells, lined and unlined open wells, ponds, and rainwater. Monthly maintenance consists of scrubbing the ceramic filter element to unclog pores and washing the receptacle tank and spigot to prevent bacterial growth. As there are no mechanical parts to maintain, if the ceramic filter elements are available in the market this technology is an ideal option for treating water from relatively clear (i.e., low-turbidity) water sources.[8]

Biosand water filters are a technological adaptation of the centuries-old slow sand filtration process. Biosand filters remove 95.0% to 99.0% of organic contaminants, including bacteria, viruses, protozoa, worms, and particles.[9] Safe water produced by the filters is free of discoloration, odor, and unpleasant taste, and can be used for drinking, food preparation, personal hygiene, and sanitation. Most common home-based models can produce between 20 and 60 liters of water per hour. On the downside, biosand filters can be complicated to clean and lack self-contained water storage. These obstacles must be addressed to ensure that the technology is successfully adopted by the community.

***Moringa oleifera* seeds** have been found to be an effective way of treating water with natural material. Village women in Sudan, for example, have been using seeds from this tree to treat water for many years. *M. oleifera* seeds work on two levels, acting as both a coagulant and an antimicrobial agent. *M. oleifera* seeds have a high content of low-molecular-weight, water-soluble proteins that carry a positive charge. When added to untreated water, these proteins bind with the negatively charged particles that make water turbid (muddy or cloudy) – most often clay, silt, and bacteria. After stirring, these particles flocculate and settle to the bottom of a container. Antimicrobial aspects of *M. oleifera* continue to be researched, but findings support recombinant proteins both removing microorganisms (by coagulation) and acting directly as growth inhibitors. Although clearer, the water resulting from *Moringa* treatment is not entirely purified. *Moringa*-treated water should be filtered and sterilized to be made completely safe for drinking.

The SODIS system was developed by scientists at the Swiss Federal Agency for Environmental Science and Technology (EAWAG). SODIS is a simple, low-cost, and effective treatment method that uses solar energy to inactivate and destroy microbes in drinking water. SODIS is highly effective in treating small quantities (2 liters or

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8 Roberts, Michael. 2003. *Ceramic Water Purifier: Cambodia Field Tests*. IDE Working Paper No. 1. International Development Enterprises.

9 Engineers Without Borders. 2008. *Biosand Filter Construction Guide: Muramba, Rwanda Supplemental Report*. Madison: University of Wisconsin.

less) of relatively clear water (turbidity less than 30 NTU) through ultraviolet (UV) radiation. It does not change the chemical quality of the water (for example it does not remove arsenic contamination) or the odor or taste of the water. Using the SODIS system, water is exposed to UV radiation in sunlight and becomes heated; both effects contribute to the inactivation of waterborne microbes. Clear plastic bottles are preferable to use for this process because they are lighter, less likely to break, and less costly. Polyethylene terephthlate (PET) bottles are better than polyvinylchloride (PVC) bottles because they are less likely to leach elements into the water or to pass on tastes and odors to the water, and they are chemically stable. PET bottles should periodically be replaced, as they can be scratched and deformed if temperatures exceed 65°C.[10]

6.2 Wastewater Management

6.2.1 Constructed Wetlands for Wastewater Treatment

Naturally occurring wetlands remove inorganic and organic materials from water through natural, physical, chemical, and biological processes. Slow movement of water through wetlands allows contaminants to settle, wetland plants to take up wastewater nutrients, microorganisms to decompose organic compounds, soils to absorb ions, and minerals and metals to precipitate and become more stable.[11]

A "constructed wetland" is defined as a wetland specifically constructed for the purpose of pollution control and wastewater management, at a location other than that of an existing natural wetland.[12] Constructed wetland systems have been widely used throughout the world to reproduce these naturally occurring wetland environments for treating industrial and domestic wastewater. In recent years, many civil works departments, housing developers, and consultants have used wetlands in the treatment of domestic wastewater.[13] Constructed wetlands have been successfully used to treat even heavy metals or hazardous pollutants found in acid mine drainage, food industry waste, and petrochemicals from highway runoff.[14,15]

An example of a typical constructed wetland, is one used at the Kanawat Health Center in arid Kanawat, Uganda, in which several modifications were made to the exiting water and sanitation mechanisms. The health center's sewage (some flush toilets and grey water) was made to drain into a treatment system consisting of a settling tank, a sludge-drying bed, and a horizontal subsurface constructed wetland for secondary treatment of the settling tank's outflow. The constructed wetland system was built on a 45 m^2 area in which indigenous non-fruit plants grew. Wastewater was pretreated in the settling tank to remove solids (by sedimentation and flotation), then allowed to flow by gravity to the inlet of the constructed wetland. Once it reached a certain level (ideally every three months, but realistically once a year), the fecal sludge from the settling tank was stirred and discharged by gravity via a pipe into the drying bed (and then dried together with fecal material from the dry composting toilets). The treated wastewater is collected in a concrete tank to be used as irrigation water.

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10 Sobsey, M. 2002. *Managing Water in the Home: Accelerated Health Gains from Improved Water Supply.* Geneva: WHO.

11 DeBusk, W.F. 1999. *Wastewater Treatment Wetlands: Contaminant Removal Processes.* SL155 fact sheet. Soil and Water Science Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

12 U.S. Environmental Protection Agency. 1993. *Constructed Wetlands for Wastewater Treatment and Wildlife Habitat.*

13 Corea, E.J.H. 2001. Appropriate disposal of sewage in urban and suburban Sri Lanka. PhD Thesis, University of Leeds, UK.

14 Christensen, E. 1999. *Wastewater Treatment through Wetlands.* Rocky Mountain American Society of Civil Engineers.

15 Korkusuz, E. 2005. *Manual of Practice on Constructed Wetlands for Wastewater Treatment and Reuse in Mediterranean Countries.* Mediterranean Network on Wastewater Reclamation and Reuse.

In April 2007, the Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ), Oxfam, IFRC, U.S. Agency for International Development Environmental Services Program (USAID-ESP), and UNICEF in Aceh, Indonesia, compiled *Guidelines for the Selection and Implementation of Sustainable Systems for the Reconstruction in Aceh and Nias.*[16] The guidelines advise that all sanitation systems include primary and secondary treatment, and describe in detail the use of subsurface wetlands or vegetated leach fields as appropriate secondary treatment methods. Many NGOs in Aceh, including Atlas Logistics, Oxfam, and the American Red Cross, included wetlands as an integral part of their sanitation system design.

At the time of writing, an inter-agency group that includes GTZ and USAID was in the process of testing effluent from constructed wetlands to determine the exact reduction of inorganic particles and nutrients in effluent material in the designs being used. The inter-agency group believed these systems would perform well for several reasons: People use water for ablutions, so there is a low level of fecal matter in the initial wastewater; there is a high level of knowledge within the local population about the need for proper sanitation; and a large number of people are used to maintaining plants in their own yards. This type of sanitation system is not without its difficulties. Sludge removal from the primary treatment chamber can be difficult, and some households have not adequately maintained their wetlands or protected them from livestock contamination. Additionally, the sanitation system may add to construction, operation, and maintenance costs. Project planners also need to make sure that treatment wetlands are not planted with potentially invasive plant species. Local and native plant species should be a first choice.

16 Deutsche Gesellschart fuer Technicshe Zusammanarbeit (GTZ). 2007. *Guidelines for the Selection and Implementation of Sustainable Sanitation Systems for the Reconstruction in Aceh and Nias.* Banda Aceh, Indonesia.

The constructed wetland shown to the right of the house is an example of the household-level wastewater treatment systems that were constructed in Aceh, Indonesia, after the 2004 Indian Ocean tsunami. The constructed wetland is part of the water and sanitation system that was built by the American Red Cross. Both the house and the treatment wetland were elevated for protection against flooding. The floor of the treatment wetland is sealed to prevent wastewater from contaminating the groundwater before it has been treated. The house was constructed by the British Red Cross and uses timber that has been certified by the Forest Stewardship Council. © Azhar/WWF

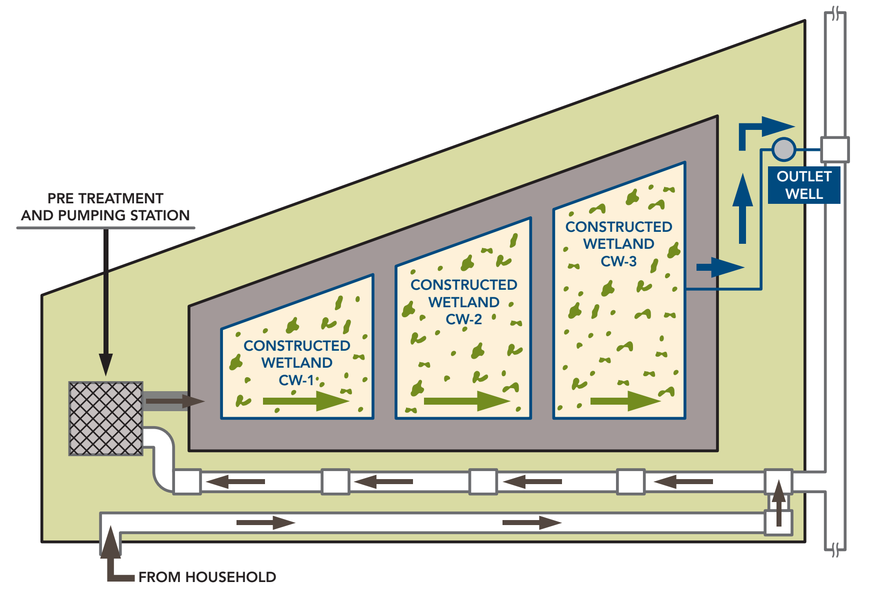
THAI RED CROSS AND COMMUNITY CONSTRUCTED WETLANDS IN BAAN PRU TEAU TOWNSHIP, THAILAND

Several small villages along the coast of Phang Nga province were completely devastated by the 2004 Indian Ocean tsunami. The inhabitants who survived lost their homes and property and were in many cases moved to new townships. The Bann Pru Teau constructed wetland system treats the wastewater from a newly built township that was established with the help of the Thai Red Cross. The new township includes 80 households with an estimated four people per house. The average daily flow rate is estimated to be about 40 m^3. Each house has a conventional concrete septic tank for black water treatment. Effluent from the septic tanks and all grey water is discharged into a newly established drainage network that leads the wastewater to the constructed wetland treatment system. High priority in the rehabilitation project was to secure sustainability through the fitting of the wastewater management system into the local settings and by applying low-cost, robust, ease of operation and appropriate technologies. The approach of the rehabilitation project was therefore to focus on decentralised nature-based infrastructure and wastewater management techniques and, where relevant, to promote the recovery and reuse of wastewater. Additional technical details are described below.

The wastewater treatment system (below) consists of the following components: (i) An overflow weir to prevent flooding and overloading of the wetland during heavy rain; (ii) a stainless steel screen with a bar spacing of 10mm to collect garbage and prevent it from entering and blocking the pumps; (iii) a sand trap; (iv) an oil and grease trap; (v) a pumping station with two pumps that lift the wastewater into the constructed wetland cells; (vi) three wetland cells with horizontal subsurface flow that operate in series; and (vii) an outlet well for regulation of water level in the wetland cells and discharge of effluent to the drainage system along the road. The three wetland cells have a total surface area of 220 m^2 and are filled 0.6 m deep with 8mm-to-40mm-diameter gravel. A piped tee discharges the wastewater onto the surface of the three gravel filters. From the outlet tee the wastewater seeps into the gravel filter and flows evenly through the filters, which are between 3cm and 10cm below the surface of the gravel. Underground outlets connect to the inlet in the next gravel filter through a PE pipe. The water level can be adjusted at the inlet in the next gravel filter with the adjustable tees. Pipes for inspection of water level in each gravel filter are installed near the outlet. The wetlands are lined with polyethylene to avoid water loss and provide an equal water level. The filters are planted with Canna lilies to assist in the treatment and make the treatment plant more aesthetically pleasing. Furthermore, the treatment plant area is planted with grass and wetland edges and the perimeter of the area is planted with trees and shrubs. A small house, benches, and an information board have also been installed.

Source: Brix, Hans, Thammarat Koottatep, and Carsten H. Laugesen. 2007. Wastewater Treatment in Tsunami-Affected Areas of Thailand by Constructed Wetlands. *Water Science and Technology 56: 69-74.*

General layout of the constructed wetland systems at Baan Pru Teau consisting of a pretreatment unit comprising screening, a sand trap, grease and oil trap, and a pumping station; three horizontal subsurface-flow constructed wetlands in series (CW-1 to CW-3); and an outlet regulation well.



6.2.2 Anaerobic Filters/Biofilters for Wastewater Treatment

Anaerobic filter systems are mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which act as a support matrix for anaerobic biological activity. In constructed anaerobic filters, the typical filter medium used is crushed stone or gravel supported by a perforated filter floor. In these systems, while acting as a support matrix, the media also works as a physical filter medium, further improving the effluent water quality. In the prefabricated anaerobic filter systems available in the market (brand names include Biocell, Biotech, and Biofil), a plastic floating medium is used. The system uses a combined primary and secondary treatment chamber. Many humanitarian aid agencies prefer to use a prefabricated system rather than a constructed anaerobic filter, mainly because of immediacy of need, and the popularity of the prefabricated systems has grown in recent years.

For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than traditional systems such as precast cylindrical-shaped septic tanks or soakage pit systems. Both the septic tank and soakage pit systems are difficult to make waterproof, leading to groundwater contamination. In some cases, the biofilters can also be used as a secondary treatment step prior to further treatment in constructed wetlands.[17] The proper use of biofilters can help ensure that pollutants that cause public health problems and eutrophication have been adequately treated.

In Sri Lanka, biofilters were used for wastewater treatment prior to the 2004 Indian Ocean tsunami, but their use increased under post-tsunami reconstruction activities. The fact that many of the newly installed cylindrical septic tanks and soakage pits have failed to meet the Sri Lanka standards for septic tank construction has led to many of these systems being replaced with prefabricated biofilters. Due to the popularity of these filters, the Sri Lankan government is creating a new standard for the design and construction of the systems.

Similar to the constructed wetlands described above, the anaerobic filter system has some drawbacks. The prefabricated systems may have negative environmental consequences, as they may not provide the same level of effluent treatment as constructed anaerobic filters. This is mainly due to the slower retention times of wastewater through these units and lack of physical filtration provided by plastic filter media. These impacts and tradeoffs should be weighed against the positive environmental and health benefits achieved by the improved treatment of domestic wastewater. If the prefabricated biofilter has a septic tank preceding it, performance is better.

6.2.3 Dry Composting Toilets

The use of human excreta for fertilizer is an ancient practice dating back some 4000 years in Asia and the Pacific, and remains the only agricultural use option in areas without sewerage facilities.[18] The main goal of a composting toilet is to contain human waste and create conditions for rapid decomposition – including of any pathogenic organisms – into humus, a safe and stable soil-like substance. Humus can be used as a fertilizer for plant and tree growth. It can also be composted and dug into the earth to enrich the soil. Rapid decomposition of human waste requires adequate oxygenation to remove any excess liquid. The airflow that enters the composting toilet ensures this process and eliminates odors via the unit's vent pipe. It should be noted that cultural barriers exist in many countries and must be considered when evaluating appropriateness of using dry-composing toilets.

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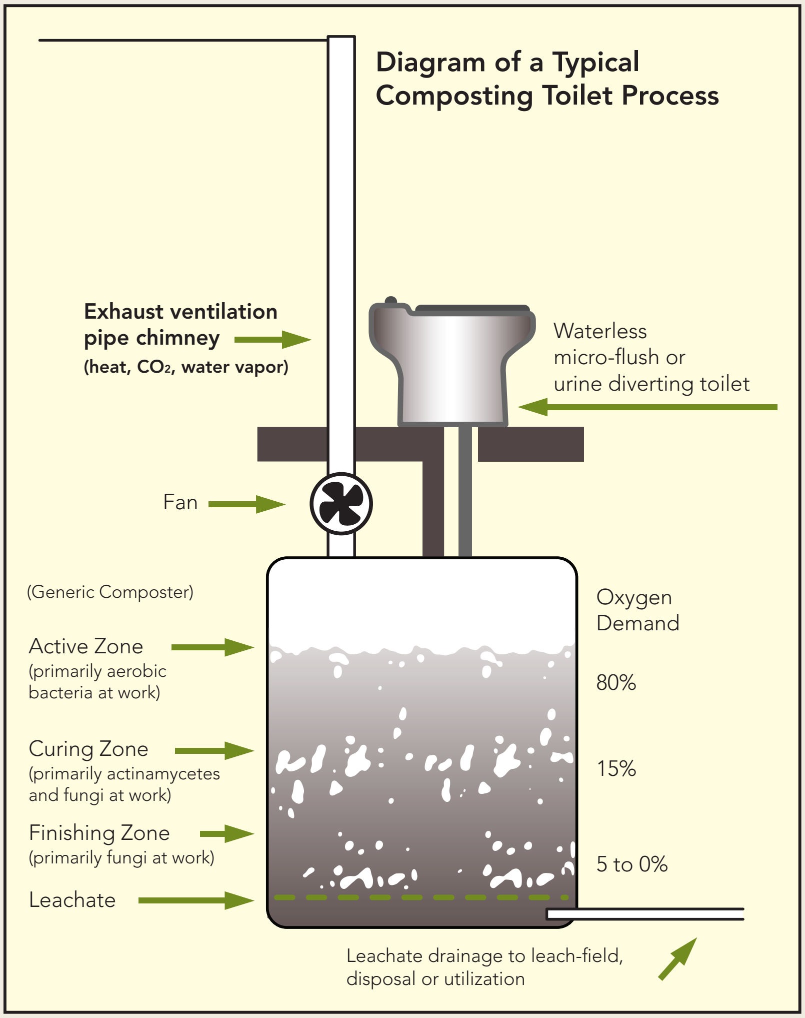
17 Corea, E.J.H. 2001. Appropriate disposal of sewage in urban and suburban Sri Lanka. PhD thesis, University of Leeds, UK.

18 WHO. 1989. *Guidelines for the use of wastewater and excreta in agriculture and aquaculture.* WHO Technical Reports 778. Geneva, Switzerland.

FIGURE 6. COMPOSTING TOILET



Source: Del Porto, David and Carol Steinfeld. 2004. *Composting Toilet System Book: A Practical Guide to Choosing, Planning and Maintaining Composting Toilet Systems.* Center for Ecological Pollution Prevention

Urine is separated from fecal matter, and the fecal matter is then dried by exposure to heat or the sun. Lime, ash, sawdust, or similar material is added to control moisture. Introduction of organic refuse such as vegetable waste to the toilet chamber encourages compost creation and controls chemical balance. Latrine contents are isolated from human contact for a minimum of ten months to reduce pathogens and make the waste safe for handling (the longer the waste is stored the more pathogens are destroyed). Thereafter, the waste may be used as fertilizer or fuel.

Properly planned and managed excreta- and wastewater-use schemes can have a positive environmental impact and increase agricultural yields. Examples of possible environmental improvements include avoidance of surface water pollution, conservation, reduced dependence on artificial fertilizers, and soil conservation through humus buildup and prevention of land erosion. It should be noted that in places where water is used for anal cleansing, urine diversion is less useful, as large amounts of water for anal cleansing are used, making the pit wet. If the anal cleansing water is diverted, it is contaminated by fecal matter and therefore unsuitable for immediate reuse, and has handling issues.

THE LADAKH IMPROVED TRADITIONAL COMPOSTING TOILET

One example of an improved traditional composting toilet can be found in Ladakh, in northern India, near the Chinese border. Ladakh retains a highly traditional culture, although tourism and other Western influences are bringing change. Ladakh is sparsely populated (3 persons/km²) with an average household size of 4.7. Its capital, Leh, is situated in a mountainous desert 3,500m above sea level with long, cold winters and severe water scarcity with rainfall below 100mm per year.

The indigenous nongovernmental organization (NGO), Ladakh Ecological Development Group (LEDeG), actively promotes adapted ecological technologies for renewable energy generation. In 1986 LEDeG built a project demonstration toilet at its Ecology Centre in Leh, which is used by approximately 100 visitors and workers each day. It is based on the traditional local dry toilet system, rather than the water-based toilet systems introduced by local guesthouses for visiting tourists. The dry latrine is improved by a black-painted vent pipe (similar to that used in ventilated improved pit latrines) to ventilate the collection chamber and reduce flies.

With its extremely dry climate, it is possible in Ladakh to process human excreta indoors without prior diversion of urine, by using a combination of soil composting and dehydration. On the floor of a small room upstairs, separated by some distance from the kitchen/living room, there is a thick layer of soil from the garden. In the floor, a drop hole leads to a small ground-floor room that can only be reached from the outside. People excrete on the soil that is on the floor. Soil and excreta are then pushed down the drop hole together with urine. The decomposed excreta are removed in the spring and again at the end of summer and are spread on the fields.

The design is based on traditional indigenous systems and is truly sustainable in that precious water supplies are not wasted, soil for crops is improved, and nothing is lost or wasted. In Leh, where trends toward modern development have led to the introduction of water-supported toilet systems, this model shows a way to solve future problems by looking at traditional systems from the past.

Source: Deutsche Gesellshcart fuer Technicshe Zusammanarbeit (GTZ). 2006. *Data sheets for Ecosan projects 031: Improved Traditional Ladakhi Composting Toilet.* Leh, India.

6.3 Solid Waste Management

One of the most common issues after a disaster is the build-up of debris and solid waste. Solid waste comes from a variety of sources in the period following a disaster. Immediately following the disaster event, solid waste is composed of destroyed and damaged infrastructure, downed vegetation, and other sources. During the recovery and reconstruction phases, the construction of temporary, transitional, and permanent housing and other infrastructure generates construction waste. In the long-term, the occupation of newly constructed buildings leads to the generation of household and commercial waste. All of these types of solid waste must be managed properly with consideration given to reuse, recycling and disposal.

The Sphere Minimum Standards in Humanitarian Aid require that people have an environment that is acceptably uncontaminated by solid waste, including medical waste and have the means to dispose of domestic waste conveniently and effectively. People should be able to dispose of solid waste in a means that does not further degrade the environment.[19]

In all post-disaster recovery and reconstruction activities, it is advisable to create a waste management plan if one does not already exist. The plan should include disposal site locations identified in consultation with

19 The Sphere Project. 2004. *Minimum Standards in Water Supply, Sanitation and Hygiene Promotion.* Sphere Handbook. Geneva: Oxfam Publishing.

local authorities, including the ministries of the environment. Disposal sites should avoid contamination of water sources and degradation of natural resources, such as fisheries, agricultural land, and wetlands. Land for housing and livelihoods production should be avoided when locating disposal sites and/or protected from any negative impacts such as leachate. Burning waste should also be avoided where possible to minimize potential health impacts. Toxic and hazardous wastes, such as medical waste, should be separated from domestic waste and disposed of in an appropriate manner in consultation with solid waste management experts. More information on solid waste management in emergencies is contained in Annex 2. In addition *The Handbook on the Safe Management of Wastes from Health-Care Activities* recommends safe, sustainable, affordable and culturally acceptable methods for the treatment and disposal of health-care waste.[20]

6.3.1 Home Composting and Gardening

One of the easiest ways to dispose of solid waste, increase food security, and decrease a community's carbon footprint is to compost. Compostable waste like food scraps and yard trimmings makes up 30% of waste that regularly ends up in landfills around the world.

Compost is one of nature's best mulches and soil amendments. It can be made at virtually no cost. Compost improves soil structure, texture, and aeration, and increases the soil's water-holding capacity. Compost loosens clay soils and helps sandy soils retain water. Adding compost improves soil fertility and stimulates healthy root development in plants. The organic matter provided in compost provides food for microorganisms, which keep the soil in a healthy, balanced condition.

Almost any organic plant material is suitable for a compost pile. The pile needs a proper ratio of carbon-rich materials, or "browns," and nitrogen-rich materials, or "greens." Among acceptable brown materials are dried leaves, straw, and wood chips. Nitrogen materials are fresh or green, such as grass clippings and kitchen scraps. Mixing certain types of materials or changing the proportions can make a difference in the rate of decomposition. The ideal ratio approaches 25 parts browns to one part greens. Too much carbon will cause the pile to break down too slowly, while too much nitrogen can cause odor. The carbon provides energy for the microbes, and the nitrogen is used for protein building. This ratio can be achieved by combining 1/3 rehydrated dry vegetation, 1/3 green vegetation (including kitchen waste), and 1/3 soil, by weight.

The ground beneath the pile should be loosened to a depth of 12 inches to provide good drainage. The minimum size of a pile is 1 cubic yard/meter (3 feet by 3 feet by 3 feet). Compost materials should ideally be added to the pile in 1 to 2-inch (2- to 5-cm) layers, with dry vegetation on the bottom, kitchen waste and green vegetation second, and a thin layer of soil third. Compost piles may be built in a pit in the ground or in a pile above the ground. The latter is preferable, as heavy rains may fill a pit quickly. A pile may be made with or without a container.

Containers shape a pile, keep it neat, and provide some protection. An inexpensive container can be made of 1m-wide chicken wire (4m long) and 2cm by 5cm boards. The boards are nailed along the ends of the chicken wire and at 1m intervals, and secured together with hooks and eyes. The unit is placed as a circle on the ground and compost material is placed inside. Other containers can be made from wooden pallets (four used as sides and top covered with plastic), wooden planks (made into a box), or larger wire fabric.[21]

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20 World Health Organization. Healthcare waste and its safe management. www.healthcarewaste.org/ (Accessed on June 8, 2010)

21 Based on: FAO. Home Garden Technology Leaflet 6: Special Techniques for Improving Soil and Water Management. www.fao.org/docrep/003/X3996E/x3996e30.htm (Accessed on April 7, 2010)

Alternatively, live fencing can be used to build the containers. Live fences can be divided into two basic categories; live fence posts and live barriers or hedges. Live fence posts are widely spaced, single lines of woody plants that are regularly pruned back and used instead of metal or wooden posts for supporting barbed wire, bamboo, or other materials. Hedges are thicker, more densely spaced fences that generally include a number of different species and usually do not support other fencing materials. The primary purpose of a live fence is to control the movement of animals and people; such fences have proven to be extremely diverse, low-risk systems that provide farmers with numerous benefits. Besides their main function, living fences can provide fuelwood, fodder, and food, and can act as windbreaks and enrich the soil, depending on the species used.

A "backdoor" approach to waste composting and separation can be introduced through the promotion of home gardening within the community. Training on organic home gardening techniques can complement training on composting and solid waste management. During training sessions, participants can receive material inputs of seeds, plants, and starter compost. They are then able to immediately enjoy the benefits of composting and pesticide-free vegetables in their home gardens. This in turn helps improve nutrition and increase food security and household savings. While making compost, the households can also be encouraged to separate recyclables, and recycling business networks can be developed to collect the recyclables from the villages. Waste minimization through "reduce, reuse, and recycle" can also be promoted through community campaigns.

A "backdoor" approach to waste composting can be introduced through the promotion of home gardening. Compost from household waste can be used as fertilizer and help to support food security. © Achala Navaratne/WWF

6.3.2 Biogas

Other waste treatment technologies include biogas production using human and animal feces; recycling of construction debris; recycling of PET plastic water bottles; and condominium septic systems. Biogas refers to gas produced by organic matter breaking down in the absence of oxygen. One type of biogas is produced by the fermentation of biodegradable materials such as manure or sewage, municipal waste, and green waste. This type of biogas comprises primarily methane and carbon dioxide. Biogas can be used as a low-cost fuel for heating and cooking. It can also be used to run any type of heat engine and to generate either mechanical or electrical power. Biogas can be compressed, much like natural gas, and is a renewable fuel.

BIOGAS IN NEPAL

"One fine day I told my husband that I wasn't going to risk my life by collecting wood from the forest anymore and that we were going to get a biogas stove, even if we had to take a loan," says Jari Maya Tamang, 41, as she stands proudly next to the first biogas plant in her village.

Jari Maya took a microcredit loan and became the first to install a toilet-attached biogas plant in Badreni, a small village on the edge of Chitwan National Park in Nepal's Terai. Today, 80% of the 82 households in Badreni have toilet-attached biogas plants with support from the WWF. The Terai has a dense population, high biodiversity, and fragile ecosystems. Deforestation is a major issue. Firewood is relied on for cooking by 61% of all households in the Terai, and 49% of households source their wood from nearby government-managed forests. A typical family uses an average of 1.3kg–2.5kg of wood every day, and evidence suggests that this is not sustainable. Given the population of more than 6.7 million in the Nepal Terai, the problem of deforestation will become acute without environmentally sound interventions.

There are also increasing incidents of human-wildlife conflict as animals raid agricultural crops and livestock, and more people, especially women, are likely to be attacked in the wild.

Alternate waste management and energy promotion is an important strategy for dealing with farm and household solid waste, reducing pressure on the forests, and improving local livelihoods in the Terai. In Nepal, the locally designed and developed fixed-dome biogas plant is popular. This model is considered to be reliable, well functioning, and simple. It has low maintenance cost and a durable design.

In Nepal, one medium-sized biogas plant (the most popular one) costs around US$500. Biogas technology is still out of reach for the majority of people in the region who are poor; however, local NGOs have funded microfinance schemes through grassroots partners like Community Forest User Groups. This arrangement had made it easier for the poor and disadvantaged communities to easily access loans at lower interest rates in order to construct the biogas plants. The household latrine is situated by design to feed the biogas plant, which is also fed by barnyard wastes.

Source: Gurung, T. 2007. BIOGAS, Saving Nature Naturally. *WWF Ecocircular Newsletter 42:1-3.*

© WWF-Canon/Michel Gunther

7 RELATED INTERNATIONAL STANDARDS

The environmentally sustainable water and sanitation technologies presented in this module are integral to achieving international standards related to water supply and waste management agreed upon by humanitarian organizations. Meeting the standards discussed in this section requires the appropriate use of these technologies.

7.1 Sphere Standards

The Sphere Project was launched in 1997 by a group of humanitarian NGOs and the Red Cross and Red Crescent movement. Sphere is based on two core beliefs: first, that all possible steps should be taken to alleviate human suffering arising out of calamity and conflict; and second, that those affected by disaster have a right to life with dignity and therefore a right to assistance. Sphere is three things: a handbook, a broad process of collaboration, and an expression of commitment to quality and accountability. The project has developed several tools, the handbook in particular.

With respect to Water and Sanitation and environmental sustainability, Sphere has a key indicator for Water Supply Standard 1 (Access and Water Quantity) that specifies that "Water sources and systems are maintained such that appropriate quantities of water are available consistently or on a regular basis." The guidance note for Standard 1 also specifies "All sources need to be regularly monitored to avoid overexploitation." Similarly, Water Supply Standard 2 (Water Quality) has a key indicator: "People drink water from a *protected* or treated source in preference to other readily available water sources."[22]

7.2 UN Millennium Development Goals (MDGs)

UN MDGs address the issues of environmental sustainability and water and sanitation in Goal 7: Ensure Environmental Sustainability. This goal identifies four targets together with the following key interventions. The integration of water and sanitation interventions with environmental sustainability can help project planners achieve several of these targets:

Target 1: Integrate the principles of sustainable development into country policies and programs, and reverse the loss of environmental resources.

- Immediate action is needed to contain rising greenhouse gas emissions.
- Success in limiting ozone-depleting substances helps to mitigate climate change.

Target 2: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss.

- Marine areas and land conservation need greater attention.
- Deforestation slows and more forests are designated for biodiversity conservation.
- The number of species threatened with extinction require greater protection measures.
- Fish stocks require improved fisheries management to reduce depletion.

22 The Sphere Project. 2004. *Minimum Standards in Water Supply, Sanitation and Hygeine Promotion.* Sphere Handbook. Geneva: Oxfam Publishing.

Target 3: Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation.

- Almost half of the world's population faces a scarcity of water.
- More people are using improved sanitation facilities, but meeting the target will require a redoubling of efforts.
- In developing regions, nearly one in four people use no form of sanitation.
- Though access to improved drinking water has expanded, nearly one billion people do without.
- Women shoulder the largest burden of water collection.

7.3 World Summit on Sustainable Development

The World Summit on Sustainable Development, held in Johannesburg in 2002, brought together tens of thousands of participants, including heads of State and Government, leaders of non-governmental organizations, community members, and business to focus on ways to improve people's lives and conserve natural resources. The Plan of Implementation for Sustainable Development, Section IV, includes the formulation of national plans for IWRM and for water use efficiency. Section IV deals with protecting and managing the natural resource base of economic and social development, and addresses the essential need to manage the natural resource base in a sustainable and integrated manner. In this regard, the Plan deemed necessary the implementation of strategies at the national and, where appropriate, regional levels to protect ecosystems and to achieve integrated management of land, water, and living resources while strengthening regional, national, and local capacities. Because post-disaster recovery supports sustainable development, humanitarian staff should take steps to promote IWRM and water use efficiency.

ANNEX 1: ADDITIONAL RESOURCES

The following organizations and publications provide a variety of tools, resources, and information that elaborate on the concepts presented in this module.

Organizations

The following agencies can provide technical expertise on how to ensure that water and sanitation projects worldwide are environmentally sustainable, as well as direct financial and physical humanitarian support on the ground after disasters occur. Each of the agencies contributes to the development and research of practical and effective water and sanitation technologies and/or projects. Water and sanitation specialists, hygiene specialists, and governmental officials can greatly benefit from the publications produced and disseminated by these agencies.

International Water Management Institute (IWMI): IWMI is one of 15 international research centers supported by a network of 60 governments, private foundations, and international and regional organizations collectively known as the Consultative Group on International Agricultural Research (CGIAR). IWMI's mission is to improve the management of land and water resources for food, livelihoods, and nature. IWMI targets water and land management challenges faced by poor communities in developing countries, and through this contributes to the achievement of the UN Millennium Development Goals (MDGs) of reducing poverty and hunger and maintaining a sustainable environment.

Research is the core activity of IWMI. The research agenda is organized around four priority themes: Water Availability and Access; Productive Water Use; Water Quality, Health, and Environment; and Water and Society. Cross-cutting activities in all themes include assessment of land and water productivity and their relationship to poverty; identification of interventions that improve productivity as well as access to and sustainability of natural resources; and assessment of the impacts of interventions on productivity, livelihoods, health, and environmental sustainability. *www.iwmi.cgiar.org*

Deutsche Gesellschart fuer Technicshe Zusammanarbeit (GTZ) Ecosan Program: The concept behind ecological sanitation (ecosan) is that sanitation problems could be solved more sustainably and efficiently if the resources contained in excreta and wastewater are recovered and used rather than discharged into the surrounding environment, including water bodies. Ideally, ecosan systems help preserve soil fertility, safeguard long-term food security, and minimize the consumption and pollution of water resources. Contact GTZ for more information on this concept and how it may be applied to differing situations. *www.gtz.de/en/themen/umwelt-infrastruktur/wasser/8524.htm*

Water, Engineering, and Development Centre (WEDC): WEDC is one of the world's leading education, training, research, and consultancy institutes concerned with improving access to infrastructure services for the poor in low- and middle-income countries. Founded in 1971, WEDC is part of the Department of Civil and Building Engineering at Loughborough University. WEDC is a highly regarded organization providing time-tested, quality information on water technologies in developing countries. *wedc.lboro.ac.uk*

International Water Association (IWA): IWA comprises leading water professionals in science, research, technology, and practice. IWA has its roots in two strong associations: the International Water Supply Association (IWSA) and the International Water Quality Association (IWQA). IWSA was established in 1947 while IAWQ was originally formed as the International Association for Water Pollution Research in 1965. IWSA and IAWQ came together in a merger in 1999 to form IWA. There are 10,000 individual and 400 corporate members, spread across 130 countries. IWA runs a series of events, projects, and interest and specialist groups, helping members to share views, enhance knowledge, and contribute to water development worldwide.

IWA's mission is to create and foster a global network of leading-edge water professionals through the provision of services and products to members, including conferences, publications, and support for member groups. In addition, IWA represents the views of members in international forums and projects key messages to the sector at large to advance best practice in sustainable water management. *www.iwahq.org*

Global Water Partnership (GWP): The Global Water Partnership's vision is for a water-secure world. GWP was founded in 1996 by the World Bank, the United Nations Development Programme (UNDP), and the Swedish International Development Agency (SIDA). Its aim is to foster integrated water resource management (IWRM) and to ensure the coordinated development and management of water, land, and related resources by maximizing economic and social welfare without compromising the sustainability of vital environmental systems. During the past 12 years, the GWP Network has become active in 13 regions and over 70 countries. *www.gwpforum.org/servlet/PSP*

Publications

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Cap-Net. Integrated Water Resources Management Tutorial. www.archive.cap-net.org/iwrm_tutorial/mainmenu.htm (Accessed on March 31, 2010)

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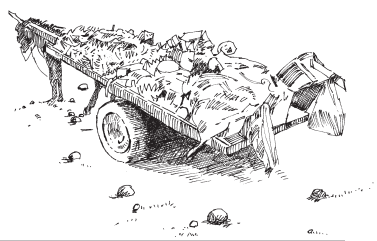
Solid waste management
in emergencies



World Health Organization

This technical note outlines some of the key activities in dealing with solid waste in the immediate aftermath of a disaster. Solid waste refers here to all non-liquid wastes (e.g. rubbish or garbage). Sometimes solid waste may contain faeces. Solid waste can create significant health problems and a very unpleasant living environment if not disposed of safely and appropriately. It can provide breeding sites for insects and vermin (e.g. rats) which increase the likelihood of disease transmission, and can attract snakes and other pests. Unmanaged waste can also pollute water sources and the environment.

The process of planning solid waste management in an emergency is illustrated in Figure 1.

Initial assessment

The first stage in dealing with solid waste is to understand the emergency context and the nature of waste being generated. The following sections outline key questions for consideration.

The context

- What solid waste management systems/ equipment is already in place? How has it been affected? Is it possible to work with and learn from the existing systems?
- How many people are affected? Where are they? What are they doing with waste at present? Are there any pertinent cultural factors?

> **Waste generation, density and sources**
>
> Waste is produced by households, shops, markets, businesses, medical centres and distribution points.
>
> Generation rates vary considerably according to seasons, diets (e.g. changes from fresh vegetable to packaged aid goods) and even the day of the week. An average of around 0.5kg/ capita/ day is common in low-income cities.
>
> Waste densities also vary considerably. Densities for low-income cities are usually around 200-400 kg/m^3.
>
> Where lots of packaging is used in emergency situations, densities are likely to decrease.

- What opportunities or restrictions does the environment present? Is it possible to dig pits? Where are surface water sources located? At what level does the water table like? Where is land available?

The waste

- What waste is being generated (e.g. organic, hazardous, dry etc.)?
- Where is waste being generated? How accessible are waste generators?
- How much waste is being generated?

Please note: Medical and hazardous wastes are not discussed in this technical note.

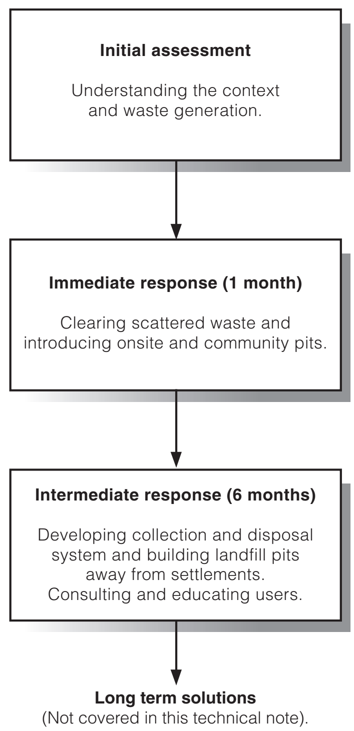


Figure 1. The process of planning solid waste management in an emergency

Solid waste management

Immediate response

Activities should be prioritised according to present and future health hazards of different waste types and sources. Activities are likely to focus on clearing of existing scattered waste and managing waste from households and markets.

On-site household disposal

Suitable where space is not too limited and where waste has a high organic content (as it will decompose and reduce in volume). Also useful in areas where access is difficult.

Pits should be 1m deep and be frequently covered with ash/soil to prevent access to waste by insects and rats, and to reduce odours.

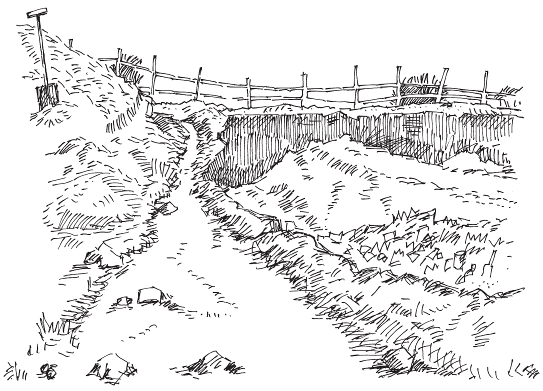
Note that on-site disposal is labour-intensive and requires advanced household cooperation.

Community pits

Must be located within 100m walking distance of any household (SPHERE Guidelines).

As a rough guide guide, 50 people will fill 1m^3 of a pit each month, depending on generation rates and density.

These are rapid to implement and requires little operation and maintenance. Note that some people may object to walking 100m to deposit waste.

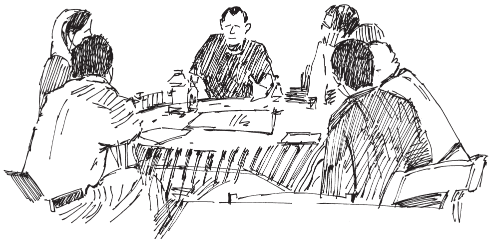


Intermediate solutions

Community issues

Consultation. It is useful and important to consult potential users of a waste management system before and during design and implementation.

Education. It is important for participating communities to understand how good solid waste management can be achieved and can benefit their health.

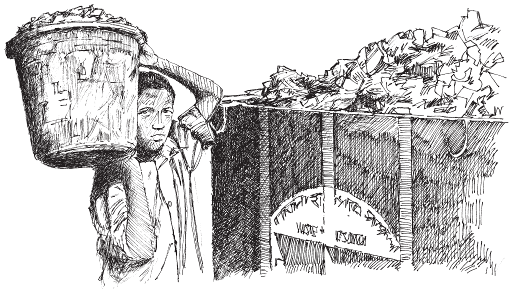


Collection and storage

In some situations on-site, community pits may be a suitable medium-term solution, whilst in others it will be necessary to devise ways of removing and disposing of waste. This will usually involve the following:

- storage in the house;
- deposition at intermediate storage point; and
- collection and transport to final disposal.

In the home, plastic bags or a small container with a lid make suitable storage containers.



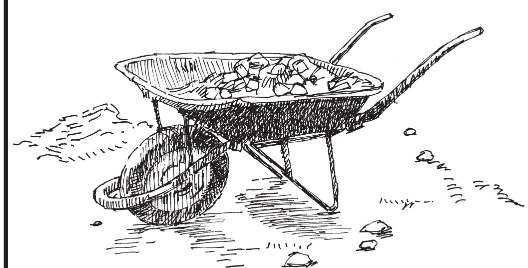
For intermediate storage points in communal areas bins of maximum 100 litre capacity are required (when full this will weigh around 40kg). Oil drums cut in half can be suitable. Ideally the bin will be arranged so that it can be emptied easily (e.g. hinged so it can tip into a handcart). A 100 litre bin is required for each 50 people or for a few market stalls. Bins require daily emptying, and this is labour-intensive.

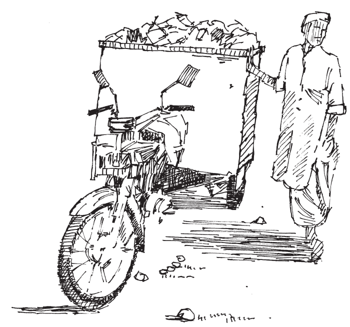
Transport

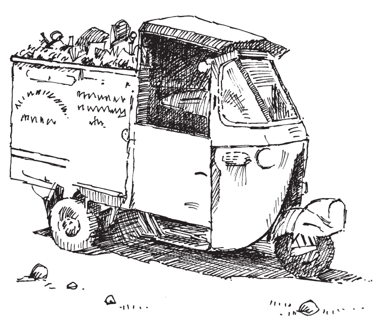
When selecting suitable vehicles, waste generation rates and densities need to be considered along with:

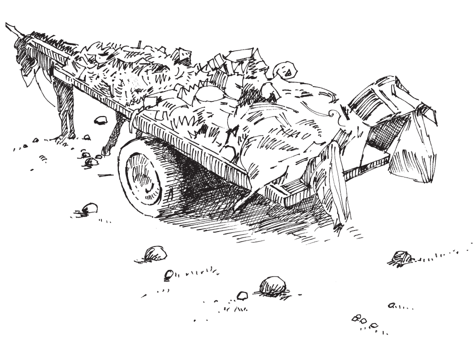
- areas they need to access (e.g. narrow alleys or uneven paths); and
- distance between collection and disposal points.

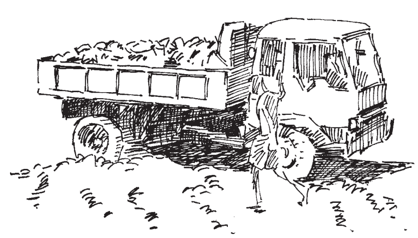
For example, a wheelbarrow could collect waste from approximately 50 individuals before requiring emptying.











Solid waste management

Disposal
As a medium-term solution, larger-scale landfill pits can be constructed. Without leachate (liquid runoff) treatment these are not suitable for long-term use. They should be situated at least1km downwind of settlements, at a location selected in consultation with the population. They should also be situated downhill of water sources and at least 50m from surface water sources. Carefully consider drainage where the pit is on sloping ground and erect fences to keep animals and scavengers out.

Staff
Approximately 2.5 workers are required for 1000 community members (WHO/ UNEP 1991). Protective clothing and equipment need to be considered (e.g. gloves, boots, visibility jackets).

Other important factors

Incineration
Incineration is not usually a favourable option for solid waste management as it requires a large capital input and care for operation and management to ensure non-polluting bone. Where burning is deemed necessary (e.g. to reduce waste volume), it must be done at least 1km downwind of settlements, and ashes should be covered with soil daily. On-site burning of household waste can be highly-polluting and can be a fire hazard.

Care of equipment
Waste can often be corrosive, so it is important to paint all metal waste management equipment and to wash it frequently. Such activity can significantly increased the life of equipment.

Emergency response waste
Packaging of emergency response provisions (e.g. food, water, medicine, shelter) can produce serious waste problems. Consider this in procurement and where possible manage packaging waste at point of distribution to prevent its widespread scattering.

Recycling and composting
In time it may be possible to work with local recycling industries to encourage entrepreneurs or waste collectors to gather recyclable items. This can provide a source of income as well as reducing the amount of waste requiring disposal. Home composting can also be an effective means by which to reduce the volume of waste requiring collection and disposal.

Management and implementation
It is important to consider management structures and implementation methods. At times in emergency situations, particularly early on, activities may have to be strongly enforced until more participating systems can be introduced.

Continuously review, monitor and response to the nature of waste, pervading conditions and levels of community participation.

Long-term waste management
In the long-term, capacity of landfill sites need to be increased, leachate needs to be contained and treated and the overall sustainability of waste management practices must be considered. Long-term solutions are beyond the scope of this technical note.

Further information

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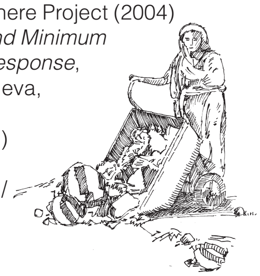

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GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas*. Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source: World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future*. Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

8 GREEN GUIDE TO

LIVELIHOODS

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

8

GREEN

GUIDE TO

LIVELIHOODS

Anita van Breda, World Wildlife Fund

Charles Dufresne, InterWorks, LLC

Aaron McNevin, World Wildlife Fund

A NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster recovery and reconstruction approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on integrating environmentally sustainable approaches into livelihoods projects.

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MODULE 8: GREEN GUIDE TO LIVELIHOODS

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1 INTRODUCTION

1.1 Module Objectives

The module provides information and references to help participants identify environmental issues associated with post-disaster livelihoods recovery projects. This module also provides participants with an overview of environmental management techniques designed to reduce environmental impacts and improve livelihood outcomes for people and communities recovering from disaster.

Specific learning objectives for this module are as follows:

1. Explain how livelihoods, disaster recovery, risk reduction, and ecosystems are linked.
2. Identify the recurring environmental impacts of typical livelihoods interventions.
3. Understand and address solutions for sector-specific livelihoods challenges, and be able to identify sources of expertise to improve livelihoods project outcomes.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 8 in a series of 10 modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment and taking opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction and how it helps make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

The module workshop is designed for program staff planning and implementing livelihoods recovery projects with post-disaster or conflict-affected populations and communities. The range of livelihoods recovery projects is expected to be broad and varied and not simply limited to rural agriculture, aquaculture, or fishing projects. Workshop participants will include a mix of program and project officers from humanitarian, development, and environmental organizations. The target audience is emergency recovery managers who may implement cash-for-work programs, cash grants, and other early-recovery livelihoods programs, as well as, project planners involved in longer-term livelihoods recovery projects.

1.4 Module Key Concepts

This module builds on three key concepts:

1. Livelihoods planners should incorporate a conceptual livelihood framework that includes the environment as an asset in their programs and projects.
2. Project planners can use several existing assessment methods and tools to evaluate and address the environmental impacts of a livelihoods project. The Environmental Stewardship Review for Humanitarian Aid is one such tool.
3. It is crucial to ensure that a variety of different stakeholders (e.g., government officials, donors, partners, and affected populations) understand the environmental linkage to the project's benefits and support the project's intended outcomes.

1.5 Module Assumptions

This training module assumes that participants are generally familiar with the needs arising from various post-disaster and post-conflict contexts (e.g., earthquakes, floods, hurricanes, violent civil conflicts) and with community-based livelihoods-planning approaches. This is not a "how to manual" for livelihoods. The focus of the module is on ways to address *environmental issues* relative to livelihoods projects in a post-disaster or post-conflict recovery and reconstruction setting. Given the diversity of potential livelihoods activities, it is not possible to provide detailed technical solutions to address the environmental impacts of every type of livelihoods project. The module will support project planners in "how to think" instead of "what to think," because no two disaster recovery scenarios are the same. This module is intended to provide sufficient information for program managers to identify some typical issues and solutions, obtain more information, and gain an understanding of when additional technical expertise may be required.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry.

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits.

Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.

A livelihood comprises the capabilities, assets, and activities required for a means of living. Livelihoods can exist on multiple scales from a local, artisanal fishery to a multi-national corporation. In this picture, a woman waters pepper plants in her home garden in southern Sri Lanka which she will later sell at a community market in support of her livelihood. © American Red Cross/Daniel Cima

2 PROJECT CYCLE AND SUSTAINABLE LIVELIHOODS

In planning and carrying out disaster response activities, many humanitarian agencies follow a standard project management cycle, as shown in Figure 1.

The project manager should consider the environmental implications and opportunities related to sustainable livelihoods at the earliest stages of project planning, and continue throughout the project design process as shown in Figure 2. The majority of the technical content in this training module falls under Step 3 (Project Design) and Step 4 (Implementation).

FIGURE 1: STANDARD PROJECT MANAGEMENT CYCLE

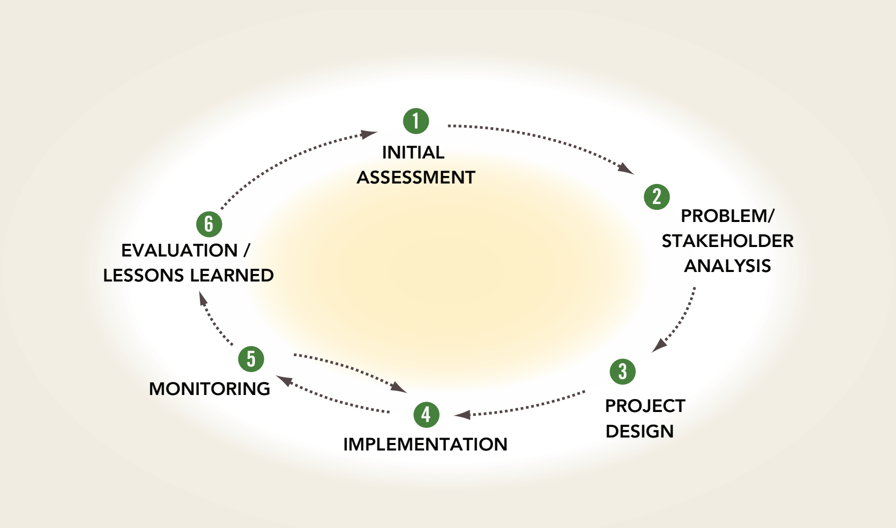
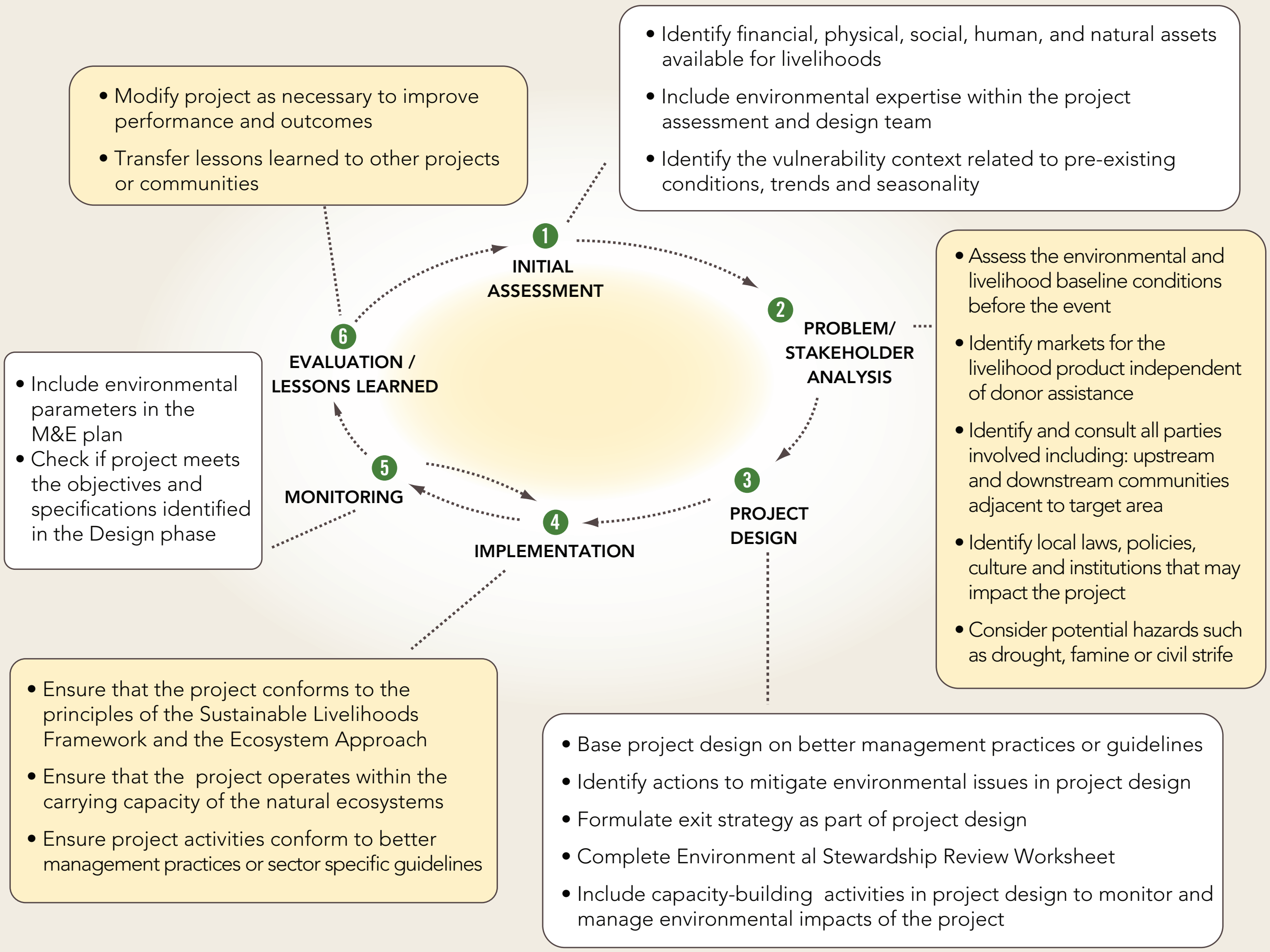


FIGURE 2: PROJECT MANAGEMENT CYCLE FOR LIVELIHOODS AND ENVIRONMENTAL CONSIDERATIONS



2.1 Initial Assessments

At the initial assessment stage, it is crucial for livelihoods project planners to understand the range of livelihoods activities that are practiced by the disaster-affected communities and to what extent these livelihood activities are dependent on natural resources. Module 3, Green Guide to Environmental Impact Assessment Tools and Techniques, contains information on specific assessment tools that can be used at the initial assessment stage. One such tool is the Rapid Environmental Impact Assessment Guidelines, which provide guidance on how to identify, define, and prioritize potential environmental impacts in disaster situations and improve linkages between sustainable environmental management and disaster response.[1]

If livelihoods are closely linked to natural resources (e.g., people are fishermen or farmers versus shopkeepers), than it is important to assess the baseline for the natural resources. The baseline is essentially the starting point from which to measure change. For example, if a community reported catching an average of 6.2 tons per

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1 Kelly, Charles. 2005. *Guidelines for Rapid Environmental Impact Assessment in Disasters (REA)*. Version 4.5. London: CARE International and Benfield Hazard Research Center.

year of a certain species of fish between the period 2000 and 2008 and only 4.3 tons of fish in 2009, it can be said that the 2009 catch is lower than the average for the baseline period. When evaluating the baseline for a natural resource, it is useful to be aware of the "shifting baseline syndrome."[2]

When reestablishing livelihoods, consideration should be given to preexisting conditions. Livelihoods project planners should consult local government agencies, research institutions, and communities about historical levels of natural resources, to see if there has been a trend of declining resources over time that need to be taken into account during project designs. Project planners conducting initial assessments may want to consider the inclusion of environmental specialists in their assessment teams.

2.2 Problem/Stakeholder Analysis

During this phase, it is important to understand the local environment and work with local experts in order to further understand the range of traditional livelihood activities practiced and their environmental impacts. The problem analysis should include consideration of whether the natural resource base that supports these livelihoods activities is sufficient to continue activities into the future. At this stage, consideration should also be given to the evaluation of regional-level donor or national government-driven initiatives outside of the immediate project area that may be putting an added strain on the natural resources that support livelihood activities. If the natural resources base is at risk of being overexploited or is already in decline, project planners should consider alternative livelihoods activities that will place less pressure on resources, or ways to ensure that project activities strengthen the natural resource base (e.g., a timber-harvesting project that includes a replanting and conservation component).

Stakeholder analysis should include consideration of how to build back the local human capacity to manage natural resources and minimize environmental impacts. At the project design stage, this may include investment in the development of formal and informal institutions at the local level (e.g., fisheries cooperatives or local government agricultural extension officers).

Additionally, the stakeholder analysis should explore ways to equitably share the natural resource capital assets, with particular attention paid to the poorest and most disadvantaged groups and to women, to make sure their needs are met. The analysis should also consider that men and women use and/or have access to different resources. For example, women are often responsible for firewood and wild food plant collection and men often undertake hunting and logging. Both men and women may fish, but they often catch different fish species in different places with different techniques.

Project planners should inquire within communities about traditional natural resource management practices that guard against overuse, and these should be taken into account. Livelihoods activities should reinforce these preexisting natural resource management practices and the local institutions that promote them.

2 The shifting baseline syndrome occurs when each generation of evaluators accepts as a baseline the stock size and species composition that occurred at the beginning of their careers, and uses this to evaluate changes. So an evaluator who starts his or her career in 1985 might set the baseline at the 1980s levels, whereas the evaluator who starts a career in the 2000s might set the baseline at the 2000 levels. The problem with this gradual shift of the baseline is that it can lead to the gradual acceptance of the slow disappearance of species that form the basis of natural capital assets.

2.3 Project Design

The design phase is where livelihood project planners can play a critical role in addressing the potential environmental implications of livelihood project activities. The project design should reflect the information gathered during the assessment phase in terms of the quantity of resources that will be used to implement and maintain the livelihood activity. For example, if the project is for an agriculture-based activity, the project design should include consideration of the amounts of fertilizer, seeds, and pesticides that might be used during project implementation. The project design should be adjusted to minimize the environmental impacts accordingly (e.g., promotion of organic fertilizer or local seed stock). Project designers should also make sure that the activities do not result in unintentional overextraction of the natural resources (e.g., oversupply of boats for fishermen or supplying nets that are so large they result in harvesting of the fishery resource beyond the natural capacity).

Additional guidance is provided in Section 5, Guidance for Project Planners.

2.4 Implementation

During the implementation phase, project managers for livelihoods projects can make sure that better management practices are being followed by training their staff on the techniques. If inputs are required for the livelihoods project, such as timber for constructing markets or seed stock for agriculture, the project manager should ensure that the materials are sustainable (e.g., use sustainable timber or local noninvasive species for agriculture plants). Note: Better management practices (BMPs) are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing commodities on the planet's water, air, soil, and biological diversity. They can also help producers make a profit in an environmentally sustainable way. BMPs have been developed for a wide range of activities such as fishing, farming, and forestry. Additional information on BMPs is contained in Section 5.

2.5 Monitoring and Evaluation

During the monitoring and evaluation phase, project planners can monitor the project for unanticipated environmental impacts and implement ways to correct them. For example, if farmers are using chemical fertilizers, then the project managers should consider alternative techniques with less environmental impact (e.g., organic fertilizer or use of fewer chemical fertilizers with the same benefit). Additionally, the rates of use of inputs should be monitored so that they do not exceed the original project design, and do not result in the waste of both natural resources and money (e.g., overfertilizing, catching more bait fish than necessary for fisheries projects). The communities in the immediate vicinity of the project area should also be monitored so the project does not have unintended consequences, such as fishing in one community adversely impacting another community's livelihood activities.

2.6 Project Completion and Exit Strategy

Subsidizing livelihood generation through capital inputs or capacity building is common and undoubtedly necessary in many disaster recovery instances; however, if the subsidies or capacity building are required to support the livelihood, then there is the potential for the livelihood to collapse once the external support is no longer available. If the livelihood collapses once the project is completed or the external agency departs, the livelihood project will have wasted time, financial resources, community effort, and natural resource capital assets that could have been put to better use.

It is critical therefore that exit strategies be planned during the development of the project so that the initial investment in terms of time, funds, and natural resources extracted or utilized **does not go to waste and the livelihoods activities continue after the withdrawal of the assistance agency.**

As illustrated by the disaster to development continuum in Section 3, the goal of recovery and reconstruction is to move to sustainable development that in turn supports disaster resilience and risk reduction. Exit strategies will likely be modified as projects progress. Key tenets of a sufficient exit strategy include the following:

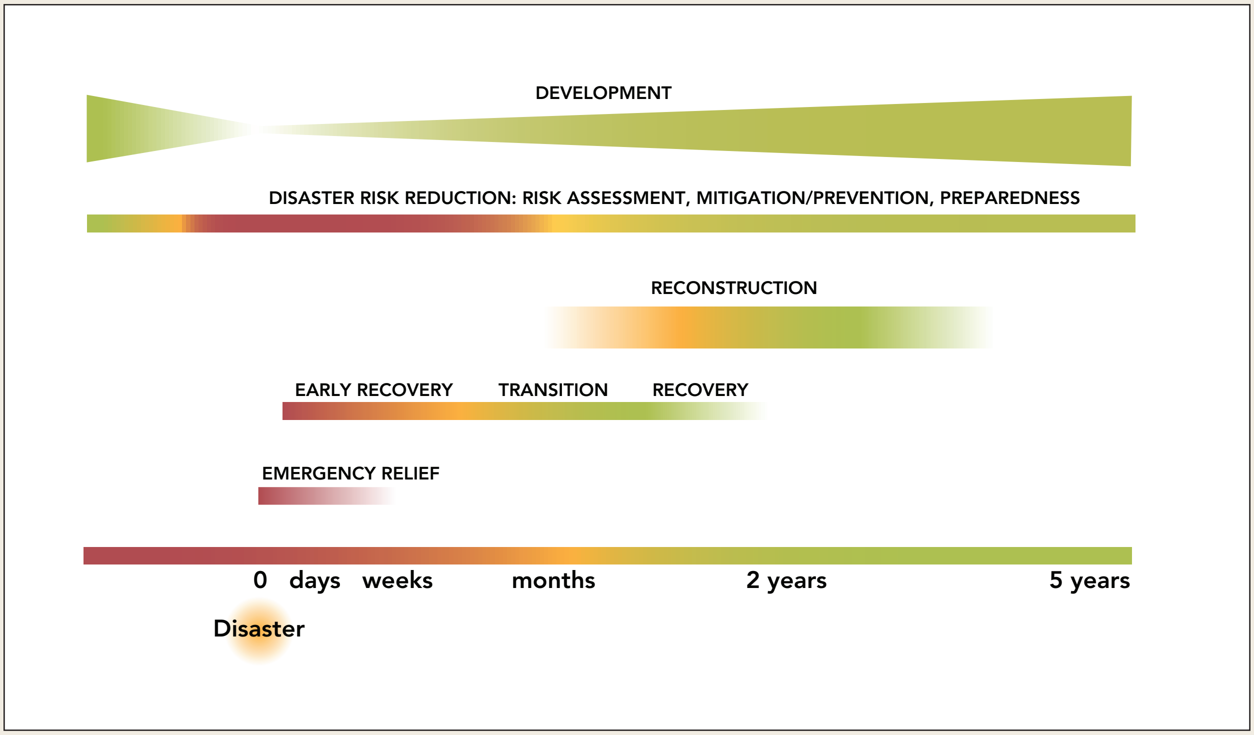
- ❑ Organizational, community-level, or government monitoring, evaluation, and controls are established to prevent overuse of primary resources.
- ❑ If products are produced or skills were taught, there is a market for these products and skills that will be present for the foreseeable future.
- ❑ The communities receiving livelihood project assistance are themselves contributing, and are aware of and understand the inevitability of the sponsoring organization's departure.
- ❑ The communities receiving livelihood project assistance agree to attempt the facilitated livelihood following this departure.
- ❑ The communities have sufficient capacity and adequate internal governance processes to continue the livelihood activity in an equitable manner.
- ❑ Contracts and agreements with communities are fulfilled.

3 LIVELIHOODS, DISASTERS, AND THE ENVIRONMENT

Disasters can cause many adverse ecological effects. Earthquakes can result in fires, landslides, and the release of toxic chemicals into the environment. Oil spills and leaks can destroy fisheries and tourism livelihoods (e.g., Exxon Valdez in Alaska in 1989, the 2001 Galapagos oil spill, and British Petroleum in the Gulf of Mexico in 2010). Flooding caused by hurricanes and tsunamis may destroy vegetation and salinize soils, making them unfit for agriculture, and can pollute ground and surface water with garbage, debris, and toxic chemicals carried in wave surges.[3] Marine and coastal environments, including coral reefs (nursery grounds for fisheries and tourism points of interest), may also be damaged as waves recede and carry sediment and debris back into the ocean after hurricanes or tsunamis. Landslides, mainly in the hills and mountains, expose infertile soils and may reduce the productivity of agricultural or forest lands. Moreover, landslide debris that gets carried down by flash floods such as those that occur in Nepal, India, and Bangladesh destroy productive lands with sedimentation.

One disaster, therefore, can wipe out development (including infrastructure and livelihoods) that may have taken generations to build. Although there are differences between humanitarian and development activities, it is clear that disaster preparedness, recovery, and reconstruction are all links in the disaster-to-development continuum. A simplified version of this continuum is shown below.

FIGURE 3: DISASTER TIME LINE



3 Srinivas, Hari. Cyclical Interlinkages of Disasters and the Environment. GDRC. www.gdrc.org/uem/disasters/disenvi/cyclical.html (Accessed on April 13, 2010)

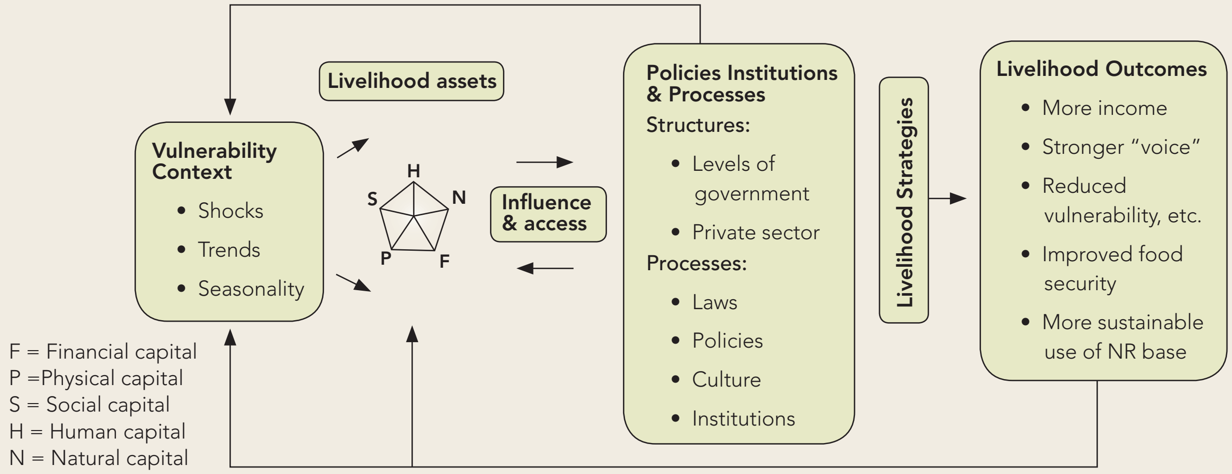
Humans depend on ecosystems to alleviate the effects of disasters and to provide resources for their livelihoods. There are therefore strong and critical links between disasters, livelihoods, and ecosystems. In many regions of the world, people are vulnerable to disasters as a result of poverty, disputes over natural resources, and the hazard-prone areas that they inhabit. For example, certain communities can be marginalized to high-risk regions that could be susceptible to the impacts of floods or landslides. Violent conflict can result from various groups' limited or disputed access to natural resources on which their livelihoods depend. In addition, climate change may lead to displacement and/or migration, creating "climate refugees." Therefore, livelihood recovery projects should be designed to restore, manage, and have limited impact on the environment.

In natural disasters, people with a greater asset base are often less vulnerable and able to recover more quickly. Emergencies have varying impacts on assets, which may be lost, destroyed, or sold. In complex emergencies, people's assets themselves can be transformed into life-threatening liabilities as other groups try to gain control over these assets.

In order to reduce future risk and vulnerabilities, organizations can integrate an ecologically sound approach in livelihoods recovery to support sustainable development, which in turn supports disaster preparedness and disaster risk reduction.

The importance of integrating the environment into the planning of livelihoods activities is underscored by the Sustainable Livelihoods (SL) Framework developed by the United Kingdom's Department for International Development (DFID). While the SL approach was developed for use in "development" contexts, it has been used in and adapted to disaster contexts. The UN International Labour Organization and UN Food and Agriculture Organization have, for example, used the concept to underpin their "Livelihood Assessment Tool-kit" for use in post-disaster situations.[4] The Office of Foreign Disaster Assistance (OFDA) uses the SL as a disaster assessment tool.

FIGURE 4: DFID SUSTAINABLE LIVELIHOODS FRAMEWORK ADAPTED FROM CARNEY ET AL, 1999



Source: DFID. 1999. *Sustainable Livelihoods Framework*. Guidance Sheets.

4 FAO and ILO. 2009. *Disaster Livelihood Assessment Toolkit: Analysing and responding to the impact of disasters on the livelihoods of people.*

The SL framework suggests that reestablishing or preserving Natural Capital or "N" in the figure above (e.g., land, forests, mangroves, animals, etc.) is dependent on an understanding of its dynamic relationships to peoples' other assets and to the larger forces and factors that influence their desired livelihood strategies and desired outcomes. Thus, livelihoods projects may need to include initiatives to address the education, policies, institutions, and processes that undermine sustainable livelihoods and limit people's sustainable livelihoods options. For example, work to restore agricultural livelihoods may need to be accompanied by training on new farming techniques or advocacy work on environmental policy, land rights, or land use issues. A full discussion of the SL Framework is included in Annex 4, Livelihoods Frameworks.

Another method utilized for livelihood development is the Ecosystem Approach[5], which is a strategy for the integrated management of land, water and living resources that promotes sustainable use of natural resources in an equitable way. The Ecosystem Approach can be used to seek an appropriate balance between the conservation and use of natural resources in areas where there are multiple resource users. It is therefore of relevance to professionals and practitioners active in post-disaster recovery of livelihoods in farming, forestry, fisheries, protected areas, urban planning and many other fields. A full discussion of the Ecosystem Approach is included in Annex 4.

LINKING LIVELIHOODS, ECOSYSTEMS, AND DISASTER RISK MANAGEMENT

Ecosystem management can contribute to more effective reduction of disaster risk and sustainable livelihoods. Productive ecosystems can support sustainable income-generating activities and are important assets for people and communities in the aftermath of a disaster. For ecosystems to make these contributions, it is essential that they be factored into relief and rebuilding efforts in the post-disaster response phase. Not taking care of critical ecosystems after a major disaster can cause significant economic and environmental losses, and impose hardships on already vulnerable communities.

Source: Sudmeier-Rieux, K., H. Masundire, A. Rizvi and S. Rietbergen (eds). 2006. *Ecosystems, Livelihoods and Disasters: An integrated approach to disaster risk management.* Gland, Switzerland and Cambridge, UK: UK

5 UNEP. Operational guidance for application of the ecosystem approach. Convention on Biodiversity. www.cbd.int/ecosystem/operational.shtml (Accessed on June 9, 2010)

4 COMMON ENVIRONMENTAL IMPACTS OF LIVELIHOODS ACTIVITIES

In order to understand the methods for minimizing the environmental impacts of livelihoods activities, it is useful to begin with a discussion of some common environmental challenges. They can be grouped into the following categories: 1) overharvesting of natural resources; 2) loss, degradation, and fragmentation of land; 3) pollution; and 4) invasive species. Guidance on how to address these environmental issues is contained in Section 5.

4.1 Overharvesting of Natural Resources

In many cases, livelihoods depend on the sale of products that originate from natural capital, that is, physical resources such as trees, fish, agricultural plant, or animal products. In addition, some communities use natural resources as reserves to tide them over during an emergency or crisis period. Unless products are developed and managed so that the natural capital is renewable for the long term, there can be detrimental human and environmental impacts associated with livelihoods products as described further below.

4.1.1 Fish, Seafood

Seafood production has a high revenue potential when compared to many other animal or agricultural products. This revenue potential makes it a highly desirable livelihood that is often promoted in coastal communities after a disaster. Seafood capture (both industrial and artisanal) has depleted the world's oceans and continues to stress fisheries' ability to reproduce enough to maintain viable stocks globally. In addition to the capture of fish for human consumption, the farming of fish may raise pressure on wild fisheries by extracting wild juveniles for further culturing, or by utilizing wild fish as a feed source. Therefore fisheries-based livelihoods may be vulnerable to collapse because of insufficient natural capital.

Guidance note: Ensure that fisheries-related livelihoods...

- ❑ are based on assessment of the viability of target fish stocks.
- ❑ support proper monitoring practices that allow understanding of the trends in fish stocks.
- ❑ are developed in consultation with local environmental NGOs with experience in fisheries and livelihoods.
- ❑ include training with the community, fisheries agencies, and fishing cooperatives in ecosystem-based management of fishing livelihoods.

See Section 5.2.1, Fisheries, for additional guidance on how to address these issues.

4.1.2 Timber, Block, Cement, Brick

The harvesting or extraction of building materials as a livelihoods activity (e.g., timber from forests, or sand and clay from hillsides, streams, or rivers) can result in increased sediment runoff, landslides, and increased flooding risk. In addition, the habitat destruction involved with these types of livelihoods can result in reduction of habitat for wildlife, resulting in a threat to livelihoods that are based on ecotourism. Habitat destruction caused from resource extraction can also lead to food insecurity related to the decrease in harvestable wildlife.

In times of disasters, these materials become a precious commodity, often used for the reconstruction of homes and businesses. Unlike gradual development processes, rapid resource extraction on a large scale – needed after most significant disasters – increases the above-mentioned impacts if not actively managed.

Guidance note: If livelihoods activities involve the harvesting or extraction of natural resources for building materials, then project planners should ensure that associated environmental damage is minimized by implementing better management practices.

See Section 5.2.2, Forestry, and Module 5, Green Guide to Materials and the Supply Chain, for additional guidance on how to address these issues.

4.2 Loss, Degradation, and Fragmentation of Land

Habitat and associated ecosystem services perform vital functions for society and wildlife. Therefore, the loss, degradation, and fragmentation of habitat are paramount environmental and societal issues. For example, if entire forests are cut down to provide timber for rebuilding, there can be a negative impact on a community's water supply, or erosion could prevent the community from using the land for agriculture. Thus, how, when, and where to convert a natural resource (such as cutting down forested areas to clear land for an agricultural field) needs to be considered carefully in terms of other needs and opportunities. Land use analysis at a watershed scale can provide an overview of multiple objectives, complementary as well as conflicting, taking place in a particular location so that adjustments could be made. Almost all livelihoods sectors have the potential to result in some type of habitat conversion.

Guidance note: Consider alternative needs and use of land prior to commencing livelihood development and ensure that prospective livelihoods do not preclude alternative use of land or downstream resources. If existing government development or land use plans are available, consult them for guidance.

See Section 5.2, Sector-Specific Guidance, and Module 4, Green Guide to Site Selection and Development, for additional guidance on these issues.

Youth with a tuber he dug from the spiny forest after the village lost its rice crop in floods from a cyclone. The village protected the forest, recognizing its value for emergency food and medicines. © Cara Honzak/WWF

4.3 Pollution

Pollution is the addition of unwanted substances into the environment as a consequence of human activities and can come in several forms, including the addition of nutrients (e.g., from fertilizers) to land and waterways; the addition of sediment or soil particles (from erosion from hillsides and drainage systems); and the input of chemicals (e.g., pesticides and chemicals used in manufacturing processes).

4.3.1 Nutrients

Some livelihoods activities lead to the eutrophication[6] of waters that receive effluent or runoff from agriculture and aquaculture. The main nutrients of concern are nitrogen and phosphorus. Excessive nitrogen and phosphorus can lead to overproduction of algae or plants that alter natural water conditions and can kill important food species.

Guidance note: Farmers add nutrients to crops or ponds to improve production of the target organism. However, if the farmer uses more nutrients in the form of fertilizer than can be absorbed, the excess causes pollution. Thus, for the benefit of the farmer who purchases fertilizer, and for the environment that has to absorb excess, livelihood project managers should encourage farmers (of, for example, rice, shrimp, or milkfish) to reduce the net release of nutrients into the environment. Wasting nutrients is wasting money and can cause negative downstream environmental impacts, putting other livelihoods at risk.

See Section 5.2, Sector-Specific Guidelines, for additional guidance on how to address these issues.

4.3.2 Sediment

Upstream activities such as slash-and-burn agriculture, logging, and infrastructure development may result in release of sediments, which are defined as any particulate matter (e.g., sand, gravel, soil, minerals, plant leaves) that can be transported by water. Sediment often is the major carrier of organic matter and phosphorus, which will have the pollution effects described above. Sediment can also create turbidity in water, restricting light penetration and preventing important plant growth. Sediment can cover natural spawning grounds of a variety of aquatic organisms to such an extent that the organisms cannot reproduce and may die. It can suffocate coral reefs, thus having a negative impact on livelihoods associated with those resources, such as fisheries and tourism. Additionally, sediment can cause an increased rate of the filling in or "shallowing" of natural water bodies, thus having a negative effect on livelihoods taking place in those water bodies, such as fisheries or seaweed farming.

6 Defined as the process of over-enriching waters in mineral and organic nutrients that promote a proliferation of plant life, especially algae, which reduces the dissolved oxygen content and often causes the extinction of other organisms.

Guidance note: Livelihoods project managers should be aware of rivers, streams, wetlands and other waterways that are located within their proposed project or have the potential to be affected by project activities. The design of the livelihoods project should include specific measures to ensure that project activities do not result in soil erosion or deposition of excess dirt, soil, or rocks in waterways. Specific measures may include the following: maintaining vegetation buffer zones along waterways, planting vegetation to restore plant cover, and installing temporary silt fences around construction activities to prevent soil movement into waterways. Project managers should also monitor whether livelihoods activities are leading to unexpected impacts to waterways over the life of the project. Awareness-raising and capacity-building within local communities can also assist with monitoring and addressing environmental issues, such as sedimentation.

See Section 5.2, Sector-Specific Guidelines, for additional guidance on how to address these issues. GRRT Module 6, Green Guide to Construction, also contains information on techniques for reducing environmental impacts during construction.

4.3.3 Chemicals

Agriculture, forestry, aquaculture, and manufacturing processes often use a variety of chemicals. Row crop farmers may apply pesticides to plants to reduce loss from insect foraging, aqua culturists may use antibiotics to treat disease outbreaks in the culture system, and loggers may use creosote on site to preserve wood. The use of chemicals in manufacturing processes (e.g., dyes used in fabric production) can lead to harmful effects for humans and the environment. All of these chemicals can be transported through effluents and runoff and enter into soil and waterways, and can pose serious threats to terrestrial and aquatic organisms as well as to human health. An impact on people's livelihoods might include pesticides used on agricultural land crops that inadvertently kill non-target organisms (e.g., bees) that are required for pollination of other crops. Another example would be the wastewater associated with aquaculture projects that is released into water bodies and results in the death of fish species that are harvested by other communities.

Guidance note: Livelihoods project managers should first determine if the chemical is legal for the stated use; no chemical should be provided for use in a project if it is illegal. Similar to the discussion on nutrient recovery, the best use of pesticides or antibiotics is achieved when they are captured in the target organisms. For insect pests, too much pesticide application will waste money and potentially kill non-target organisms that other people normally harvest for sale or consumption. In the case of antibiotics used in animal husbandry, if these are not administered to animals efficiently, antibiotics are wasted and released into the environment, causing negative downstream effects on other livelihoods. Livelihoods project planners should ensure that project beneficiaries are trained on the proper use of chemicals to avoid public health problems and ensure that the products are not being overused. Many people believe that "more is always better," but in the case of chemical products, such as fertilizers, this is often not true. Additionally, prophylactic use of antibiotics should not be practiced, as unintended consequences are difficult to monitor or control, potentially putting other people's health and livelihoods at risk.

See Section 5.2, Sector-Specific Guidelines, for additional guidance on how to address these issues.

4.4 Invasive Species

Some livelihoods projects seek to introduce an exotic (nonnative) species, such as a new agriculture species like rice or corn or aquaculture species like tilapia. Nonnative species that are not completely contained and accidentally get introduced to the local environment can quickly outcompete native species for food and habitat, threatening the native species with local extinction. Local extinction of native species can have a negative effect on livelihoods dependent on those species and can cause unintended ecological havoc. Therefore it is best to avoid introduction of nonnative species. In some carefully monitored and maintained instances, however, a nonnative species can be utilized.

INTRODUCING SPECIES FOR LIVELIHOODS: THE GOOD AND THE BAD

Nepal: Introducing Higher-Productivity, Stalled Cattle

There are situations in which introduction of improved species did improve livelihoods and the environment. One example is from the Terai region of Nepal, where free-roaming cattle were taken out of a forest and replaced by a species of introduced, higher-productivity cattle that were confined to stalls and fed. This led to a restoration of the forest (now free from cattle grazing and soil compaction), improved children's nutrition from improved milk, and improved income from sale of better-quality milk.

Philippines: Introducing The Golden Apple Snail

The golden apple snail *(Pomacea canaliculata)* was introduced intentionally into Asia in 1980 with the expectation that it could be cultivated as a high-protein food source for local consumption and as an export commodity for high-income countries. It has since invaded Asian rice systems, where it is dispersed through extensive irrigation networks and feeds voraciously on young rice seedlings. In the Philippines, the cumulative cost of the snail invasion to Philippine rice agriculture in 1990 were between $425 and $1200 million (USD), even without taking into account the nonmarket damages to human health and ecosystems. If this amount were invested in an effective quarantine and inspection program for nonindigenous species, similar exotic pest problems in agriculture could be avoided in the future.

Source: Naylor, R. 1996. Invasions in Agriculture: Assessing the Cost of the Golden Apple Snail in Asia. *Ambio 25:443-448.*

Guidance note: Avoid no new species introduction as an element of a livelihood project. If a new species must be introduced, conduct research or consult experts in order to determine if the species has the potential to escape the target project area, threaten other species, and cause environmental harm. Beneficiaries should be informed and trained in ways they can minimize threats from nonnative introduced species.

See Section 5 for additional guidance on these issues.

5 GUIDANCE FOR LIVELIHOODS PROJECT PLANNERS

5.1 Tools for Assessing and Addressing Environmental Impacts

There are a few generalized tools that project planners involved in livelihoods activities after disasters can use to identify and address environmental impacts. The Environmental Stewardship Review for Humanitarian Aid, the U.S. Agency for International Development (USAID) Environmental Guidelines for Small-Scale Activities in Africa, and Better Management Practices are three such tools that are described in more detail below. In addition, several sector-specific checklists are provided in Section 5.2.

5.1.1 Environmental Stewardship Review for Humanitarian Aid

The World Wildlife Fund's Environmental Stewardship Review for Humanitarian Aid (ESR) is a tool that can assist staff in improving livelihoods project performance by identifying and addressing environmental sustainability issues in the project design and implementation phases. This can help reduce time-consuming and costly project adjustments required during implementation. The tool examines 22 parameters, including factors such as air, water, hazardous materials, cultural resources, socio-economics, natural resources, disaster management, and spatial planning. The tool also supports coordination with applicable government and technical organizations — such as the national ministries of agriculture or fisheries. It also includes a requirement to identify actions to mitigate environmental issues and identify areas that need further investigation and expertise. Sector specialists can adapt the ESR to specific needs and sectors. For example, the World Wildlife Fund has adapted the ESR for aquaculture projects in order to identify key sustainability issues for that sector. A copy of the ESR is included as Annex 2 and the resource CD for this module. More detailed information on using the ESR is contained in Module 3, Green Guide to Environmental Assessment Tools and Techniques.

5.1.2 USAID Guidelines

The USAID Environmental Guidelines provide guidance to assess environmental impacts and develop environmental practices for implementing small-scale activities. The guidelines are specifically related to livelihoods activities in Africa, but can be modified or adapted to other locations.[7] The guidelines address the following sectors:

- Agriculture and irrigation
- Community-based natural resources management
- Ecotourism
- Energy sources for small-scale development
- Fisheries and aquaculture
- Forestry
- Humanitarian response and natural disasters
- Livestock production

7 USAID Africa Bureau. 2007. *Environmental Guidelines for Small-Scale Activities in Africa: Environmentally Sound Design for Planning and Implementing Development Activities*. 2nd ed.

- Micro- and small enterprise (including brick and tile production, food processing, leather processing, metal finishing, wet textile operations, and wood processing)
- Pest management: integrated pest management
- Pest management: safer pesticides

5.1.3 Better Management Practices

Better management practices (BMPs) are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They can also help producers make a profit in a sustainable way. An example of a BMP is keeping livestock off of shrimp or milkfish pond embankments. This practice is good for the environment because it prevents erosion, and keeps soil and nutrients from polluting the pond. It is also cost effective because it helps keep the pond banks stable so they require less frequent repairs. Better management practices criteria are available for seaweed, clams, oysters, mussels, scallops, abalone, shrimp, salmon, catfish, tilapia, trout, and tuna.[8] See Section 5.2 for sector-specific BMPs.

Most products sold to markets that meet BMP criteria will be of higher quality (if appropriate product handling and transport post harvest is maintained) and can therefore command a higher price and financial return to the producer, by, for example, minimizing inputs such as fertilizers or feed.

BMPs are designed to improve product quality, not necessarily product quantity. Therefore, BMPs limit the amount of natural resource capital required. BMPs are a way to improve efficiency (and thus produce savings). Producers that implement BMPs may not always command a higher retail price at the marketplace if consumers are not aware of the better practices that were used in the good's production or if consumers are unwilling to pay extra for a sustainably-produced good. Products that have received a certification by an independent third party can improve the retail price; however, product certification does require some investment which can be out of reach for some producers. The use of BMPs will frequently result in cost-savings by increasing production efficiency rather than commanding higher market prices.

Better Management Practices and Shrimp Farming in Aceh: In Banda Aceh, Indonesia, following the 2004 tsunami, many agencies worked to reestablish shrimp farming as a key local livelihood. The natural tendency of most farmers is to produce high quantities of a crop at an acceptable level of quality. In Aceh, however, the way shrimp farmers achieved high quantity was to soak dead shrimp in water to absorb more weight, a technique that decreases the quality. Unknowingly, farmers reduced the unit price of the shrimp sale. Some farmers could reduce their production by 25%, increase quality by using better management practices (BMP) such as avoiding overfeeding, and make the same amount of money at the point of sale as they did when producing more shrimp of lower quality. From a resource extraction perspective, farmers who use BMPs are doing more with less; from a farming perspective, farmers are decreasing their inputs and increasing their net profits; and from a pollution perspective, farmers are feeding less and thus releasing fewer nutrients into receiving waters.

8 WWF. 2005. *Aquaculture and the Environment: A WWF Handbook on Production Practices, Impacts, Markets.*

5.2 Sector-Specific Green Reconstruction Guidelines

The following section provides sector-specific guidelines and BMPs that can be used to improve the sustainability of livelihoods projects during disaster recovery and reconstruction.

5.2.1 Fisheries

- ❑ Develop a sustainable fisheries reconstruction plan that focuses on creating an overarching sustainable fisheries management framework; sustaining target fish populations; conserving sites critical for replenishment; rebuilding boats, gears, supporting infrastructure, and markets; strengthening local institutions involved in fisheries; and strengthening small-scale fisheries governance.
- ❑ Where possible, promote community-led reconstruction efforts, including investment in local industries and local capacity for rebuilding boats and infrastructure and livelihoods, taking care to ensure that fish are not overharvested.
- ❑ Where possible, promote the use of recycled or sustainably sourced materials in the rebuilding of boats and supporting infrastructure, and re-equip with appropriate gears according to national and local management frameworks, working within an overarching sustainable fisheries management plan.
- ❑ Avoid the introduction of inappropriate technologies (e.g., steel boats), and critically evaluate donor or national government-driven initiatives that seek to introduce substantially different boats or gear.
- ❑ Invest in the reconstruction of strong local formal and informal institutions and human capacity for management, including monitoring and enforcement.
- ❑ Protect and effectively manage all known important fisheries spawning and recruitment sites, using appropriate traditional, local, and national management mechanisms (including time-area closures and marine protected areas).
- ❑ Ensure that effective surveillance, enforcement, and compliance mechanisms are in place to prevent overexploitation of fish populations and other targeted components of the ecosystems, and to prevent other activities from having a significantly damaging impact on the health of the ecosystems.
- ❑ Provide incentives and access to markets for products that meet a certification standard to encourage better practice and, if appropriate, develop infrastructure and trade networks and seek markets to support such ventures.
- ❑ Maintain or improve water quality in coastal and nearshore environments.
- ❑ Maintain traditional fishing grounds, including traditional access to beach landing sites.

For more information, see:

Berkes, F., R. Mahon, P. McConney, R. Pollnac, and R. Pomeroy. 2001. *Managing Small-Scale Fisheries: Alternative Directions and Methods.* IDRC.

Defeo, O., and J. C. Castilla. 1999. *A co-management approach to artisanal fisheries in Chile and Uruguay.* Wise Coastal Practices for Sustainable Human Development Forum. www.csiwisepractices.org/?read=12 (Accessed on April 14, 2010)

Johnson, C. 1998. Beyond Community Rights: Small-Scale Fisheries and Community-Based Management in Southern Thailand. *TDRI Quarterly Review* 13:25-31.

Sustainable Fisheries Livelihoods Program. 2008. *Niger: National Workshop on Poverty Reduction in Fisheries.* FAO.

Ward T. J., D. Heinemann, and N. Evans. 2001. *The role of Marine Reserves as Fisheries Management Tools: A review of concepts, evidence and international experience.* Canberra: Bureau of Rural Sciences.

Ward T. J., and E. Hegerl. 2003. *Marine Protected Areas in Ecosystem-Based Management of Fisheries.* Canberra: Department of Environment and Heritage.

5.2.2 Forestry

- ❑ Promote fuel-efficient stoves to reduce work and time spent collecting firewood, reduce demand for firewood and thus protect the forest's natural capital asset, and reduce indoor air pollution.
- ❑ Forestry sector development activities can include reforestation, natural forest management, and agroforestry; each sector has unique opportunities and challenges.
- ❑ For all forestry-related activities, organize information to create watershed-specific forest cover mapping and land-use plans to forecast the demands on the natural resources.
- ❑ Comply with the principles of the Forest Stewardship Council[9] in any livelihoods development around this industry:
    - ❑ **Comply with Laws and Principles:** Forest management shall respect all applicable national laws, international treaties, and agreements to which the country is a signatory.
    - ❑ **Clearly Define Tenure and Use Rights and Responsibilities:** Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented, and legally established.
    - ❑ **Recognize and Respect Indigenous Peoples' Rights:** The legal and customary rights of indigenous peoples to own, use, and manage their lands, territories, and resources shall be recognized and respected.
    - ❑ **Maintain and Enhance Community Relations and Workers' Rights:** Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.
    - ❑ **Manage for Social and Environmental Benefits from the Forest:** Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.
    - ❑ **Minimize Environmental Impact:** Forest management shall conserve biological diversity, water resources, soils, and unique and fragile ecosystems and landscapes, and by so doing maintain the ecological functions and integrity of the forest.
    - ❑ **Draft Written Management Plan:** A management plan appropriate to the scale and intensity of operations shall be written, implemented, and kept up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.
    - ❑ **Ensure Monitoring and Assessment:** Monitoring shall be conducted to assess the condition of the forest, yields of forest products, chain of custody, and management activities, as well as their social and environmental impacts.
    - ❑ **Maintain Natural Forests:** Primary forests; well-developed secondary forests; and sites of major environmental, social, or cultural significance shall be conserved. Such areas shall not be replaced by tree plantations or other land uses.
    - ❑ **Utilize Plantations Where Appropriate:** Plantations shall complement, not replace, natural forests. Plantations should reduce pressures on natural forests.
- ❑ Ensure that all project activities comply with local, regional, and national laws that govern natural resource management. Note that some laws may be changed as a result of the disaster.

For more information, see:

Heising, K. Ed. 2006. *Improved Stoves as a Key Intervention to Enhance Environmental Health in the Andes.* Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)

Marsh, R. 2002. *Working with local institutions to support sustainable livelihoods.* www.fao.org/sd/2002/PE0702a3_en.htm (Accessed on April 14, 2010)

McCall, M. 2004. *Can participatory-GIS strengthen local-level spatial planning: Suggestions for better practice.*

International Network on Household Energy in Humanitarian Settings: www.fuelnetwork.org

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9 The Forest Stewardship Council (FSC) is a non-profit organization devoted to encouraging the responsible management of the world's forests. www.fsc.org

5.2.3 Aquaculture

- ❑ As far as possible, provide alternative livelihoods and compensation while the aquaculture sector is reviewed for environmental and economic sustainability, infrastructure needs are assessed, and a sector-specific redevelopment plan is completed.
- ❑ Ensure that reconstruction is framed within a larger coastal zone management and spatial planning framework, and that there is effective participation of local communities in issues of land tenure, reclamation, and zoning.
- ❑ Ensure that reconstruction follows better practice guidelines for aquaculture, including minimal impact on other ecosystems and provision of incentives and access to markets for products of a certification standard.
- ❑ Use the reconstruction of the aquaculture sector as a means of promoting local-level enterprise opportunities, coupled to the implementation of best practice, such as providing individuals with equity in a larger enterprise.
- ❑ Follow the standards for siting under the aquaculture dialogues[13] for the respective species.
- ❑ Ensure that actions fall within the legal framework and land use planning.
- ❑ Ensure that product quality is high and that chemicals are not used.
- ❑ Embody resource efficiency to reduce cost to producers and reduce impacts on the environment. Resource efficiency refers to management of raw materials, energy, and water to minimize waste and thereby reduce cost

For more information, see: [10]

Tucker, C., and J. Hargreaves. Eds. 2008. *Environmental Best Management Practices for Aquaculture*. Hoboken: John Wiley and Sons.

World Bank, NACA, WWF, and FAO. 2003. *Shrimp Farming and the Environment: A Consortium Program to Analyze and Share Experiences on the Better Management of Shrimp Aquaculture in Coastal Areas.* Synthesis Report.

World Bank, NACA, WWF, and FAO. 2003. *Shrimp Farming and the Environment: Can Shrimp Farming Be Undertaken Sustainably?*

World Bank, NACA, WWF, and FAO. 2003. *Shrimp Farming and the Environment Booklet.*

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10 WWF engaged more than 2,000 people — farmers, conservationists, academics, government officials, and others — in roundtables called “Aquaculture Dialogues.” Jointly through these dialogues, they are creating standards that will minimize key negative environmental and social impacts for 12 species including shrimp, salmon, abalone, clams, mussels, scallops, oysters, pangasius, tilapia, trout, seriola, and cobia.

5.2.4 Agriculture

- ❑ Provide alternative livelihoods options for those displaced or unable to use impacted lands, prioritizing those most in need.
- ❑ Frame reconstruction efforts within a spatial management planning framework that includes sector-specific reconstruction plans with environmental safeguards, and rehabilitation strategies for lands suffering degradation such as saltwater intrusion.
- ❑ Promote crop production according to standards of sustainability or in accordance with better management practice guidelines, including avoidance of human-wildlife conflict.
- ❑ Ensure that agriculture practices have minimum negative impacts on water quality and do not have negative impacts on the watershed or adjacent river basins.
- ❑ Employ production practices that reduce soil erosion, pesticide use, and water population, and better manage production wastes.
- ❑ Ensure that rebuilt agriculture industries do not use more water than is sustainably available in the long term, and that they consider trends in climate change and climate variability.
- ❑ Ensure that effective systems are in place to prevent pollution, sedimentation, and contamination of water systems from all human activities (e.g., agriculture, aquaculture, heavy and light industry, urban and rural waste, runoff, infrastructure development).
- ❑ Promote agroforestry where appropriate. Agroforestry is a system of land use in which harvestable trees or shrubs are grown among or around crops or on pastureland, as a way to maintain or enhance productivity. The increased diversity of crops can improve nutrition (e.g., with fruit trees) and enhance food security, especially important in areas with high climate variability. Agroforestry improves soil fertility, reduces erosion, and can create habitat for pollinators; this helps to increase productivity, and is especially important for families with small land holdings. The trees create shade and shelter from wind, and can provide fodder for livestock and woody products such as timber. All this helps to improve livelihoods and make them more sustainable.

For more information, see:

Asian Development Bank. Agriculture Sector Program Loan Afghanistan. www.adb.org/Documents/Profiles/LOAN/37046013.ASP (Accessed on April 14, 2010)

Bishkay, F. 2003. *Towards Sustainable Agricultural Development in Iraq: The Transition from Relief, Rehabilitation and Reconstruction to Development.* FAO.

The East Timor National NGO Forum. www.pcug.org.au/~wildwood/01junagriculture.htm (Accessed on April 14, 2010)

5.2.5 Tourism

- ❑ Protect and effectively manage all known important areas for endangered or vulnerable species (e.g., turtle nesting beaches), as well as other plant and animal species of interest, using appropriate traditional, local, and national management mechanisms.
- ❑ Protect sites of importance for cultural, historical, or traditional values, maintain access to such sites, and take advantage of the ecosystem that encompasses the main tourist activities in particular settings, such as beaches, jungles, and deserts. Protect the natural resource base such as wildlife concentrations, including birds and fish, to protect tourism development and potential.
- ❑ Adopt integrated land management as a framework for protecting marine, coastal, or terrestrial sites of high natural and cultural value.
- ❑ Link rehabilitation and protection efforts to the spatial planning process to ensure that identified areas are included in a redevelopment spatial plan.
- ❑ Promote development of tourism associations so that an organized body can be engaged in upstream and downstream resource management decisions that will impact tourism-based livelihoods.
- ❑ Ensure that the planning process is participatory, taking into account needs of the local community and the environment, and ensuring that the needs of women, the poor, and the disadvantaged are taken into account.

For more information, see:

Overseas Development Institute. Tourism Program. www.odi.org.uk/programmes/tourism/default.asp (Accessed on April 14, 2010)

Pro Poor Tourism Partnership. Pro Poor Tourism. www.propoortourism.org.uk/ (Accessed on April 14, 2010)

UNEP. 2001. *Environmental Impacts of Tourism*. www.gdrc.org/uem/eco-tour/envi/index.html (Accessed on April 14, 2010)

UNEP and CBD. 2007. *User's Manual on the CBD Guidelines on Biodiversity and Tourism Development.*

5.2.6 Microfinance and Small-Scale Enterprise

- ❑ Include prescreening and stipulations such that ecosystem integrity is a condition of lending.
- ❑ Make the business case for protecting the ecosystem one aspect of the livelihood microfinance lending program.
- ❑ Promote microfinance mechanisms that enable lending to women and poor and disadvantaged groups, not just wealthier individuals; poor and disadvantaged people are often more dependent on natural resources, especially during times of crisis. Microfinancing can help tide them over shocks and reduce additional environmental pressures.

For more information, see:

Consultative Group to Assist the Poor. Microfinance Gateway. www.microfinancegateway.org/ (Accessed on April 14, 2010)

Global Development Research Center. The Environmental Colours of Microfinance Theory and Practice. www.gdrc.org/icm/environ/environ.html (Accessed on April 14, 2010)

5.2.7 Animal Husbandry

- ❑ Ensure sufficient knowledge to manage intensive farming. For example, when farmers increase animal densities, there is often an increase in animal disease, which requires access to veterinarians or substantial veterinary training.
- ❑ Do not allow animals that are pastured to roam in coastal or freshwater buffer zones or other critical natural habitats, and delineate and fence watering areas to reduce erosion.
- ❑ Recycle animal waste to reduce reliance on fertilizers used on other crops.
- ❑ Consider climate, terrain, and ecosystem.
- ❑ Evaluate policy, legal, customary, and cultural context.
- ❑ Assess current and proposed species and breeds.
- ❑ Evaluate current and proposed livestock management practices, likely acceptance of new practices, and who the practices will benefit most (will the poor and disadvantaged benefit, or only richer members of the community?).
- ❑ Assess demand for, markets for, and use of livestock products through a feasibility study.
- ❑ Assess livestock ectoparasite management.
- ❑ Consider livestock population pressure, carrying capacity of pasture or rangeland, and disease burden.
- ❑ Consider existing and potential conflict with wildlife, including disease transmission and attacks on livestock.

For more information, see:

USAID. Asia and Near East: Sector Specific Guidelines. www.usaid.gov/our_work/environment/compliance/ane/ane_guidelines.htm (Accessed on April 14, 2010)

ANNEX 1: ADDITIONAL RESOURCES

The following organizations and publications provide additional resources that elaborate on the concepts presented in this module.

Organizations

African Development Bank: The bank's policy on environmentally sustainable development in Africa is based on the belief that to sustain economic growth in Africa, the ecological capital enriching such growth must be preserved. In 2004, the bank developed an Implementation Plan that seeks to ensure that a strong and diversified economy will continue to value environmental protection, and to guarantee that all developmental decision making integrates economic, social, and environmental considerations. *www.afdb.org/en/topics-sectors/sectors/environment/*

Asian Development Bank (ADB): The ADB, based in Manila, is dedicated to reducing poverty in the Asia and Pacific region through inclusive economic growth, environmentally sustainable growth, and regional integration. ADB is raising awareness of the poverty-environment linkage and improving poverty-reduction operations through sound environmental management, disaster protection, and emergency support for the vulnerable poor. *www.adb.org/poverty/environmental-sustainability.asp*

Eldis-Livelihoods Connect: Livelihoods Connect aims to provide researchers, policy makers, and development practitioners with up-to-date, diverse, and credible information on the application of livelihoods approaches to development, research, policy, and practice. *www.eldis.org*

International Finance Corporation (IFC): A member of the World Bank Group, IFC's purpose is to create opportunity for people to escape poverty and improve their lives by helping to generate productive jobs and deliver essential services to the underserved. IFC is committed to environmental and social sustainable development as a fundamental part of its mission, and applies environmental and social standards that minimize the impact on the environment and on affected communities of all the projects it finances. *www.ifc.org*

International Union for Conservation of Nature (IUCN): IUCN's Commission on Environmental, Economic and Social Policy (CEESP) is an interdisciplinary network of professionals providing expertise and policy advice on economic and social factors for the conservation and sustainable use of biological diversity. The CEESP has several themes and working groups organized around key topics in sustainability, one of which, the Theme on Sustainable Livelihoods (TSL), is concerned with local aspects of environmental sustainability and community well-being. *www.iucn.org/about/union/commissions/ceesp/*

Network of Aquaculture Centres Asia Pacific (NACA): NACA is an intergovernmental organization that promotes rural development through sustainable aquaculture. NACA implements development assistance projects in partnership with research centers, governments, development agencies, farmer associations, and other organizations to help farmers prepare and adapt to climate changes affecting aquaculture systems worldwide. *www.enaca.org/*

UN Food and Agriculture Organization (FAO): The FAO has long promoted natural resources management and environmental protection in its work. FAO's Sustainable Development Department provides policy and program support to help countries analyze the core elements for fostering sustainable livelihoods, one of which is the dynamics of the natural resource base. *www.fao.org/sd/*

UNEP: UNEP seeks to minimize environmental threats to human well-being from the environmental causes and consequences of conflicts and disasters. UNEP has produced a wide variety of reports and guidance on the integration of environmental issues into livelihoods. *www.unep.org*

UNEP provides four core services to Member States through its Disasters and Conflicts Programme:

- Post-crisis environmental assessments
- Post-crisis environmental recovery
- Environmental cooperation for peace building
- Disaster risk reduction

United States Agency for International Development (USAID): USAID's programs in natural resource management are closely linked with programs to improve health, increase agricultural productivity, and mitigate or adapt to climate change. *www.usaid.gov/our_work/environment/*

World Bank: The World Bank integrates principles of environmentally sustainable development. It has developed an environment strategy that identifies the importance of the close links between poverty and environmental change and clusters them into three strategic areas of work: environment and health, livelihoods and natural resources, and vulnerability and resource management. The World Bank provides analytical work, training, and project support in many areas. *www.worldbank.org*

WorldFish Center: WorldFish believes that climate change poses huge threats to aquatic food production and the poor who depend upon it. Much of WorldFish's work involves research on impacts, mitigation, and the adaptation crucial to making fisheries and aquaculture systems more resilient to global climate change, thereby securing a brighter future for the people that depend upon them. *www.worldfishcenter.org*

World Wildlife Fund (WWF): WWF is working directly with humanitarian organizations and governments to advise them on better practices for rebuilding communities impacted by disaster. The goal of the Humanitarian Partnerships Program is to ensure that recovery and reconstruction efforts include environmentally sustainable options. To reduce risk and vulnerability and achieve long-lasting results for affected communities, the recovery and reconstruction process must be comprehensive and must include a "design through implementation" approach to ensure restoration of livelihoods, protection of natural resources, and strengthening of communities against future disasters. *www.worldwildlife.org/what/partners/humanitarian/index.html*

Emergency Market Mapping and Analysis (EMMA), developed for Oxfam GB and International Rescue Committee UK (IRC) by Practical Action Consulting. The EMMA tool kit can be used by project managers to undertake essential market analysis. This analysis can inform early decisions about the possibility of using cash, help identify opportunities and actions needed to restore or rehabilitate critical market systems, and track the impact of a crisis and humanitarian interventions on critical markets. EMMA provides accessible, relevant guidance to staff who are not already specialists in markets or livelihoods analysis. The ultimate purpose of EMMA is to improve the efficiency and effectiveness of the early humanitarian actions taken to ensure people's survival, protect their food security, and re-establish their livelihoods. For more details about the publication, contact http://practicalactionpublishing.org/publishing/emma

Publications

Ariyabunu, M. 2005. *Livelihood Centered Approach to Disaster. Management: A Policy Framework for South Asia.* Practical Action South Asia.

Canadian International Development Agency. 2005. *Environmental Handbook for Community Development Initiatives.* 2nd Ed.

FAO and ILO. 2009. *Disaster Livelihood Assessment Toolkit: Analysing and responding to the impact of disasters on the livelihoods of people.*

Kelly, C. 2005. *Guidelines for Rapid Environmental Impact Assessment in Disasters (REA).* Version 4.5. London: CARE International and Benfield Hazard Research Center.

Neefjes, K. 2000. *Environment and Livelihoods: Strategies for Sustainability.* Oxfam.

Pallen, D. 1997. *The Environmental Sourcebook for Micro-Finance Institutions (MFIs).* Canadian International Development Agency-Asia Branch.

Small Enterprise Education and Promotion Network. 2009. *Minimum Standards for Economic Recovery After Crisis.*

Sudmeier-Rieux, K., H. Masundire, A. Rizvi, and S. Rietbergen. Eds. 2006. *Ecosystems, Livelihoods and Disasters: An integrated approach to disaster risk management.* Gland, Switzerland: IUCN.

ANNEX 2: ENVIRONMENTAL STEWARDSHIP REVIEW FOR HUMANITARIAN AID

Environmental Stewardship Review for Humanitarian Aid

The purpose of this worksheet is to assist humanitarian staff improve project performance by identifying and addressing environmental sustainability issues. Use of this worksheet is consistent with SPHERE Standard #6. Include a completed worksheet with the project file.

A. Project Information

Implementing Agency: **Humanitarian International** Project Title: **Pa'agnan Island Relocation**

Project Location: **Pa'agnan, Rakudinia**

Project Coordinator: Joe Reconetto

Environmental Stewardship Review completed by: Achalo Nanathumo/ Mittaka Dangadasa Date: 08-02-2009

B. Project Objectives

Approximately 3,600 people were left homeless when the 2008 tsunami rolled across the tiny island of Ngeri in the country of Rakudinia. The project objective is to resettle the affected community members at an alternate location in the nearby Pa'agnan Island which was previously uninhabited in order to increase community resiliency against future disasters.

C. Project Description

Humanitarian International is planning to construct of a total of 315 houses, primary school, secondary school, community administration building, community buildings, waste water disposal system, electric network, roads and street lighting.

D. Coordination *(Develop a list of local, state, and national experts that can assist with identifying the key environmental issues associated with your project and contact them. Examples include the Ministry of Natural Resources, local planning authorities, Ministry of Fisheries, national and international environmental NGOs, and academic institutions. These contacts will also be useful for completing the Environmental Issues Matrix in Section E. Use the following table to record the results of coordination or attach additional sheets.)*

Name	Organization	Key Issues	Date contacted
Sandib Mohammed Baaklini	Ministry of Energy, Environment and Water (MEEW)	Wastewater outflow to the marine environment, proper permitting	23-12-2008
Esther Chuyana	Atoll Office	Not using coral as a source of building materials. Maintaining fish stocks for the fishermen.	05-01-2009

Note: Humanitarian International is in constant contact with both these offices regarding various issues related to Dhuvafaaru, and to obtain permission for various construction activities.

Environmental Stewardship Review for Humanitarian Aid

E. **Environmental Issues Matrix** *(Complete the following matrix based on the coordination you completed in Section D, along with field visits, and additional research as needed. The objective is to identify the key environmental issues associated with your project and ways to address these issues. Instructions for completing the matrix are in the first row of each column.)*

		Environmental Issue	To answer…	Yes	No	Not sure	Comment	Action Taken
		This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.	*This column suggests ways to obtain the information needed to answer the questions at the right.*	*Check this box if the answer is "Yes."*	*Check this box if the answer is "No"*	*Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*		*This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Air	1	Will the project result in the emission of air pollutants (e.g., smoke, gases, dust particles)?	Review project proposal. Consult local natural resources department.	X			Emissions from the three generators installed have been controlled. However, solid waste is burnt under uncontrolled conditions in the open.	Ensure solid waste is burnt under controlled conditions. If not, in future waste burning could become a serious issue. There is also opportunity to improve the waste collection and separation to reduce burning of hazardous waste such as batteries, electronic items, etc.

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue *This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.*	To answer… *This column suggests ways to obtain the information needed to answer the questions at the right.*	Yes *Check this box if the answer is "Yes."*	No *Check this box if the answer is "No"*	Not sure *Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*	Comment	Action Taken *This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Water	2	Will the project result in alteration of waterways (addition of spring catchments, drainage infrastructure, placement of rock along river bank)	Review area maps. Consult with local environmental organizations.	X			The groundwater lens is 1m deep and currently clean. It has been noticed to be recharging relatively quickly in areas where rainwater is not being harvested. Each house has a well but there is no measurement of usage. The waste management centre and fuel storage sites are both concrete padded, and/or bunded with grease traps to collect any wastewater. Each house has a 2,500l rainwater harvesting tank. There are fourteen 10,000l community rainwater harvesting tanks. All the wastewater from households are pumped out to the deep sea. As the underground wastewater collection lines run close to the groundwater lens, there is a possibility for the wastewater pumping system to pump out the groundwater if there is groundwater infiltration into the pipes due to construction defects. This could reduce the groundwater sources rapidly as it is replenished only through rainwater.	Promote water conservation with the beneficiaries and ensure they understand efficient use of the groundwater source and protect it being polluted. Community sensitization programs would be required to ensure community understands their responsibility to conserve water and protect water resources. At present there is a drinking water shortage in the island. Rain Water Harvesting would need to be increased through increasing roof area used for water collection and increasing water storage tank volumes. Increased rainwater harvesting will reduce the recharging of the groundwater aquifer. However, considering the amount of open space available (through observations) for rainwater infiltration to ground, this would not pose a significant threat as long as open spaces are maintained at present levels. As the possibility of island roads and open spaces being paved are unlikely, increasing collection of rainwater at household level should not be a major environmental threat. Ensure the wastewater collection pumps are pumping only wastewater from houses and not the groundwater lens. Regular checkups must be made on the quantity of water pumped out at each pumping station and the total must be tallied with expected wastewater quantities from the island. This needs to be done regularly and systematically.

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue	To answer…	Yes	No	Not sure	Comment	Action Taken
		This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.	*This column suggests ways to obtain the information needed to answer the questions at the right.*	*Check this box if the answer is "Yes."*	*Check this box if the answer is "No"*	*Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*		*This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Water	3	Will the project result in pollution of rivers, streams, wetlands, or other waterways? Examples include: Addition of sediment, wastewater, hazardous materials, runoff from roads.	• Review area maps. • Consult with local environmental organizations.			X	There are no surface water sources on the site. The groundwater lens is very close to the surface and it is important that islanders understand the possible methods that could pollute this water source. Construction on the island has not affected the groundwater, but future activities by islanders may do so. Wastewater collected through the sewer network is pumped out to the sea. If the sewer outfall is not properly constructed as given in the designs there could be wastewater pollution within the shallow coral areas and wash zone.	Community sensitization programs would be required to ensure community understands their responsibility to protect the water resources. Ensure sewer outfall is properly constructed underwater.
Water	4	Will the project restrict access to water sources or other public use areas/resources?	• Review spatial planning maps. • Conduct site visit.			X	During dry seasons the water resources available are inadequate for the needs of the people.	As water is scarce in the area it is recommended that water conservation be encouraged within the community. Further, drinking water sources need to be improved as this is a serious issue. Rain water harvesting needs to be increased. For this roof area collecting rain water and storage volumes need to increased.

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue *This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.*	To answer… *This column suggests ways to obtain the information needed to answer the questions at the right.*	Yes *Check this box if the answer is "Yes."*	No *Check this box if the answer is "No"*	Not sure *Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*	Comment	Action Taken *This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Hazardous Materials	5	Are there toxic or hazardous materials at the project site?	• Ask neighboring residents about current and previous use of site. • Conduct field survey	X			Fuel is present on the site which is needed for all the machinery. It is currently stored in un-bunded tanks. In the future fuel will be kept on site to run the generators. The fuel tanks are in bunded areas with grease traps for the wastewater. The wastewater goes into the main sewer line, which will be disposed beyond the reef into the ocean.	Ensure that the fuel tanks are filled with as little spillage as possible.
Hazardous Materials	6	Will the project result in the generation of hazardous materials?	• Review project proposal.		X			
Cultural Resources	7	Are there cultural, archeological, prehistoric or historic resources at the site?	• Talk with neighboring residents. • Consult local heritage organizations, museums or universities. • Conduct field survey.	X			During construction some archaeological remains were unearthed, together with an ancient well. These artifacts have been kept on the island in an area cordoned off for preservation of this historic site.	Ensure archeological site is kept protected.
Socio-economics	8	Will the project result in an increase in local fees, taxes?	• Review project proposal.	X			The Government of the Maldives will be introducing taxes in the future. A management fee would be introduced for electricity and any other services.	These fees are necessary for operation and maintenance of the facilities. A reasonable fee mechanism must be set up to maintain the general community services.
Natural Resources	9	Will the project result in the extraction of natural resources? Examples: Fish, timber, water	• Review project proposal. • Talk with local natural resource organizations.	X			Water usage will increase with the increase in population. This could have a serious impact on the groundwater sources.	As water is scarce in the area it is recommended that water conservation be encouraged within the community.

Environmental Stewardship Review for Humanitarian Aid

WWF · American Red Cross

		Environmental Issue *This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.*	To answer… *This column suggests ways to obtain the information needed to answer the questions at the right.*	Yes *Check this box if the answer is "Yes."*	No *Check this box if the answer is "No"*	Not sure *Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*	Comment	Action Taken *This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Natural Resources	10	Are there any endangered species (e.g., sea turtles, orangutans) or their habitats located near the project or have the potential to be impacted by project activities?	Talk with local environmental organizations. Talk with local, provincial, or national natural resources organizations.		X		Turtles have been noted on the beach. The community is generally quite protective of these species.	
Natural Resources	11	Are there any sensitive habitats in the project area (e.g., mangroves, peat bogs, forests, marine resources)?	Conduct field visits with local experts. Review natural resources maps.	X			Coral reef surrounds the island. Local regulations stipulate that people are not allowed to remove coral/sand from the reef. Further there is a tendency for most islanders to throw garbage into the sea.	Ensure the community is aware of this regulation and encourage them not to damage the reef. Introduce solid waste management and awareness programs within the community to reduce future impacts on marine resources.
Natural Resources	12	Have construction materials been obtained from unsustainable sources?	Talk with suppliers about the source of their materials. Talk with local environmental organizations for additional information.		X		Not applicable at this stage as construction is completed.	
Natural Resources	13	Will the project result in the introduction of non-native species (e.g., exotic plant or animal species)?	Review project proposal.	X			Beneficiaries will plant fruit trees, vegetables and exotic plants for their gardens.	Local regulations regarding removal of certain vegetative species from neighboring islands and bringing them to this one should be investigated and adhered to.
Disaster Mngt.	14	Is the project site subject to flooding?	Review floodplain maps if available; Talk with local planning authorities; Speak with neighboring residents.		X			

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue *This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.*	To answer… *This column suggests ways to obtain the information needed to answer the questions at the right.*	Yes *Check this box if the answer is "Yes."*	No *Check this box if the answer is "No"*	Not sure *Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*	Comment	Action Taken *This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Disaster Mngt.	15	Is the project vulnerable to natural hazards such as typhoons, earthquakes, landslides, unstable slopes, fires, coastal erosion, wave action, tides, sea level rise?	Talk to National Emergency Management Agency or similar agency to determine relevant natural hazards in the project area. Review hazard identification maps.			X	This island is protected by the reef to a large extent. The maximum height of the island is 2.5m above sea level.	As any other island in Maldives this island is also vulnerable to sea level rise, tides, coastal erosion and typhoons.
Disaster Mngt.	16	Will the project result in the ponding of water (thus providing a disease vector for mosquitoes?)	Review project proposal.	X			There is potential for mosquito breeding within the household wells and rainwater harvesting tanks more than in open ponds.	Protect wells and rainwater harvesting tanks with mosquito netting and filters to reduce mosquito breeding in clean water.
Disaster Mngt.	17	Will the project result in removal of vegetation on slope slides?	Review project proposal. Conduct site visit.		X		There are no slopes on the site.	
Disaster Mngt.	18	Will the project involve soil movement or excavation that could lead to an increase in landslides?	Review project proposal. Conduct field visit. Talk with geologists or geo-technical engineers.		X			
Spatial Planning	19	Is the project located within a designated Coastal Zone buffer?	Talk with local planning authorities to determine if there is a legally designated coastal buffer zone and how this coastal zone policy relates to your project.			X	Some construction activity visible close to the coastal zone.	
Spatial Planning	20	Are there any current or planned Parks or Protected Areas within 15 km distance to the project site?	Review provincial maps. Talk with local authorities.		X			

Environmental Stewardship Review for Humanitarian Aid

		Environmental Issue	To answer…	Yes	No	Not sure	Comment	Action Taken
		This column asks questions related to key environmental issues. Note: during the coordination phase in Section D, you may have identified some issues that are not described below but should be addressed in order to ensure your project achieves environmental sustainability.	*This column suggests ways to obtain the information needed to answer the questions at the right.*	*Check this box if the answer is "Yes."*	*Check this box if the answer is "No"*	*Check this box if the answer is "Not Sure." Contact experts identified in Section D to assist with answering the question.*		*This column provides space to identify what further action needs to be taken to address the environmental issue. These actions may include improvements to the design of the proposed project, additions to the project TOR (i.e., addition of contract requirement that timber be obtained from sustainable sources), need for additional coordination with resource experts, or preparation of additional studies.*
Spatial Planning	21	Will the project impact or be impacted by other sectors in the project area, such as spatial planning decisions, water and sanitation projects, disaster management, livelihoods activities, etc.?	• Coordinate with other donor agencies and other organizations at work in the project area. • Review spatial planning maps.		X		Spatial planning could have been done better before the construction of the housing to maintain enough greenery within the island as it resembles a desert environment at present.	Greenings programs should be conducted urgently to improve the general environmental conditions. These could be done in partnership with home gardening programs at household level.
Spatial Planning	22	Will the project deviate from existing village plans?	• Review village spatial plans. • If village plans have not been developed speak with community planners/leaders.		X		Permission had to be obtained from local authorities and the government was responsible for planning of the island	

Environmental Stewardship Review for Humanitarian Aid

F. Other information *(Please answer the following questions)*

Are personnel preparing this form familiar with the site? x Yes ☐ No

Did personnel visit the site? x Yes ☐ No

Have local laws been considered and applied to the project? x Yes ☐ No

Are there existing local, state, or national management plans that pertain to the project (e.g., Village Plan, Integrated Water Resources Management Plan, Fisheries Management Plan, etc.)? x Yes ☐ No If so, list plan name(s):

If plans exist, is the project consistent with existing plans? x Yes ☐ No
(If no, determine how the project can better fit with existing plans or whether existing plans need to be updated to reflect current conditions. If no plan exists, consider whether one should be undertaken in coordination with implementation of the proposed project)

Has the community been given the opportunity to provide input on the proposed project? x Yes ☐ No. In not, ensure that community involvement has been integrated into project planning. If so, describe the method used to obtain community input:

Community has been involved in the project from the planning stage to the managing of the island after it was handed over to them. Housing allocation and beneficiary selection was also conducted in a participatory manner.

G. Determine Need for Additional Studies

Based on completion of Sections A – F, determine whether you require additional information or if the project requires an Environmental Impact Assessment (EIA). In determining whether additional information/EIA is required, consider:

- **Size and scale of the project**. *If the project is of such a size and scale that it can not be adequately evaluated in this worksheet, consider preparing a more detailed EIA.*
- **Uncertain and potentially significant environmental risks.** *If the environmental effects of the project are not well-understood and could lead to potentially significant risks to the environment and the beneficiaries who depend on it, consider preparing additional information and/or preparing an EIA.*
- **Cumulative impact.** *If the project has a relationship with other activities that, when considered cumulatively, would have a potentially significant impact, then consider conducting additional studies and/or preparing an EIA to fully understand the impact. For example, if the project involves the installation of groundwater wells in area where several other agencies are also installing a number of groundwater wells, there may be a cumulatively significant impact on the area's groundwater supply, and a groundwater resources assessment should be conducted.*

In consideration of the above factors, are additional studies or an EIA necessary?

☐Yes x No. If Yes, list the additional studies that are needed (examples include EIA, groundwater study, Fisheries Management Plan, hazardous materials survey, Solid Waste Management Plan, hydrology study, biological assessment, endangered species survey, Forest Management Study):

Environmental Stewardship Review for Humanitarian Aid

H. Take Action!

The most important component in environmental stewardship is to take action. In Sections D (Coordination) and E (Environmental Issues Matrix), you identified the key environmental issues associated with your project and ways to address these issues. These actions may have included improvements to the design of the proposed project, specifications in the Terms of Reference, or the need for additional consultations and research. Use this page to list the specific measures that were identified to eliminate or minimize the impact of the proposed project on the environment.

	Action	Has Action Been Taken?	
		Yes	No
1	Ensure solid waste is burnt under controlled conditions. If not, in future waste burning could become a serious health issue. Need to improve waste collection, separation and reduce burning of hazardous waste such as batteries, electronic items, etc.		
2	Introduce solid waste management and awareness programs within the community to reduce future impacts on water and marine resources		
3	As water is scarce in the area it is recommended that water conservation be encouraged in the community. Community sensitization programs would be required to ensure community understands their responsibility to conserve water and protect the water resources.		
4	Ensure sewer outfall is properly constructed underwater.		
5	Ensure the wastewater collection pumps are pumping only wastewater from houses and not the groundwater lens. Regular checkups must be made on the quantity of water pumped out at each pumping station and the total must be tallied with expected wastewater quantities from the island. This needs to be done regularly and systematically.		
6	Protect wells and rainwater harvesting tanks with mosquito netting and filters to reduce mosquito breeding in clean water. Conduct public health awareness programs for the community on mosquito borne diseases such as Dengue and Chikangunya.		
7	Initiate greening programs in the island and promote home gardening programs to increase greenery and shade. It would further improve the community livelihoods and make the island more habitable.		
8	Ensure fuel tank spillage will not harm the groundwater lens		

ANNEX 3: SECTORAL INTERNATIONAL STANDARDS

Agriculture Dialogues

Roundtable on Responsible Soy: www.responsiblesoy.org

Better Sugarcane Initiative: www.bettersugarcane.org

Better Cotton Initiative: www.bettercotton.org

Roundtable on Sustainable Palm Oil: rspo.org

Aquaculture Dialogues

Shrimp: www.worldwildlife.org/what/globalmarkets/aquaculture/dialogues-shrimp.html

Salmon: www.worldwildlife.org/what/globalmarkets/aquaculture/dialogues-salmon.html

Mollusk: www.worldwildlife.org/what/globalmarkets/aquaculture/dialogues-molluscs.html

Tilapia: www.worldwildlife.org/what/globalmarkets/aquaculture/dialogues-tilapia.html

Freshwater Trout: www.worldwildlife.org/what/globalmarkets/aquaculture/troutdialogue.html

Pangasius: www.worldwildlife.org/what/globalmarkets/aquaculture/dialogues-pangasius.html

Abalone: www.worldwildlife.org/what/globalmarkets/aquaculture/dialogues-abalone.html

Seriola and cobia: www.worldwildlife.org/what/globalmarkets/aquaculture/seriolaandcobiadialogue.html

Marine Stewardship Council: The MSC works with partners to transform the world's seafood markets to a sustainable system. With the help of experts, MSC developed standards for sustainable fishing and seafood traceability. These ensure that MSC-labeled seafood comes from, and can be traced back to, a sustainable fishery. The MSC meets the highest benchmarks for credible certification and eco-labeling programs, including the UN Food and Agriculture Organization guidelines and the ISEAL Code of Good Practice. www.msc.org

Forest Stewardship Council: The FSC sets high standards to ensure that forestry is practiced in an environmentally responsible, socially beneficial, and economically viable way. The FSC guarantees that the wood from a certified well-managed forest is available across the world from a variety of mills, manufacturers, and distributors. www.fsc.org

Rain Forest Alliance: The Rainforest Alliance works with farmers to ensure compliance with the SAN standards for protecting wildlife, wild lands, workers' rights, and local communities. Farms that meet these rigorous standards are awarded the Rainforest Alliance Certified seal. www.rainforestalliance.org

Marine Aquarium Council: The Marine Aquarium Council (MAC) is an international not-for-profit organization that brings marine aquarium animal collectors, exporters, importers, and retailers together with aquarium keepers, public aquariums, conservation organizations, and government agencies. MAC's mission is to conserve coral reefs and other marine ecosystems by creating standards and certification for those engaged in the collection and care of ornamental marine life from reef to aquarium. www.aquariumcouncil.org

ANNEX 4: LIVELIHOODS FRAMEWORKS

Sustainable Livelihoods Framework[11]

The sustainable livelihoods (SL) framework is a visual representation of the sustainable livelihoods approach to poverty eradication based on core principles of people-centered, participatory, sustainable activities. The SL framework places people and their priorities at the center of development and recognizes that there is a multiplicity of actors, influences, livelihoods strategies, and outcomes. While the SL framework was developed for use in normal development situations, the ILO and FAO have used the concept to underpin its "Livelihood Assessment Tool Kit" for use in post-disaster situations.[12]

The SL framework recognizes that livelihoods and the forces that influence them are dynamic. It focuses on poverty reduction interventions that empower the poor to build on their own opportunities, support their access to assets, and develop an enabling policy and institutional environment. While there are several SL frameworks in use, the one referenced in this paper is based on the DFID SL framework, as it is perhaps the best known and the least organizationally specific.[13]

The SL framework represents the factors and dynamic forces affecting peoples' livelihoods, including:

- The priorities that people define as their desired **livelihood outcomes**
- People's access to social, human, physical, financial, and natural **capital or assets**, and their ability to put these to productive use
- The different **strategies** they adopt (and how they use their assets) in pursuit of their priorities
- The **policies, institutions**, and processes that shape their access to assets and opportunities
- The context in which they live, and factors affecting **vulnerability** to shocks and stresses

The SL framework can be used to help select and plan post-disaster livelihoods recovery activities and to assess the contribution that existing activities have made to the sustenance of livelihoods.

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11 Unless otherwise noted, this section draws most heavily on content found on the Eldis Livelihoods Connect Web site and also includes excerpts from others cited at the end of this paper in the section "Sustainable Livelihoods Approaches."

12 FAO and ILO. 2009. *Disaster Livelihood Assessment Toolkit: Analysing and responding to the impact of disasters on the livelihoods of people.*

13 The DFID model builds on other organizations that use or have adapted the SLA; these include ILO, FAO, UNDP, WFP, IFAD, ODI, CARE, Oxfam, and Cooperative Housing Foundation.

Livelihood Assets

At the core of the SL framework are people's livelihood assets. The SL framework takes a broad view of these and expresses these assets as an "Asset Pentagon," which includes the following[14]:

- Human capital: skills, knowledge, health and ability to work
- Social capital: social resources, including informal networks, membership of formalized groups, and relationships of trust that facilitate cooperation
- Natural capital: natural resources such as land, soil, water, forests, animals, and fisheries
- Physical capital: basic infrastructure such as roads, water and sanitation, schools, and ICT, and producer goods, including tools and equipment
- Financial capital: financial resources including savings, credit, and income from employment, trade, and remittances

Households with many livelihood assets are generally more resilient or better able to withstand shocks than are households with fewer assets. Resilient *farming households* have sufficient savings to buy food when crops fail; resilient *small traders* have sufficient cash to buy new stocks of raw materials after a disaster has destroyed their previous stock; and resilient *pastoralists* can afford to lose or sell a few animals and still have enough to build up their herds again after the emergency passes.[15]

The SL framework helps one see that natural capital (e.g., land, forests, mangroves, animals) is just one asset amongst many and has to be seen in conjunction with other assets in order to understand its importance in an overall livelihood strategy. If one is interested in reestablishing or preserving natural capital, one needs to understand the dynamic relationship of natural capital to these other assets, and to people's wider vulnerability context, structures, institutions and processes, livelihood strategies, and desired livelihood outcomes.

Vulnerability Context

Assets can be destroyed or created as a result of the trends, shocks, and seasonal changes in the vulnerability context within which people live. The factors comprising the vulnerability context are important because they can have a direct impact on people's assets and the options available to them to pursue beneficial livelihood strategies. The model presents three main categories of vulnerabilities:

- Trends: population trends, economic trends, resource trends (including increasing tensions and confrontations over resources), government and political trends, technological trends, etc. Not all trends (e.g., technology, medical advances) are negative.
- Shocks: natural disasters, conflicts, economic or financial shocks, epidemics, etc. Shocks can destroy assets directly or force people to dispose of assets as a coping strategy.
- Seasonality: seasonal fluctuations in prices, production, health, and employment opportunities.

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14 Subsequent to the original DFID model, other categories of capital and assets have been identified, including people's political capital (i.e., their power and capacity to influence decisions).

15 FAO and ILO. 2009. *Disaster Livelihood Assessment Toolkit: Analysing and responding to the impact of disasters on the livelihoods of people.*

A *coping strategy* is a short-term response to threats to one's livelihoods. Coping strategies can be successful, in terms of protecting the ability to make a livelihood, when they are able to preserve vital assets, or negative, when they are unable to do so and may lead to further impoverishment. Any response should aim to support existing positive coping strategies and release households and communities from dependence on negative ones.

- Examples of coping strategies following the Kashmir earthquake in 2005[16]:
    - Distress migration to peri-urban areas
    - Selling or slaughtering animals
    - Consuming crops that were either ready for harvest or had just been harvested

The magnitude of the shock, coupled with the low level of assets of the population, meant that for many people these coping strategies were unable to preserve vital assets.

Policies, Institutions, and Processes

People's vulnerability is usually influenced by external factors outside their direct control; it is dependent on wider policies, institutions, and processes that operate from the household to the global level, and within both private and public arenas. These policies, institutions, and processes are important because they determine people's access to and use of various types of assets and livelihood strategies, and can reduce or worsen the impacts of external shocks on vulnerable people.

Policies, institutions, and processes include the interrelated issues of the following:

- Social relations: the way in which gender, ethnicity, culture, history, religion, and kinship affect the livelihoods of different groups within a community
- Social and political organization: decision-making processes, civic bodies, social rules and norms, democracy, leadership, power and authority, rent-seeking behavior
- Governance: the form and quality of government systems including structure, power, efficiency and effectiveness, rights and representation
- Service delivery: the effectiveness and responsiveness of state and private-sector agencies engaged in delivery of services such as education, health, water, and sanitation
- Resource access institutions: the social norms, customs, and behaviors (or "rules of the game") that define people's access to resources
- Policy and policy processes: the processes by which policy and legislation are determined and implemented, and their effects on people's livelihoods

Policies, institutions, and processes can have a great influence on access to assets by creating those assets, determining access to them, and influencing rates of asset accumulation. Those with more assets are more likely to have greater livelihood options with which to pursue their goals and reduce poverty. This dimension of the SL framework also helps us understand how macrostructures in society and the economy enable or constrain the livelihood strategies that can be locally developed.

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16 FAO and ILO. 2009. *Disaster Livelihood Assessment Toolkit: Analysing and responding to the impact of disasters on the livelihoods of people.*

To illustrate how policies, institutions, and processes affect natural resource management, consider how they might influence forests. The public sector's ability to make and enforce legislation impacts people's access to and use of forests. Similarly, the existence (or lack thereof) of local natural resource management organizations influences forestry use legislation and enforcement. The existence (or lack thereof) of markets for forest products influences the types of livelihood options that people and communities might pursue. Culture also influences forestry use depending on what value and symbolism people and their communities ascribe to forests.

Livelihood Strategies

Livelihood strategies are the combination of activities that people choose to undertake to achieve their livelihood goals. These include productive activities, investment strategies, and reproductive choices. Livelihoods approaches try to understand the strategies pursued and the factors behind people's decisions; to reinforce the positive aspects of these strategies and mitigate constraints.

The choice of strategies is a dynamic process in which people combine activities to meet their changing needs. For example, in farming households, activities are not necessarily confined to agriculture but often include non-farm activities to diversify income and meet household needs. Migration, whether seasonal or permanent, is one common livelihood strategy.

According to FAO, one of the most important factors in determining the success of livelihood strategies is people's access to capital assets, although the vulnerability context and the constraints and opportunities posed by wider institutional processes also play a crucial role.[17]

While capital assets can gauge the success of livelihoods that depend on capital assets, there still remain communities that do not have to fill an income gap to sustain a livelihood. An example of this non-capital incentive, community-based livelihood can be observed in areas of Africa and South America where indigenous people do not and have never relied on a monetary income to sustain community or individual viability.

Livelihood Outcomes

Livelihood outcomes are the goals to which people aspire, the results of pursuing their livelihood strategies. Livelihood approaches stress the importance of understanding and supporting poor people's efforts to achieve these goals.

Examples of livelihoods outcomes include:

- Increased income
- Reduced vulnerability
- Increased well-being
- Improved food security
- More sustainable use of natural resources

Livelihoods outcomes are important because they help us understand the results of peoples' livelihoods strategies in a particular context, why people pursue particular strategies, what their priorities are, and how they are likely to respond to new opportunities or constraints.

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17 Cotula, Lorenzo. 2002. *Improving Access to Natural Resources for the Rural Poor – The Experience of FAO and of Other Key Organizations from a Sustainable Livelihoods Perspective.* FAO Livelihoods Support Programme.

The Ecosystem Approach: Twelve Guiding Principles[18]

The following 12 principles are complementary and interlinked.

Principle 1: The objectives of management of land, water and living resources are a matter of societal choices. Different sectors of society view ecosystems in terms of their own economic, cultural and society needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

Principle 2: Management should be decentralized to the lowest appropriate level. Decentralized systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge.

Principle 3: Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems. Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises.

Principle 4: Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:

- Reduce those market distortions that adversely affect biological diversity.
- Align incentives to promote biodiversity conservation and sustainable use.
- Internalize costs and benefits in the given ecosystem to the extent feasible.

The greatest threat to biological diversity lies in its replacement by alternative systems of land use. Land use that degrades the environment often arises through market distortions which undervalue natural systems and populations and provide perverse incentives and subsidies to favor the conversion of land to less biologically diverse systems.

Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs such as pollution escape responsibility. Alignment of incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay.

Principle 5: Conservation of ecosystem structure and functioning in order to maintain ecosystem services should be a priority target of the ecosystem approach. Ecosystem functioning and resilience depends on a dynamic relationship within species, among species, and between species and the natural environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these interactions and processes is of greater significance for the long-term maintenance of biological diversity than simply protection of species.

Principle 6: Ecosystem must be managed within the limits of their functioning. In considering the

18 UNEP. Operational guidance for application of the ecosystem approach. Convention on Biodiversity. www.cbd.int/ecosystem/principles.shtml (Accessed on June 9, 2010)

likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different degrees by temporary, unpredictable or artificially maintained conditions and, accordingly, management should be appropriately cautious.

Principle 7: The ecosystem approach should be undertaken at the appropriate spatial and temporal scales. The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterized by the interaction and integration of genes, species and ecosystems.

Principle 8: Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term. Ecosystem processes are characterized by varying temporal scales and lag-effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones. A balance between fulfilling poor people's immediate needs and human rights and long-term ecosystem health is important to be reached. Otherwise it will be impossible to secure livelihood, disaster reduction and healthy ecosystems

Principle 9: Management must recognize the change is inevitable. Ecosystems change, including species composition and population abundance. Hence, management should adapt to the changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential "surprises" in the human, biological and environmental realms. Traditional disturbance regimes such as periodic wildfires or floods, may be important for ecosystem structure and functioning, and may need to be maintained or restored. The ecosystem approach must utilize adaptive management in order to anticipate and cater to such changes and events and should be cautious in making any decision that may foreclose options; at the same time, however, mitigating actions to cope with long-term changes such as climate change should be considered.

Principle 10: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity. Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems

Principle 11: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices. Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use is desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, inter alia, any decision to be taken under Article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against available knowledge and views of stakeholders.

Principle 12: The ecosystem approach should involve all relevant sectors of society and scientific disciplines. Most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.

GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source: World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future.* Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

9

GREEN

GUIDE TO

DISASTER RISK REDUCTION

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

9

GREEN

GUIDE TO

DISASTER RISK REDUCTION

Charles Kelly, Consultant

NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster response approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on integrating environmentally sustainable approaches into disaster risk reduction.

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MODULE 9: GREEN GUIDE TO DISASTER RISK REDUCTION

Table of Contents

1 INTRODUCTION

1.1 Module Objectives

This module is intended to increase the knowledge of disaster risk reduction (DRR) specialists with respect to the integration of environmental considerations in disaster preparedness, mitigation, risk assessment, and risk reduction.

Specific learning objectives for this module are as follows:

1. Describe the ways in which disaster risk and environmental conditions are linked.
2. Integrate environmental issues into typical disaster risk reduction assessments.
3. Identify a set of ecosystem-based activities that can reduce risk and enhance disaster risk reduction programs.
4. Describe how disaster risk reduction activities can have negative impacts on the environment and how these impacts can be mitigated.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 9 in a series of 10 modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment and taking advantage of opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction to help make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4, 5, and 6 pertain specifically to building construction, with Module 4 focusing on site planning and development, Module 5 on building materials and the supply chain, and Module 6 on building design and construction management. GRRT Modules 7 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

Module 9 is intended for DRR managers, planners, and field staff; hazard-risk assessment teams; and other practitioners responsible for planning and implementing post-disaster recovery and reconstruction efforts.

1.4 Module Key Concepts

1. **DRR and the environment are linked.** In many cases, the root cause of disaster risk is a degraded environment. The use of environmental management to reduce disaster impact is often less costly, more effective, and more socially sustainable than more traditional structural measures. When structural disaster risk reduction activities are used, however, it is critical that they address

environmental sustainability so that future risk is not increased and neighboring communities are not adversely affected.

2. **Risk assessments should include environmental considerations and participatory involvement of disaster-threatened communities.** There are a number of procedures and tools used for a participatory assessment of disaster risk, including capacity and vulnerability assessment and community-based disaster risk assessment. Root cause analysis is essential to an understanding of the underlying causes of vulnerability, and to addressing these causes in the risk reduction process. In order to address root causes of disaster risk, it is important to consider the extent to which a community's disaster risk is linked with environmental management practices (e.g., increased flood risk that is caused by the conversion of natural landscapes to agricultural areas). The use of participatory assessment tools is critical for successful risk reduction, as it is individual communities and members who are directly affected by disaster risk and who need to take action to reduce this risk. It is unlikely that risk reduction efforts will be successful without local participation and support during the assessment stage. In terms of environment-based risk reduction, local participation is critical to success, as environment-based approaches require a holistic approach and may require short-term reductions in access to natural resources. Such efforts will not succeed without local agreement.
3. **There is a set of ecosystem-based activities for risk reduction that should be considered alongside more conventional, infrastructure-based activities.** A few examples include stabilizing hillsides with vegetation, creating open spaces to absorb floodwaters, and restoring mangrove cover for coastal protection against storm surge. These approaches can be an integral part of disaster risk reduction planning that would also include early warning systems, response capacity, and infrastructure-based approaches.
4. **Environment-based DRR should be integrated into development programming as well as pre- and post-disaster humanitarian action.** Much of disaster management involves actions that reduce the risk from immediate disaster impacts, such as warning and evacuation systems, capacity building, and structural measures to limit hazard impacts (e.g., embankments and flood-prevention walls). DRR needs to be an integral part of humanitarian action and development programming, where potential risks are identified and addressed through the action provided. These longer-term risk assessment and reduction efforts should include the environment as a source both of hazards and the means to reduce or avoid disaster impacts.

1.5 Module Assumptions

This module is intended to increase the knowledge of DRR specialists with respect to the integration of environmental considerations in risk assessment and risk reduction. The workshop participants are expected to have a strong grounding in DRR, including knowledge of community-based disaster risk assessment and reduction tools and procedures. The authors of this module acknowledge that there is a variety of terminology describing the elements of disaster risk management. This module focuses on the environmental issues associated with the risk assessment process and risk reduction activities (i.e., mitigation).

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Climate change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation.

Disaster risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk.

Disaster risk reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards).

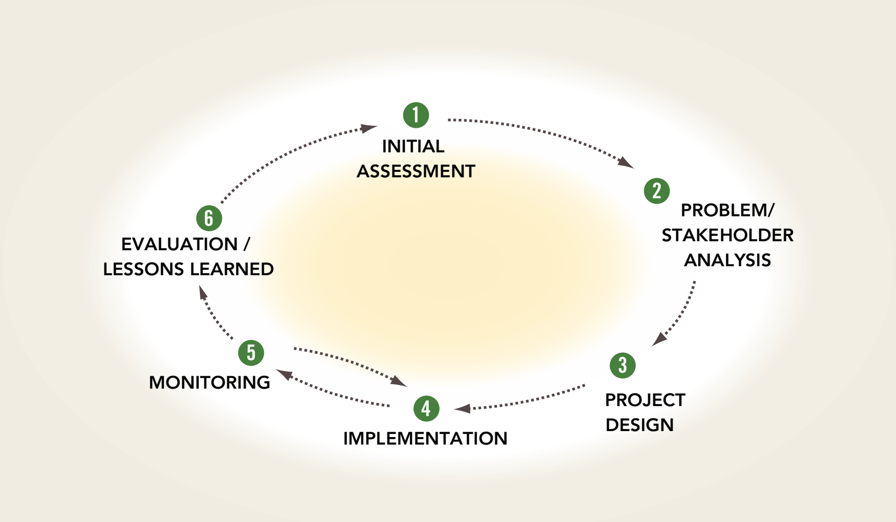
Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Vulnerability: *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies.

2 PROJECT CYCLE AND DISASTER RISK REDUCTION

In planning and carrying out their disaster response activities, many humanitarian agencies follow a standard project management cycle, as shown in Figure 1.

FIGURE 1: STANDARD PROJECT MANAGEMENT CYCLE



The focus is often on DRR in disaster preparedness (e.g., early warning, evacuation planning) and in post-disaster response (integrating DRR into recovery). DRR should be integrated into all stages of disaster response and development activities.

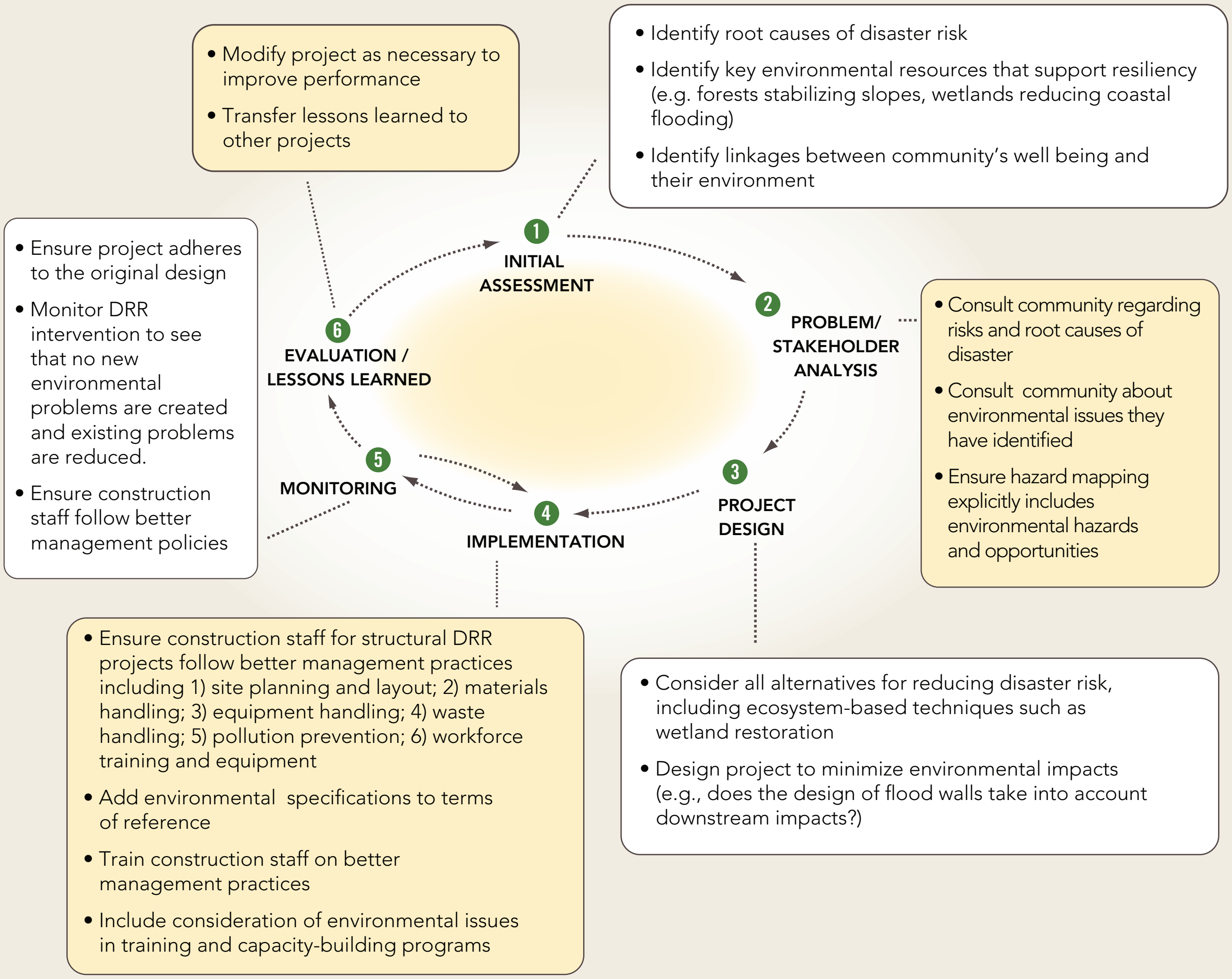
In developing DRR projects, there are opportunities throughout the project cycle for introducing and reinforcing the principles of environmental sustainability as shown in Figure 2.

At the Initial Assessment phase, it is important to understand the root causes of the disaster risks facing a community and to determine if there are environmental links. For example, if a community identifies flooding as a hazard, examine if there are environmental factors, such as deforestation, that are contributing to the risk. Similarly, if there are environmental factors that are strengthening resilience, such as the availability of natural resources (e.g., fish) for livelihoods, these should be noted as well. A more detailed discussion about integrating the environment into Disaster Risk Reduction Assessments is contained in Section 3.

During the Problem/Stakeholder Analysis phase, it is important to engage a wide range of relevant stakeholders, the community in particular, to better understand the environmental context and the major actors in the project area. This will also help with buy-in for the long-term success of the project. Communities should be asked, specifically, what environmental issues are most important to them. In addition, environmental expertise should be accessed from NGOs, as well as from government environmental and natural resource ministries to better understand local context and increase participation in DRR.

During the Project Design and Implementation phases, the project designers should be sure to consider all of the alternatives for reducing disaster risks, including structural and nonstructural solutions. Ecosystem-based solutions such as mangrove rehabilitation should be considered as part of this process. The environmental impacts of implementing a DRR project (such as building a flood wall or raising houses) should be considered and minimized in order to reduce future risk and vulnerability.

FIGURE 2: PROJECT CYCLE WITH OPPORTUNITIES FOR INTRODUCING ENVIRONMENTAL SUSTAINABILITY PRINCIPLES INTO DISASTER RISK REDUCTION PROJECTS



During the Monitoring phase, the project should be reviewed to ensure that it meets the original specifications of the design and the project performance objectives. The results of the Monitoring phase can be used by project managers to adapt the project as needed during implementation. For example, if a sea wall project is helping one community but increasing flooding in a neighboring community, then the project should be adapted as necessary. The Monitoring phase also informs the Evaluation phase (e.g., midterm and final evaluations) to track the project's progress in meeting objectives. Specific indicators in the project logframe and/or Monitoring and Evaluation plan related to environmental sustainability will help to ensure that the project achieves its sustainability objectives. The integration of DRR into projects is a more cost-effective and efficient way to reduce the impacts of disasters and improve the environmental sustainability of the recovery and reconstruction process.

3 LINKING THE ENVIRONMENT WITH DISASTER RISK REDUCTION

The environment has a significant role to play in reducing the risk of disasters and reducing the impact of disasters once they occur. Well-managed ecosystems can reduce the risk of hazards, such as landslides, flooding, avalanches, and storm surges.[1] Many disasters are either caused or exacerbated by environmental degradation. For example, the creation of drought conditions and the relative severity and length of time the drought lasts are mainly natural phenomena. But drought conditions may be exacerbated by environmental degradation resulting from poor cropping patterns, overgrazing, the stripping of topsoil, poor conservation techniques, depletion of both surface and subsurface water supplies, and unchecked urbanization.[2] Similarly, the root causes of many human conflicts are conflicts over natural resources, such as timber in Liberia, water in Bolivia, and diamonds in Sierra Leone.[3]

Protecting and restoring ecosystems is a project activity that disaster risk reduction managers can use alongside of other DRR techniques like the construction of drainage infrastructure, early warning systems, and training and capacity building. For instance, wetlands can be used as flood-retention areas – a use similar to their natural function – or vegetation can be used to stabilize erosion-prone slopes. **Environment-based risk reduction interventions can have a lower cost and lower maintenance requirements than do traditional engineered interventions, such as concrete floodwalls. According to the World Bank, investments in preventive measures, including maintenance of healthy ecosystems, are seven-fold less costly than the cost incurred by disasters.[4]**

The extent to which an ecosystem will buffer against natural hazards and contribute to reducing risk depends on the ecosystem's health and the intensity of the event. Degraded ecosystems can sometimes still play a buffering role, although to a much lesser extent than fully functioning ecosystems.[5]

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1 Sudmeier-Rieux, K. and N. Ash. 2009. *Environmental Guidance Note for Disaster Risk Reduction: Healthy Ecosystems for Human Security*. Revised Ed. Gland: IUCN.

2 International Institute of Rural Reconstruction and Save the Children USA. 2007. *Leaving Disasters Behind: A guide to disaster risk reduction in Ethiopia*. Nairobi and Addis Ababa.

3 Homer-Dixon, Thomas. 1999. *Environment, scarcity, and violence*. Princeton: Princeton University Press.

4 World Bank. 2004. *Natural Disasters: Counting the Cost*. Press release, March 2, 2004.

5 Sudmeier-Rieux, K. and N. Ash. 2009. *Environmental Guidance Note for Disaster Risk Reduction: Healthy Ecosystems for Human Security*. Revised Ed. Gland: IUCN.

PAKISTAN: EARTHQUAKE AND LANDSLIDES

"In this once-remote region, loss of green cover from commercial logging, local cutting, and overgrazing has made the land less compact and less able to retain water, which now rushes easily down mountainsides to set off slides that some call 'ecological land mines.'" Nithin Sethi, of the Delhi-based Centre for Science and Technology

"If there had been more trees, we would not have lost as much. The impact would not have been as great. It is our mistake." Qayoon Shah, teacher at the Jabla village school

Pakistan's geographical position makes it subject to a number of natural hazards, of which flooding, earthquakes, cyclones, and drought/heat waves are the most significant. The earthquake hazard in the Himalaya Mountains is particularly high, due to tectonic movement. Scientists had been predicting a major earthquake in the region for several years, a prediction that came tragically true on October 8, 2005, when Pakistan experienced one of the greatest natural disasters in the region in recorded history. The epicenter of the earthquake, which measured 7.6 on the Richter scale, was in the district of Muzaffarabad, in Azad Jammu Kashmir (AJK), but its effects were felt over an area of approximately 30,000 km^2 in AJK and the North Western Frontier Province (NWFP).

The October earthquake, being natural in origin, was unavoidable. However, the extent of damage that was caused to human life and property could be attributed to socio-ecological causes, having its roots in policies and actions related to human use of the mountains and their natural resources. Despite the known likelihood of major earthquakes hitting the region, there has been little thought given to mitigation of impacts, and the vulnerability of Pakistan to disaster has been exacerbated by unchecked urban development and extensive deforestation. Large parts of the area affected by the earthquake, for example, have lost considerable forest cover over the last few decades as a result of encroachment, illegal logging, and agriculture – increasing the likelihood of landslides. Today, forests cover about 11 percent of AJK compared with nearly 30 percent in 1947; in NWFP, a study in the Hazara Division found a 52 percent decline in forest resources between 1967 and 1992. AJK is particularly known for its high-quality cedar wood, which had been generating income from timber for decades until a government decision to ban felling in 1997. However, the extraction of "dead, decayed, or diseased" trees allowed deforestation to continue, and with fines for illegal felling at less than US$10 a tree, many villagers continue to use wood for building and fuel.

The commitment of the government of Pakistan to increase the country's area of natural forests has been stated in several policy documents such as the National Environmental Policy 2005 and the Pakistan Poverty Reduction Strategy Paper (PRSP-2003); however, activities on the ground do not always seem to be in line with this policy (e.g.. a proposed development project within the only remaining intact area of the Blue Pine ecosystem in one of the best remaining Himalayan temperate forest areas in Punjab).

The effect of human interference on the environment, and in particular depletion of the forest cover, was studied in relation to landslides around Dehra Dun and Mussoorie in Uttar Pradesh in the Indian part of the Himalaya. Land use and land cover data for a period of 60 years were analyzed. The study found that forested areas accounted for only 9 percent of landslide occurrence, whilst about 60 per cent of the landslides were in nonforested areas that were forested in 1930. That forest clearing accelerates erosion, and thus causes landslides in mountainous terrain, has been discussed for more than a century.

The restoration of vegetation cover will take a long time to decrease landslide risk. A study of the environmental changes in three severely degraded watersheds in the Chamoli district (Central Himalaya) has concluded that even after 20 years of restoration, there is only a marginal reduction in landslide activity. In this case, the stabilization process of the active landslide zones seems to have been quite slow due to the presence of sheared carbonate rocks. Any restoration of forest areas in these highly vulnerable areas will thus have to consider the best way to achieve stabilization as quickly as possible. Experts have suggested that although natural regeneration should be used as much as possible, the plantation and direct sowing of trees, shrubs, and pasture herbs and grasses will enhance the revegetation process of the bare soil. Land-use planning is therefore a key issue in the creation of any kind of environmental stability in the area. Although restoration of forest resources is important, one of the most important land use decisions that needs to be made is the effective protection of the forest cover that remains.

Source: Stolton, S., N. Dudley, and J. Randall. 2008. *Natural Security: Protected areas and hazard mitigation.*

While the use of the environment has considerable scope in risk reduction, two significant challenges exist. First, environment-based risk reduction needs to be grounded in the best possible understanding of the natural environment and the local context. Structural DRR methods such as floodwalls and storm channels require engineering expertise. Similarly, environment-based risk reduction requires consultation with environmental specialists. For instance, use of wetlands to manage flooding needs to incorporate a clear understanding of the frequency, duration, magnitude, and return period of the floods to be managed. If these factors are not accurately included in the design of a risk mitigation activity, then the activity may not, in fact, fully mitigate the expected floods. The result is a false sense of safety and the likelihood of needless loss of life and livelihoods when flooding does occur.

Second, risks change as society and the environment change. For instance, increased urbanization can increase the likelihood of flash flooding even in areas where river flooding may have been managed in an environmentally sustainable manner. As a result, risk reduction interventions need to be designed for change and periodically reviewed to ensure that they remain effective against targeted, newly emergent risks, including changes in socioeconomic and political systems.

If efforts to reduce disaster risks do not take into account the impact on the environment, root causes of risk that link to the environment, and the sustainability of risk reduction activities, risk reduction efforts will likely fail. Risk reduction efforts themselves need to be screened for environmental consequences, because poorly planned risk reduction activities can have negative impacts on the environment and will adversely impact people by increasing risk and vulnerability.

When conducting a disaster risk reduction assessment, it is important to consider the environmental factors that contribute to vulnerability. As shown in this picture from Pakistan after the 2005 earthquake, temporary shelter has been located in a hazard-prone area within a riverbed. Environmental factors that could contribute to vulnerability in this picture include modification of the river upstream that can increase flooding downstream, removal of vegetation along the riverbanks that can increase river flow and velocity, and steep slopes that increase the risk of landslides.
© Karl Schuler/IUCN-Pakistan

4 INTEGRATING THE ENVIRONMENT INTO DISASTER RISK REDUCTION ASSESSMENTS AND DESIGN

As defined by the UN International Strategy for Disaster Reduction, a disaster risk reduction assessment is a method for determining the nature and extent of risk. A DRR assessment analyzes potential hazards and evaluates existing conditions of vulnerability that could pose a potential threat or harm to people, property, and livelihoods, as well as the environment on which these things depend.[6] The assessment typically consists of three components: 1) a hazard assessment to determine the characteristics, frequency, forewarning, duration, causes, and effects of hazards facing a community (e.g., drought, flood, wildfire); 2) a vulnerability assessment to determine who and what is vulnerable, their level of vulnerability (e.g., high, moderate, low), and the underlying reasons for the vulnerability (e.g., 15 families are highly vulnerable to flood damages because they live alongside a stream channel); and 3) a capacity assessment to determine a community's existing capacities to cope with a hazard and any gaps in the capacities. In addition to these three standard components, most disaster risk reduction assessments include an action plan specifying what types of activities need to be undertaken to increase a community's capacity to respond to threats and reduce its vulnerability. The disaster risk facing a community is typically defined as the potential disaster losses, in lives, health status, livelihoods, assets, and services, that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple formula: Risk = Hazard X Vulnerability.

At each stage in the typical disaster risk reduction assessment process, there are opportunities to integrate environmental concerns in order to ensure the long-term sustainability of the DRR intervention. These are described in the following table.

TABLE 1: ENVIRONMENTAL INTERVENTION POINTS IN THE DRR PROCESS

DRR COMPONENT	ENVIRONMENTAL INTERVENTION POINTS
HAZARD ASSESSMENT	Hazards are potentially dangerous or damaging events that negatively affect lives, property, and/or activities. Hazards can be divided into natural hazards (e.g., earthquakes, floods, wildfires, epidemic diseases) and human-made hazards (e.g., conflict, industrial pollution from nuclear or chemical wastes, and environmental degradation). A hazard assessment should examine **root causes** of these hazards to see if they are related to environmental management. For example, if communities identify that flooding is a concern, the hazard assessment team should determine if environmental factors such as deforestation, road construction, urbanization, or topsoil removal are contributing to the root cause of the disaster. This type of analysis will reveal opportunities for addressing root causes by implementing ecosystem-based DRR activities as further described in Section 5.

6 U.N. International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/library/lib-terminology-eng%20home.htm (Accessed on April 1, 2010)

DRR COMPONENT	ENVIRONMENTAL INTERVENTION POINTS
VULNERABILITY ASSESSMENT	Vulnerability is the degree to which individuals, households, communities, or geographical areas are likely to be affected by disaster when hazardous events occur. Communities living in hazard-prone areas may be made susceptible because of physical factors (e.g., location and disaster-resistance of buildings), weak social organization, limited economic opportunities, political processes, and other factors, including the integrity of natural resources.[7] When conducting the vulnerability assessment, project planners should be sure to consider the environmental factors of vulnerability. These include: **Extent of natural resource depletion in the area.** If livelihoods are based on natural resources such as fish, and fish stocks have been depleted, then it will be harder for fishermen to recover their livelihoods after the disaster, and they and their families will be more vulnerable. Similarly, if building materials such as timber and sand are already locally depleted, it will be costly and time consuming to reconstruct infrastructure after a disaster. Local communities will be dependent on outside suppliers for critical needs. **Loss of resilience of the ecological systems.** Coastal vegetation and wetland buffers can play important roles in the protection of coastal communities from storm surge during cyclones and other storm events. If these systems are degraded, then communities will be more vulnerable to disaster impacts. **Exposure to toxic and hazardous pollutants.** Populations that have been under exposure to toxic or hazardous pollutants prior to the disaster will have added difficulty recovering because their health may already be compromised. Disaster events may also further distribute these pollutants within the community and environment, resulting in contamination of soil and water resources.
CAPACITY ASSESSMENT	Capacities are a combination of all the strengths and resources available within a community, society, or organization that can reduce the level of risk, or the effects of a disaster. They can include the physical, institutional, social, or economic means as well as skilled personal or collective attributes such as leadership and management.[8] The capacity assessment represents an opportunity for DRR project managers to identify the root causes of hazards and to see if there are linkages with environmental management. If it is determined that environmental degradation is contributing to hazard risk, then the capacity assessment can help determine what physical, institutional, social, or economic means can be used or enhanced, through DRR interventions, to address this problem.
ACTION PLANNING	Most assessments are undertaken with the idea that they will lead to action. With respect to integrating the environment into DRR action plans, there are two main points to consider: 1. In all DRR activities, project planners should make sure that the intervention does not negatively impact the environment, in keeping with the principles of "Do No Harm." This is particularly the case for infrastructure-based DRR activities, such as road construction, dam building, drainage systems, floodwalls, seawalls, and building relocations. 2. DRR project planners should consider ecosystem-based activities for reducing disaster risk. These include such things as implementing restoration programs (e.g., mangrove planting), setting aside conservation areas (e.g., establishing coastal and river buffer zones), and raising awareness about the importance of good environmental management.

7 International Institute of Rural Reconstruction and Save the Children USA. 2007. *Leaving Disasters Behind: A guide to disaster risk reduction in Ethiopia.* Nairobi and Addis Ababa.

8 UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/library/lib-terminology-eng%20home.htm (Accessed on April 25, 2010)

A full discussion of capacity and vulnerability analysis can be found on the ProVention Consortium Web site, together with a community risk tool kit and specific information on community-based disaster risk management.[9] Specific community-level risk mapping and risk management tools have been developed by the International Federation of Red Cross and Red Crescent Societies (IFRC) (Capacity/Vulnerability Analysis[10]), Oxfam,[11] and the Asian Disaster Preparedness Center,[12] among others.

In addition to the capacity and vulnerability analyses developed by DRR practitioners mentioned above, there have also been several tools developed by climate adaptation practitioners that address both climate change adaptation and disaster risk reduction in the context of better environmental management. A discussion of how to integrate climate change adaptation into disaster risk reduction can be found in the box on the following page.

The Community-Based Risk Screening Tool – adaptation and livelihoods (CRiSTAL)[13] is a tool designed to help project planners and managers integrate climate change adaptation and risk reduction into community-level projects.

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9 www.proventionconsortium.org

10 www.ifrc.org

11 www.proventionconsortium.org/themes/default/pdfs/CRA/PCVA2002.pdf

12 www.adpc.net/v2007/Programs/CBDRM/Default.asp

13 www.cristaltool.org

Wildfire is one type of hazard that is typically considered in a disaster risk reduction assessment. The vulnerability and capacity components of the assessment should include an analysis of the natural resources upon which people's livelihoods depend that can help make communities more resilient in times of disaster. In this photograph, a Kobu tribesman in Sumatra, Indonesia, watches a burning jungle which has been used by generations for hunting and medicinal plants. © Mark Edwards/WWF-Canon

GUIDANCE FOR INTEGRATING CLIMATE ADAPTATION INTO DISASTER RISK REDUCTION ASSESSMENTS AND PROJECT DESIGN

The recovery and reconstruction period after disasters is an important opportunity for project planners to incorporate **climate adaptation** into their recovery activities to make projects more resilient to a changing climate and reduce future disaster risk. There are two main categories of climate adaptation: **facilitating transitions to new conditions, and building resilience and buying time** to adapt to extreme weather events. Facilitating transitions to new conditions is needed when what people once knew as "normal" is no longer the norm, such as occurs with changes in freshwater systems due to melting of snow packs and sea level rise. Building resilience to extreme weather events helps people and nature withstand shocks after extreme events such as severe storms, drought, or flood. In practice, one or both of these approaches may be needed in a particular part of the world; building resilience can be a short-term measure while in the longer term a transition is needed to a new state – buying time in order to facilitate change.

Many of the DRR measures proposed in this module can be applied to help build resilience to climate variability and climate change, once it has been ascertained how people and ecosystems are vulnerable to climate. Because of the difficulty in discerning day-to-day impacts of long-term changes at the local level, it is often more practical and efficient to prioritize immediate and short-term impacts. If communities build capacity to manage and reduce risks in the short term, they should be more empowered to take similar actions in the future. When developing adaptation strategies, it is important to find out what indigenous strategies already exist to withstand shocks, as well as to bring in new technologies that may help communities to cope with conditions they have never seen before (for example, new strains of crops or breeds of livestock that can withstand larger climate fluctuations; environmentally sound water conservation technologies for extreme droughts; or alternative livelihoods or energy technologies to take pressure off forests, enabling them to recover so that there is less risk of future landslides caused by more intense rainfall). In areas that have recently suffered flood damage, and that are expected to become more prone to flooding due to climate change, there is a good opportunity to develop zoning plans that accommodate larger floods in the future.

Microcredit and insurance are important ways to reduce risk in the context of climate change, and help tide people over future shocks so that they are less likely to fall back on the environment and use it in unsustainable ways. Equitable access to land and resources helps build resilience to climate change and enable poor households to withstand and recover from shocks. It is very important to promote good governance and strengthen community institutions – and to create early warning systems that are appropriate for local conditions.

Loss of natural resource species of local importance (for livelihoods, economic development, source of food security, or medicines) is a risk under climate change, as species ranges will shift with new conditions. We know that some areas act as refugia, enabling species to survive in a region when they disappear from surrounding areas: for example, a deep valley that is cooler than the surrounding areas, an area of higher ground, a section of coral reef with cooler currents, or an inland mangrove zone. Depending on local conditions, there may be needs and opportunities to set aside land or marine areas as refugia in which species can continue to survive, and where limited and sustainable harvesting may still be possible. If an integrated ecosystems-livelihoods vulnerability assessment has been done, it may indicate likely areas of refugia. Strong efforts should be made to conserve these refugia and their wild species.

Consider this climate adaption checklist when designing disaster risk reduction assessments and projects:

- ❑ Project planners have contacted local government officials or experts to determine the predicted impacts of climate change within the project area.
- ❑ The project includes specific measures to address predicted changes in climate extremes in the next 5-10 years (e.g., worsening drought, greater frequency of flooding, more intense cyclones).
- ❑ The project design considers the consequences of longer-term, regional climate change effects (e.g., heat stress from rising temperatures, reduced stream flow due to loss of snow pack, sea level rise from melting ice caps).
- ❑ Alternative activities have been considered in terms of their ability to account for future climate risks.

5 ECOSYSTEM-BASED ACTIVITIES FOR REDUCING DISASTER RISK

There is increasing interest in using ecosystem-based activities for the purpose of hazard impact management (e.g., wetland protection, establishment of coastal buffer zones, planting of vegetation) based on the concept that "ecosystem-based approaches can be equally or more beneficial than infrastructure or technology-based solutions."[14]

Healthy ecosystems can provide a suite of benefits to people and communities. These benefits or **ecosystem services** include **regulating services** such as regulation of floods, drought, land degradation, and disease; **provisioning services** such as food and water; **supporting services** such as soil formation and nutrient cycling; and **cultural services** such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintaining ecosystem services, including those that contribute to reduced disaster risks.

To be effective, the use of ecosystem-system based activities requires reliable data on hazard frequency as well as a good understanding of the ecological context, such as the geologic and hydrologic conditions of a given area as well as the plant-wildlife-human interactions that take place. These issues need to be addressed on a location-by-location basis, with decisions on the use of ecological resources arrived at through community consultations. Technical information on how to apply ecosystem-based DRR activities for a specific geographic area can be obtained through consultation with environmental specialists as well as government officials in the environmental, emergency management, and land use planning departments.

COPING WITH STORM FLOW IN MADAGASCAR: THE CASE OF MANTADIA NATIONAL PARK

There is mounting concern, supported by additional evidence from local communities, that the increasing deforestation rate is causing greater flooding in the eastern half of the island of Madagascar, where the monsoon rains are particularly severe.

Mantadia National Park, established in 1989 as an outcome of Madagascar's National Environmental Action Plan, includes the watershed of the Vohitra River. The establishment of the park helped reduce deforestation rates in the area. A study of the economic benefits of the park showed that the reduction in deforestation reduced stormflow and associated losses in farmer's productivity. The results indicated that conversion from primary to secondary forest caused a three-fold increase in storm flow, and conversion from secondary forest to agricultural areas caused up to 1.5 times greater flow. Thus, the analysis concluded that conversion from primary forest to agriculture can increase storm flow by as much as 4.5 times. The study quantified the benefits from forest protection within upper watersheds in terms of reduced crop damage from floods in agricultural plots in lower basins, and concluded that the net value of watershed protection (in 1997) was US$126,700 (to put this figure into perspective, the authors note that in 1991 Madagascar had per capita GNP of US$207).

Source: Stolton, S., N. Dudley, and J. Randall. 2008. *Natural Security: Protected areas and hazard mitigation.*

14 Sudmeier-Rieux, K. and N. Ash. 2009. *Environmental Guidance Note for Disaster Risk Reduction: Healthy Ecosystems for Human Security.* Revised Ed. Gland: IUCN.

Another way to view ecosystem-based activities is through a ridge-to-reef, or ridge-to-valley floor,[15] approach to risk assessment and management. By looking at **regional** environmental impacts beyond a community, this approach focuses on how local actions (e.g., a flood retention wall) impact a broader scale of communities and ecosystems. This approach also highlights needs and impacts that fall beyond the scope of community action, such as protection from glacial lake outbursts or coastal flooding. Addressing these needs may require significant advocacy with provincial or national governments, as well as consultations between communities within and downstream of the ridge-to-reef watershed.

This type of analysis can define an integrated structure of ecosystem-based risk reduction interventions across a number of communities and ecological zones. A ridge-to-reef approach reduces the possibility that risk reduction efforts in one location can increase risks in another; an integrated approach is presumed to be more sustainable and effective than a set of unconnected risk reduction interventions.

The following table, developed from the publication ***Natural Security,***[16] identifies some ecosystem-based disaster risk reduction interventions. The risk assessment results and community consultations are keys to identifying which intervention or interventions are most appropriate. Further, root cause analysis can identify issues of power and conflict that may influence the effectiveness and adoption of specific interventions.

It is important to note that ecosystem-based DRR interventions, like all DRR activities, reduce but does not remove risk. For instance, using forests to stabilize avalanche-prone slopes reduces the frequency of avalanches but not the fact that avalanches will still occur under specific conditions. DRR efforts should use multiple approaches to reduce risk, to ensure that the multifaceted social, economic, and environmental nature of risk is addressed and avoid overstating the extent to which risk is reduced through a particular action.

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15 Ridge-to-reef refers to taking into consideration the environmental conditions from ridge-top to offshore reef (or valley bottom) in planning sustainable interventions to limit negative environmental impacts. Specifically included in this approach is the impact of human occupation of a watershed, including use of forest resources, as well as farming, mining, and other types of land use.

16 Stolton, S., N. Dudley, and J. Randall. 2008. *Natural Security: Protected areas and hazard mitigation.*

TABLE 2: SELECT ECOSYSTEM-BASED HAZARD MITIGATION ACTIONS[17]

HAZARD	ECOSYSTEM-BASED MITIGATION ACTION
FLOODING, INCLUDING RIVER, FLASH, AND SHEET FLOODING	Establish or reestablish overflow space in marshes, estuaries, and open land to reduce size and speed of flooding.
	Create retention ponds in up-slope areas (near top of drainage) to hold back and slow run-off.
	Reduce speed of run-off to reduce flows leading to flooding by planting vegetation and/or by stabilizing slopes through bioengineering.
	Reduce vegetation blocking drainage routes to speed drainage.
	Use channel plugs (rocks and brush to slow water flow) and riprap (rocks to protect channel banks) to slow flows in streams and occasional water channels.
STORM SURGE	Create or reestablish barriers against surge flow from the ocean. The barriers can be permeable (e.g., forests) to reduce the speed and intensity of surges, or impermeable (e.g., natural sand dunes) to stop surges.
LANDSLIDES AND OTHER DOWN-SLOPE MOVEMENTS OF ROCKS AND SOILS	Stabilize slopes with vegetation.
	Change land use to reduce erosion potential (e.g., from cropping to orchards).
	Establish impact zones with little or no human occupation.
AVALANCHE	Stabilize slopes with vegetation.
	Establish impact zones with little or no human occupation.
DROUGHT	Use drought-resistant vegetation for food production, commercial use, and environmental management (e.g., trees for shade).
	Increase soil quality to increase moisture retention during dry periods.
	Use crop diversity and intercropping to reduce impact of dry conditions on mono-crops.
	Maintain agriculture diversity and include wild foods and other indigenous sources of food in agricultural systems.
	Use low- or no-till methods to limit water loss and wind erosion.
	Maintain areas of natural vegetation intermixed with fields to reduce pest impacts.
	Reduce or ban burning of natural vegetation to maintain land cover and reduce evapotranspiration.

HAZARD	ECOSYSTEM-BASED MITIGATION ACTION
HIGH WINDS	Use indigenous vegetation adapted to regenerate following high-wind events.
	Plant wind-resistant vegetation near buildings to reduce impact of high winds.
	Plant trees and bushes to break flow of winds to reduce wind erosion.
HEAVY RAINFALL/HAIL	Use indigenous vegetation for shade and food production to reduce damage caused by impacts.
	See methods above under *Flooding* for dealing with run-off and flooding.
EROSION	Use indigenous vegetation to maintain soil on slopes and areas subject to erosion.
	Construct berms, bunds, and compost pits along contours of erosion-prone hills/slopes to trap or slow the flow of eroded soil.
	See *High Wind*s above on wind erosion.
EARTHQUAKE	Increase spacing between buildings to reduce impact of building collapse.
	Create open areas to serve as refuge following earthquakes. These areas can be used as parks, floor channels, or other public space between earthquakes.
FIRE	Encourage indigenous vegetation if this vegetation is considered to be fire resistant, and reduce the presence of non-fire-resistant vegetation where possible.
	Reduce vegetation load near buildings and habituated areas and avoid the use of non-fire-resistant vegetation in fire-prone areas.
	Reduce vegetation load in forests and wooded areas at risk of burning through controlled burning and/or mechanical treatment, including hand labor to trim trees and bush.

GOOD PRACTICES FOR RISK REDUCTION USING ECOSYSTEMS

- ❑ Maintain natural ecosystems, such as coastal mangroves, coral reefs, floodplains, forest, etc., to help buffer against natural hazards
- ❑ Maintain traditional cultural ecosystems that have an important role in mitigating extreme weather events, such as agroforestry systems, terraced crop growing, and fruit-tree forests in arid lands
- ❑ Provide an opportunity for active or passive restoration of such systems where they have been degraded or lost[17]
- ❑ Promote policies for the protection of ecosystems for the purpose of disaster risk reduction, climate change adaptation, and the other services ecosystems provide

17 Stolton, S., N. Dudley, and J. Randall. 2008. *Natural Security: Protected areas and hazard mitigation.*

REDUCING FIRE DISASTERS THROUGH ECOSYSTEM MANAGEMENT IN THE MEDITERRANEAN

Fire is the main cause of forest loss in the northern Mediterranean, with considerable impact on properties and livelihoods. An average of over 400,000 ha is burnt each year, with a massive 751,798 ha burnt in 2003 alone. National strategies allocating major efforts and resources to firefighting (e.g., buying of hydroplanes and helicopters) have proved to be inefficient in the growing trend of large-scale devastating fires. An integrated fire management strategy should be based on a risk reduction management framework aiming to increase ecological and social resilience to adapt to the complex interrelation between the predicted increase of heat waves and the human-induced impacts on natural ecosystems. In April 2008, IUCN, WWF, FAO, and other partners agreed on a common position – the Athens Statement – for climate change adaptation in Mediterranean forest conservation and management, with a special focus on increasing resilience to major disturbances.

A new forest fire strategy was adopted in Lebanon through a participatory process with the Lebanese government, incorporating a climate change adaptation goal: **Reducing the risk of intense and frequent forest fires whilst allowing for fire regimes that are socially, economically and ecologically sustainable.** IUCN is building ecological and social resilience to climate change impacts in high-fire-risk landscapes by doing the following:

- developing a participatory planning process to design landscape patterns resilient to fire and prevent land use changes that may alter the landscape's traditional mosaic structure and increase fire risk (e.g., the current trend of intensification of pine plantations);
- identifying fuel reduction opportunities through traditional and innovative land uses (e.g., promoting livestock grazing in high-fire-risk areas);
- developing and exploring opportunities to help adopt fire resilient land uses and landscape patterns (e.g., innovative management systems, economic incentives);
- the ecological restoration of healthy forest conditions diversifying forest land with a higher number of native resprouting species, which regenerate better after fire; and
- preventive forest practices and fuel management aiming at reducing high-forest-fuel litter and the landscape susceptibility to fires.

Source: Regato, P. 2008. *Adapting to Global Change - Mediterranean Forests.* Gland, Switzerland and Malaga, Spain: IUCN.

6 ENVIRONMENTAL IMPLICATIONS OF DISASTER RISK REDUCTION ACTIVITIES

DRR seeks to reduce the risk of harm from disasters. However, the implementation of activities defined by disaster risk assessments, or by interventions presumed to reduce risk, itself has a risk of doing harm if the activities do not address environmental sustainability. For instance, a risk reduction intervention to build concrete floodwalls in one location may exacerbate flooding in another location. These "downstream" or unintended impacts are often not incorporated into the planning of DRR interventions.

As a result, DRR activities should be subject to an Environmental Impact Assessment (EIA) to ensure that harm will not be done or, where harm may occur, that mitigation activities are taken and are acceptable to those targeted by the assistance.

The principal aim of Environmental Impact Assessment (EIA) is "to give the environment its due place in the decision-making process by clearly evaluating the environmental consequences of a proposed activity before action is taken. The concept has ramifications in the long run for almost all activity because sustainable development depends on protecting natural resources which are the foundation for further development."[18]

EIA aims to predict environmental impacts at an early stage in project planning and design, find ways to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. With EIA, both environmental and economic benefits can be achieved, such as reductions in the costs and duration of project implementation and design, avoidance of treatment/clean-up costs, and compliance with the mandatory requirements of some environmental laws and regulations.

The context of a classic EIA is often understood to be a non-disaster situation. In such situations, an EIA is often mandated by law for major infrastructure, commercial, industrial, or residential development proposals. It is a widely recognized environmental management tool for mainstreaming the environment into development projects, and has been made mandatory by legal systems in many countries. The EIA process does not have to be a lengthy one, and there are EIA tools that have been specifically developed for the humanitarian setting, such as the Environmental Stewardship Review for Humanitarian Aid (ESR) described below and in GRRT Module 3, Green Guide to Environmental Impact Assessment Tools and Techniques. Many existing DRR assessment tools can also be modified to include EIA components in order to streamline the process. For example, a Community Vulnerability Assessment (CVA) can include a section that clearly examines the environmental impacts of the proposed action items and suggests ways to minimize the environmental impacts.

MINIMIZING THE ENVIRONMENTAL IMPACT OF DRR ACTIVITIES

There are several environmental impact assessment tools available for DRR project planners and managers to determine the environmental impact of their proposed project and take steps to minimize these impacts. One such tool is the Environmental Stewardship Review (ESR) for Humanitarian Aid that was developed by World Wildlife Fund (WWF) and the American Red Cross. The ESR is meant to operate at the project level to analyze how the project may impact or be impacted by environmental factors such as air quality, water quality, water supply, hazardous resources, and natural resources. A full discussion of this topic, and a sample ESR, is contained in GRRT Module 3, Green Guide to Environmental Impact Assessment Tools and Techniques.

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18 Gilpin, Alan. 1995. *Environmental Impact Assessment – Cutting Edge for the Twenty-First Century.* Cambridge: Cambridge University Press.

DRR interventions seek to reduce risk by reducing either hazard impacts or vulnerability levels. Hazard impact reduction often involves efforts to directly modify the environment, such as building a dam to reduce the impact of drought. The environmental impact of the dam is not just about the placement of a new artifact – the dam – in the environment, but is also related to the sourcing of the resources needed to build the dam (e.g., construction of rock quarries and sand extraction from rivers) and the impact of retained waters on river and onshore environmental conditions (e.g., increased malaria or changes in aquatic flora and fauna).

A physical structure built to reduce risk is generally referred to as a *structural intervention*. Interventions such as warning systems, which may also have direct or indirect links to the environment, are generally referred to as *nonstructural interventions*. Ecology-based risk reduction interventions, such as the establishment of wetlands for flood-water retention, are generally considered to be structural interventions, although they may involve less engineering and resource mobilization (e.g., creation of borrow pits[19]) than do more traditional, engineered structures (e.g., flood barriers).

Vulnerability reduction often involves nonstructural activities with a strong focus on building capacity to avoid a disaster (e.g., evacuation planning) or respond to a disaster (e.g., training in first aid). The process of addressing the root causes of vulnerability may also involve actions that have a direct impact on the environment.

For instance, reducing the risk of drought and food insecurity can involve tree planting and intercropping, contouring to retain rainfall, installing water pumps for plant nurseries, and providing credit to buy improved seed varieties and fertilizer. Each of these interventions has an impact on the environment, and some of them can be negative if not managed properly; this is the case, for example, with overpumping ground water or excessive application of fertilizer.

Post-disaster recovery and reconstruction interventions have trade-offs in terms of environmental impacts: Increasing crop production with chemical fertilizers can lead to contaminated drinking water and fish die-offs. Environmental reviews should be conducted in order to determine the positive and negative environmental consequences of undertaking a recovery and reconstruction project.

Where these reviews are effective and are complemented by ongoing monitoring of environmental conditions, the chance that DRR efforts will have an unanticipated negative impact on the environment is reduced.

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19 A borrow pit is a location where soil or sand is taken for use elsewhere in construction.

COST EFFECTIVENESS OF ECOSYSTEMS AS NATURAL BUFFERS TO COASTAL PROTECTION IN INDONESIA.

- One hotel in West Lombok has spent US$880,000 over a seven-year period to restore a 250-meter stretch of beach that had been damaged by past coral mining.
- More than US$1 million has been spent in Bali to protect 500 meters of coastline that is no longer protected by coral reefs.

When marine and coastal ecosystems are degraded and these important coastal defense functions are lost, high economic costs can arise as the examples above from Indonesia describe. Along Indonesia's coastlines, the value of marine and coastal ecosystems in decreasing vulnerability to risks and disasters accrues mainly through damage costs avoided – and these averted losses are typically substantial. A study in Bintuni Bay, West Papua, valued mangroves at US$600 per household per year based on their ability to control erosion. A variety of values have been calculated for the coastal protection functions of coral reefs in Indonesia, depending on their location: Reefs adjacent to sparsely populated areas where agriculture is the main activity have been valued at US$829/km (based on the value of agricultural production that would be lost), reefs adjacent to areas of high population densities at US$50,000/km (based on the cost of replacing housing and roads), and reefs in areas where tourism is the main use at US$1 million/km (based on the cost of maintaining sandy beaches). In total, Indonesia's coral reefs are estimated to have a value of some US$314 million for coastal erosion prevention.

Source: Sudmeier-Rieux, K. and N. Ash. 2009. *Environmental Guidance Note for Disaster Risk Reduction: Healthy Ecosystems for Human Security*. Revised Ed. Gland: IUCN.

In addition to valuable roles in coastal protection and erosion control, mangrove forests serve as habitat for a variety of fish and shellfish critical to livelihoods and food security in tropical regions. Through these ecosystem services, a healthy mangrove forest can reduce the vulnerability of a community both before and after a disaster event. © Jurgen Freund/WWF-Canon

ANNEX 1. RELEVANT AGENCIES AND SOURCES OF INFORMATION

The following organizations and publications provide additional resources that elaborate on the concepts presented in this module.

Organizations

ActionAid: ActionAid is a non-profit organization committed to fighting poverty worldwide. ActionAid's approach to climate mitigation and disaster risk reduction is focused on the effects of climate change and disasters on the rural poor and other vulnerable groups. *www.actionaid.org*

Asian Disaster Preparedness Center (ADPC): The Asian Disaster Preparedness Center (ADPC) is a non-profit organization supporting the advancement of safer communities and sustainable development through the implementation of programs and projects that reduce the impact of disasters upon countries and communities in Asia and the Pacific. Especially relevant to this module is its Community-Based Disaster Risk Management Program. *www.adpc.net*

Emergency Capacity Building (ECB) Project: The ECB Project is a collaborative effort of seven leading humanitarian organizations that aims to improve the quality and effectiveness of humanitarian efforts. ECB offers numerous publications on disaster risk reduction topics, including case studies and pilot project reports. *www.ecbproject.org*

International Federation of Red Cross and Red Crescent Societies (IFRC): IFRC is a leading humanitarian organization that stresses disaster management as one of its core areas. IFRC provides a variety of publications and approaches to risk reduction and disaster response and preparedness. *www.ifrc.org*

Prevention Web: Prevention Web is an information source managed by UN/ISDR that provides current news and information related to disasters and disaster risk reduction around the world. *www.preventionweb.net*

Tearfund: Tearfund is a Christian humanitarian organization that indentifies environmental restoration and disaster reduction as two of its core issue areas. CEDRA (Climate change and Environmental Degradation Risk and Adaptation assessment) is an assessment tool designed to help humanitarian workers in developing countries assess and understand environmental hazards as they relate to disaster risk reduction. CEDRA is available through Tearfund's International Learning Zone Web site. *tilz.tearfund.org*

United Nations International Strategy for Disaster Reduction (ISDR): The ISDR is a system of partnerships under the UN banner with the goal of global disaster risk reduction. ISDR releases a variety of tools, publications, statistics, and other information about disaster risk reduction. *www.unisdr.org*

Publications

Cutter, S. Ed. 1994. *Environmental Risk and Hazards.* Englewood Cliffs: Prentice Hall.

Cutter, S. and E. Arnold. 1993. *Living With Risk: The Geography of Technological Hazards.* New York.

De Dios, H. 2002. *Participatory Capacities and Vulnerabilities Assessment: Finding the link between disasters and development.* Oxfam Great Britain.

ECB Project. 2007. *Emergency Capacity Building Pilot Projects: Promising Practices for Risk Reduction.*

IUCN. 2007. *Disaster Risk, Livelihoods and Natural Barriers, Strengthening Decision-Making Tools for Disaster Risk Reduction: A Case Study from Northern Pakistan.*

La Trobe, S. and P. Venton. 2003. *Natural Disaster Risk Reduction: The policy and practice of selected institutional donors.* Tearfund.

Miththapala, S. 2008. *Integrating Environmental Safeguards into Disaster Management: a field manual.* 3 vols. IUCN.

Shepherd, G. Ed. 2008. *The Ecosystem Approach: Learning from Experience.* IUCN.

Stolton, S., N. Dudley, and J. Randall. 2008. *Natural Security: Protected areas and hazard mitigation.*

Sudmeier-Rieux, K., H. Masundire, A. Rizvi, and S. Rietbergen. Eds. 2006. *Ecosystems, Livelihoods and Disasters: An integrated approach to disaster risk management.* IUCN.

Sudmeier-Rieux, K. and N. Ash. 2009. *Environmental Guidance Note for Disaster Risk Reduction: Healthy Ecosystems for Human Security.* IUCN.

Twigg, J. 2001. *Sustainable Livelihoods and Vulnerability to Disasters.* Benfield Hazard Research Center.

UN/ISDR. 2004. *Living with Risk: A global review of disaster reduction initiatives.*

Wisner, B. 2004. *At Risk: Natural Hazards, People's Vulnerability, and Disasters.* London: Routledge.

GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source*:* World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future*. Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.

10 GREEN GUIDE TO

ORGANIZATIONAL OPERATIONS

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

10 GREEN GUIDE TO

ORGANIZATIONAL OPERATIONS

Owen Williams, World Wildlife Fund

Don Schramm, University of Wisconsin-Madison

NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster response approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on greening organizational operations.

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MODULE 10: GREEN GUIDE TO ORGANIZATIONAL OPERATIONS

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1 INTRODUCTION

1.1 Module Objectives

The purpose of *Green Guide to Organizational Operations* (G2O2) is to provide a clear pathway to improve the environmental performance of an organization's operational activities. The Guide contains steps that can be used by managers or operations staff to establish a greener, more environmentally friendly operation by making adjustments to different aspects of an organization's operation including energy use, heating and air conditioning, travel, water use, waste management, infrastructure, and paper consumption. The G202 is therefore a guide for helping organizations to establish their own green "standard operating procedure." Operational functions are the focus of many of the action areas of the Guide because these areas have a significant impact on local environments, and a cumulative effect on the regional and global environment.

Operational improvements apply to all organizations, regardless of their mission, area of business, or sector. Whether a humanitarian aid organization, supermarket, legal office, or government ministry, every organization can take steps to improve its environmental performance. The framework provided by the G2O2 is meant to be flexible so it will be useful to any organization, but detailed enough to provide concrete examples for organization-specific greening practices. The G2O2 is also geared toward office environments, but the principles apply to industrial and other workplaces as well. The practices may be implemented in a formal way, through an environmental management system for tightly controlled and regulated performance, or in an informal but systematic way that allows results to be monitored. Another aim of the G2O2 is to institutionalize the principles of greening and to promote the integration of greening in all appropriate areas of an organization's work.

The Guide is based on the World Wildlife Fund's (WWF's) experience working with humanitarian organizations and on WWF's internal greening practices, and contains fully functional, accessible ideas for reducing an organization's environmental footprint, presented in a systematic way. Information about guidelines from other organizations is contained in Annex 2.

There are many generalized environmental standards systems that offer a certification or official recognition, such as the US Green Building Council's Leadership in Energy and Environmental Design (LEED) standard or the Organization for International Standards (ISO) 14000 series. These systems present formal standards and targets for organizational greening. These environmental standards systems can complement the G2O2 guidance described here and are a source of additional ideas.

The G2O2 is set up in the approximate chronological order for creating a green standard operating procedure at your workplace. It begins with the establishment of a baseline of environmental performance from which to improve (Section 2). Then it helps organizations set goals and describe the strategies that will be used to reach them (Section 3). The next section covers methods to establish responsibility for executing green practices to be sure they do not get lost in the shuffle of our busy workplaces (Section 4). Monitoring takes place throughout the life span of green practices and ensures that we meet our targets, understand our results, and continue to raise the performance bar (Section 5). The body of suggestions for green practices is contained in the Action Item section and the final section concludes with some of the additional benefits that come with successful institution of green practices, and ways to take advantage of them (Section 6).

Specific learning objectives for this module are as follows:

1. Describe the three core strategies of Green Organizational Operations and how they can be used to implement a plan for reaching greening goals and targets.
2. Assess opportunities for improving the environmental performance of the operational aspects of organizations and identify specific areas to address.
3. Describe three examples of "action items" for greening and discuss how they can be instituted within each of the core strategies.
4. Assign responsibility, motivate staff, and develop a green team to participate in greening efforts.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 10 in a series of 10 modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster and conflict by minimizing harm to the environment and taking advantage of opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction to help make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4, 5, and 6 pertain specifically to building construction, with Module 4 focusing on site planning and development, Module 5 on building materials and the supply chain, and Module 6 on building design and construction management. GRRT Modules 7 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

The audience includes humanitarian aid workers, conservation practitioners, local communities, government, and donor organizations that are interested in improving the environmental performance of their operations. Office and facilities managers, procurement officers, administrators, project managers, and office assistants are all target audiences for this module.

The GRRT focuses on those people working on the ground as part of disaster recovery and reconstruction efforts and includes staff involved in the design, implementation, and management of recovery and reconstruction. This module, however, has a broader application and is intended to be a resource for any organization that has headquarters and field offices with staff who have decided to apply the principles of sustainability to their own work environment.

The implementation and modeling of sustainable environmental practices is a particularly valuable opportunity for humanitarian organizations. In order to provide appropriate assistance to survivors of disasters and conflict, organizations have a special responsibility to model principles of sustainability as a disaster response strategy. Humanitarian organizations can then encourage their partner organizations to adopt similar behaviors and technologies. Lastly, they have an additional responsibility to their donors to be good stewards of the donors' resources, beginning with good stewardship of the environment.

1.4 Module Key Concepts

1. **Implementing greening plans:** Implementation of a greening plan begins with articulating an interest in and establishing overall objectives for greening. It is necessary to establish a starting point by assessing current green practices, environmental performance levels, staff knowledge, and current monitoring mechanisms.
2. **Strategies and action for greening:** Three strategies for greening are 1) establishing organizational policy, 2) making operational investments, and 3) changing employee behavior. These strategies are used to implement a plan through the action items that fall within each one. Action items represent the technical core of greening efforts. They represent policies, investments, and behavior changes that generate improvements in environmental performance. They are manifested in a variety of categories such as energy, water, operations, and so on.
3. **Setting objectives for greening:** Objectives for improved environmental performance should be clearly defined and based on the established baseline. Specific targets should be measurable and confined to a defined performance period.
4. **Working with staff:** Managers should provide motivation and education to staff so they can successfully participate in greening efforts. Responsibility for greening should be clearly assigned and may be formalized into job descriptions or green teams.
5. **Sharing results:** Well-organized monitoring systems will measure results in a quantifiable way. Data from monitoring is important to adjusting objectives and to ensuring the success of greening efforts. Longer-term reporting can capture broader changes in environmental performance and can be used to demonstrate the benefits of greening for recognition in a more public way. This recognition can bring about positive public relations and demonstrate corporate social responsibility.

1.5 Module Assumptions

This training module assumes that participants are familiar with organizational operations, processes, procedures, and activities. As this module focuses on how to integrate sustainability into these processes, it is also assumed that participants are committed to the goals of this integration and will continue learning about and advocating for such integration after the close of the training.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Carbon offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent different types of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle.

Green purchasing: Often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents.

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision.

An example of green purchasing is the selection of energy efficient, compact fluorescent light bulbs to replace less efficient incandescent bulbs. Energy efficient products not only reduce the emission of greenhouse gases, but they can also lower an organization's energy expenses. © Bruno Arnold/WWF-Canon

2 INITIAL ASSESSMENT – HOW GREEN ARE YOUR OPERATIONS CURRENTLY?

2.1 A First Step

The first step in greening organizational operations is to take stock of how your organization is doing right now. This will allow you to establish your starting point, from which you can later set goals to improve and measure results. The initial assessment step should help you get a sense of your organization's environmental performance and areas that can be improved. An articulation of the organization's intent and overall objectives will frame the greening work that you do.

Ask yourself: What are my organization's "green" policies and practices? You may already be using some, such as recycling, turning off electrical equipment at night, or buying used furniture instead of new. If you aren't sure, it may be helpful to review some of the action items in Section 6 and see if you practice any of them already. This will give you an idea of your needs and priorities for greening.

SUMMARY OF INITIAL ASSESSMENT STEPS

1. Ask yourself: What are the organization's current green practices?
2. Catalog current green practices.
3. Assess staff knowledge.
4. Review monitoring mechanisms, establish performance baselines, and set up a simple monitoring system to get started, if necessary.
5. Determine and write up the organization's overarching objectives.

Next, catalog your current practices. These will be integrated into your overall plan in the next few steps. For larger organizations, many of these practices will likely be related to the work of your operations or facilities and administration department and possibly the procurement or purchasing department. For other or smaller organizations, these may be practices carried out informally for environmental stewardship purposes or to limit costs of utilities and supplies.

Informal greening practices may be carried out by individual departments or staff without the knowledge of others. It may be helpful to distribute a questionnaire to the organization's employees to assess their knowledge of, interest in, and individual participation in greening practices. This will reveal informal green practices and the level of awareness of your staff, and can help identify staff members who can take on responsibilities for implementing your greening plan. Understanding staff awareness is important for training and motivating those who will be carrying out green practices and policies.

INITIAL ASSESSMENT: SAMPLE EMPLOYEE QUESTIONS

- ❑ Would you be interested in joining an internal committee that is looking for ways to improve our organization's environmental performance (i.e., becoming a member of our "green team")?
- ❑ Do you know how to print double-sided from your printer?
- ❑ Do you know what items or materials can be recycled in this area? Do you know how?
- ❑ Do you turn off any electrical equipment such as computers or copiers when you leave?
- ❑ How far do you commute to work? Do you drive? Would you consider public transportation?
- ❑ What are some areas of environmental interest to you?
- ❑ How do you think our organization affects the environment and how can we improve this?
- ❑ What do you do at home to reduce your environmental impact?

2.2 Investigate Current Monitoring Procedures

Investigate any monitoring procedures that are currently in use for measuring your organization's environmental performance, whether they pertain to greening or not. Electricity, paper, fuel, and water consumption may be tracked by your operations, purchasing, or other departments for financial purposes. This information can be easily converted into a set of performance indicators for greening practices; you will be able to set a baseline and analyze your potential objectives.

2.2.1 An Example of Monitoring Procedures

For example, if you know that your office uses 1000 kilowatt hours (kWh) of electricity on average in one month, you can set this as your expected performance baseline if you were not going to make any changes. When you begin your effort to reduce electrical consumption by installing more energy-efficient appliances or instituting limits on air-conditioning use, you can measure your results against this baseline by absolute amount saved and by percentage. If your consumption drops to 900 kWh per month, then you have succeeded in reducing electrical use by 10% or 100 kWh. After a year, you can compare results to last year's period performance and gain perspective on the bigger picture of your conservation effort.

2.2.2 Establishing a Quick Baseline

If you don't currently have any monitoring procedures in place, it will be helpful to set up a simple system to determine a baseline of current organizational practices that have a bearing on environmental performance. For example, a running tally of reams of paper used per week can be posted in a copy room or employees can track the number of miles driven on the company car. This system can be fine-tuned later but you need to know where you stand now.

2.2.3 Consider Your Intentions and Goals

When you have assessed your organization's current environmental performance, it is a good idea to step back and consider your overall intentions and objectives in greening your organization. Why are you interested in greening your organization's operations? What do you hope to achieve and how much are you willing to commit to greening in terms of staffing, time, and funds? Articulation of these general reasons for greening creates a guiding direction and rationale for your greening plan and will contextualize individual practices. You will need to draw on this when you set objectives, engage staff, set up monitoring mechanisms, pursue specific practices, and express your commitment to making positive environmental changes. Your interests may also change over time and it is useful to have a record of intentions for progressive adjustments. Remember also that many improvements can be accomplished with minimal (or zero) resource commitment.

2.2.4 Examine Your Motivations

Motivations for organizational greening vary. You may be motivated purely by environmental concerns or you may be interested in reducing your firm's costs in innovative ways. You may have the goal to "practice what you preach" if you are an organization working on natural resources issues or sustainability. Some states or countries may have tax incentives for going green. Displaying leadership in environmental awareness, global citizenship, or corporate social responsibility may be other motivations.

2.2.5 What Is the Appropriate Level of Institutional Integration?

During the process of defining overall goals, your organization should decide on the level of institutional integration that is appropriate. This question asks how your organization will commit to greening practices and to what degree these greening practices will be built into the structure of the organization. Some organizations set official organization-wide policies, create a formal Environmental Management System (EMS), or draft a mission statement or letter of commitment to their board, donors, or shareholders. You may want to institutionalize green practices in job descriptions and employee performance evaluations. Certain departments, such as the operations or facilities departments, may take the majority of the responsibility. Some organizations may decide that informal systems are more appropriate and office volunteers will oversee greening in their unspecified time allotments.

One way to cut your workforce's carbon emissions is by making informed decisions regarding company travel and transportation. When leasing or purchasing vehicle fleets, procurement staff might consider hybrid gas/electric vehicles or vehicles that use alternative fuel sources, such as natural gas. © Edward Parker/WWF-Canon

3 GOAL SETTING

In this section, goals will be established and used to determine what action items are most useful to your organization and how you can strategically plan for their implementation. With the work you have done in assessing the current status of your organization's green operations, you can identify opportunities for improving environmental performance. When these are combined with your overall goals for greening operations, you will be able to make decisions about what action items to implement.

SUMMARY OF GOAL-SETTING STEPS

1. Choose target areas.
2. Choose performance targets and time period.
3. Create SMART indicators.
4. Use core strategies to formulate a plan for implementation.
5. Assess staff knowledge.

3.1 Choosing Targets

Using your overall goals and your itemized baselines, you can identify specific areas of greening interest. You may note that your office consumes a lot of paper or electricity and produces a lot of waste. You may decide that your carbon footprint is an area of interest and choose to limit employee airplane travel. You may want to reduce the impact of a new satellite or field office being opened in the local watershed and habitat. These concerns will become your priority areas and will be addressed by specific action items with defined performance goals.

3.2 Set Performance Goals

Set a performance goal and time period for each area identified for improvement so that real progress will be evident as you continue to track performance. Many goals will have a baseline to work from, such as past electrical power usage, and will have periodic performance measurements. Others will be new activities, such as creating the first recycling program in your office or purchasing less-harmful chemical cleaning products. The performance goals for these activities might be a deadline for implementation instead of a numerical quantity.

3.2.1 Look at SMART Indicators

When setting objectives, it is helpful to have an organizational planning framework to make goals clear and realistic. One such framework is referred to as "SMART" indicators or indicators that are "Specific, Measurable, Attainable, Relevant, and Time-bound." A SMART indicator could be "Reduce paper consumption of our headquarter (HQ) office printers and copiers by 10% between April 1 and June 1 of this year based on our current usage of 200 reams per month." This indicator is specific to the HQ office equipment; it can be measured against the established baseline of 200 reams per month; it is realistic to reduce paper consumption by this amount given the type of work conducted by the office and its financial constraints; it is relevant to the objective of reducing paper consumption; and it sets a realistic and defined time period over which to implement the plan and judge success. Remember to document your objectives and indicators clearly.

3.3 Core Strategies: Policies, Investments, and Behaviors

Once goals and indicators have been set, project planners must develop strategies for achieving these goals. There are three core strategies to implement the goals: **organizational policies, operational investments,** and **behavior changes**. Each goal can be addressed in one or more ways depending on your organization's culture, institutional integration, and financial resources for green practices, as further described below.

3.3.1 Organizational Policies

Organizational Policies are official procedures used to achieve greening goals that affect all relevant departments and employees. By creating an organizational policy, office managers will formalize and systematize greening practices. Establishing a formal policy demonstrates a commitment to greening and offers the potential for comprehensive planning. Depending on the type of policy, there may be organizational cost savings (e.g., reduction in heating and air-conditioning costs because of a policy that sets limits on heating and air-conditioning usage), new investments (e.g., policy requires the purchase of energy-efficient appliances), change in purchasing behavior (e.g., policy requires that paper that is purchased be recycled-content paper instead of virgin paper), or changes in staff behaviors (e.g., policy requires that staff turn off computer monitors at the end of the day). The development of organizational policy to improve environmental performance may require staff time for drafting and managing policy components.

Section 6 of this module contains a set of examples of greening practices that are commonly in use at a number of different organizations. The following table, excerpted from Section 6, provides some examples of **organizational policies** related to recycling and reuse.

	ORGANIZATIONAL POLICY
RECYCLE AND REUSE	1. Institute or enhance the recycling program in your office. 2. Maximize reuse and recycling. 3. Educate employees on recycling procedures.

3.3.2 Operational Investments

Operational investments are financial expenditures that will reduce the organization's environmental impact. These are upfront costs but may also offer a financial return. Examples may include one-time purchases such as an energy-efficient copy machine, ongoing purchases for nontoxic biodegradable cleaning supplies, or the purchase and installation of occupancy sensor light switches.

The following table, excerpted from Section 6, provides some examples of **operational investments** related to recycling and reuse.

	OPERATIONAL INVESTMENT
RECYCLE AND REUSE	1. Provide recycling receptacles if not provided by a public agency. (Contact your recycling company to see if the vendor will provide receptacles.) 2. Negotiate with vendors or building management to recycle goods not accepted by public recycling programs, such as compost, electronics, or ink cartridges.

3.3.3 Behaviors

Behaviors can be changed to green the workplace. These will be carried out by staff in their daily routines and generally have no cost to implement. Behavioral green practices can be carried out by any organization and have the added advantage of transcending the workplace to influence green practices at home, which in turn brings greater environmental awareness to the workplace. An example of a behavioral green practice would be requiring all staff to turn off electrical equipment at the end of the day or promoting the use of reusable water bottles versus disposable plastic water bottles.

The following table, excerpted from Section 6, provides some examples of **behaviors** that an organization's staff could include in regular routines related to recycling and reuse.

	BEHAVIOR CHANGES
RECYCLE AND REUSE	1. All employees recycle paper, plastics, metals, packaging, etc. on daily basis. 2. Ensure proper sorting of materials. 3. Reuse packaging materials.

3.3.4 Combining Strategies: Policy + Investment + Behavior

Thinking about implementing greening practices will help you select your most appropriate practices and clearly identify the pathway and responsibilities to carry them out. This can be done with a single strategy or in combinations depending on how thoroughly you want to reduce your organization's environmental footprint. In many cases, it may be necessary to combine several strategies in order to make significant progress in a given area of interest, such as energy conservation or recycling and reuse.

The following table is an excerpt from Section 6 that shows how the three strategies (policy, investment, and behavior) can be combined to address the various aspects of energy conservation.

ENERGY	ORGANIZATIONAL POLICY	OPERATIONAL INVESTMENT	BEHAVIOR CHANGES
ELECTRICITY	1. Reduce heating, ventilation, and air conditioning (HVAC) hours of operation 2. Require electric utility to use renewable energy sources	1. Install solar panels 2. Purchase energy-efficient equipment 3. Maximize the use of natural lighting 4. Purchase carbon offsets	1. Turn off equipment, lights when not in use 2. Adjust computer power settings 3. Dress in layers
GAS	1. Regulation of heating, hot water 2. Switch to alternative source	1. Purchase solar-powered water heaters 2. Install superior building insulation	1. Conservative use of the thermostat 2. Climate "self regulation," (sweaters, etc.)

ENERGY	ORGANIZATIONAL POLICY	OPERATIONAL INVESTMENT	BEHAVIOR CHANGES
VEHICLE FUEL	1. Institute commuter program 2. Locate worksite near public transportation; bicycle parking 3. Develop policy on videoconferences, telecommuting	1. Use fuel-efficient vehicles 2. Purchase videoconferencing equipment	1. Use of public transport, carpool, bicycles 2. Minimize fleet use 3. Use Skype, WebEx, or other communication devices to reduce travel for meetings

3.4 Prioritizing Activities

As you begin to identify different interventions to green your organization's operation, it may become necessary to prioritize different areas of work. Should you focus on replacing your office's light bulbs with energy-efficient fluorescents? Or should you invest in more energy-efficient photocopy machines? Or should you purchase reusable utensils so that the staff does not need to use plastic disposable knives, forks, and spoons? Or should you institute a new paper recycling program?

The answers to these questions are highly specific to organizational locations, available resources, cultural settings, staff interests, and practical opportunities. In some geographic locations, such as areas with hot climates, the purchase and use of air conditioners is a necessity. In other locations, air-conditioning units are not as necessary and the decision to purchase new energy-efficient air-conditioning units may be replaced by the decision to encourage staff to open more windows or dress in layers. Similarly, depending on the locations and functions of some organizations, it is necessary to purchase and operate vehicle fleets with full-time, dedicated drivers. In other situations, these needs may be met through the periodic rental of vehicles with staff driving themselves. The decision to invest in more fuel-efficient vehicles would only be practical in certain settings. If organizations are renting cars, they may institute a policy to purchase carbon offsets for their vehicle rentals if that is an option.

In some situations, it may be useful to use a standardized assessment tool to weigh different options. One such approach is cost-benefit analysis. Life cycle assessment is another approach and is briefly explained in Annex 3.

4 ENGAGING STAFF

4.1 Assigning Roles and Responsibilities

Someone will need to carry out your plans, and it is necessary to integrate greening practices into the organization's workforce plan. The staff of your organization must be on board with greening practices if you are to successfully reduce your organization's environmental impact. The plan can be institutionalized in different ways, but responsibility for implementing green practices should be assigned. Otherwise, it is easy to lose informally implemented plans in the daily routine of a busy workplace.

SUMMARY OF ENGAGING STAFF STEPS

1. Identify and assign roles and responsibilities.
2. Educate and motivate staff.
3. Develop a green team.

If greening is important to your organization, individuals in the office should be assigned to carry out greening activities and receive recognition for their success. Regardless of the core strategy that is appropriate for your organization, staff will need an allotment of time and space to complete tasks and collaborate. An effective way to do this is to write responsibilities into individual employee job descriptions and performance goals. An office site manager could have the responsibility of implementing greening practices and delegating specific greening tasks to his or her employees. At the least, a responsible person should be identified for each SMART indicator.

One Example

For example, the official job description for the facilities manager at the WWF's United States headquarters includes the responsibility for sustainable sourcing of supplies and engaging staff on office greening. Among other things, the job description states:

> *The Facilities Manager of World Wildlife Fund manages all building operations at the environmental organization's U.S. headquarters building in Washington, D.C. In addition to providing financial and leadership support to WWF's executive team, the manager oversees the institution of successful recycling programs, the purchase of sustainable office supplies and 100 percent renewable energy offsets for building, among other projects.*
>
> *Ensure that all services, products, materials and property improvements are designed and delivered using "Green" building concepts and strategies incorporating design techniques, technologies and materials that lessen the dependence on fossil fuels and minimize our overall negative environmental impact.*
>
> *Measure and monitor building performance against established benchmarks. Use data to recommend initiatives that will reduce costs, increase revenues, reduce energy consumption, and improve efficiencies. Research, develop, and recommend greening practices into WWF's facilities design and practices. Introduce those practices approved by Vice President. Pursue path to obtain and retain certifications, such as LEED certification.*

Motivating Your Staff

If changing job descriptions or employee performance indicators is not an option, some way of assigning responsibility and progress should be created. Greening may not be the primary mission of your organization and can be lost as a kind of "pet project" of just a few interested individuals. Make tasks as clear as possible and create time frames for results.

EXAMPLE: GREENING THE AMERICAN RED CROSS OFFICE IN THAILAND

One of the signature characteristics of the American Red Cross Thailand team is that they always find a way to have fun, and we've learned that introducing new initiatives in the office can be enhanced and ultimately more effective if we find a way to get the team more creatively involved. Since the beginning of the tsunami recovery operations, we had been working with WWF in Thailand on our green recovery program, which had focused mostly on providing technical assistance to the implementation of our water and sanitation project. In late 2008, we realized that all our staff, not just the wat-san team, had a keen interest in the environment and wanted to do more, even just around the office. So we began working more closely with WWF on how to raise awareness and change employee behavior related to green office issues in all seven of our Thailand offices.

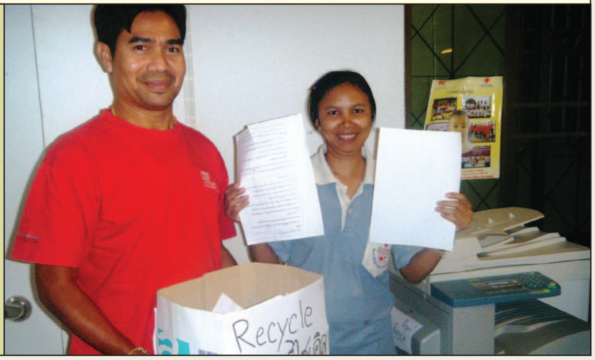
One of the most successful awareness raising and learning opportunities we implemented was to give out bright red reusable water bottles which read, "REDUCE your use of disposable bottles….. REUSE this one instead!" Since all offices already had water coolers available, we sent a strong message that staff should avoid using disposable water bottles, which is a large source of solid waste in Thailand. To date, managers and staff alike continue to self-monitor each other and point out the now "taboo" within our team of buying and using disposable water bottles.

Weeks earlier, we had announced a "Green Office Video Contest" and asked all seven offices to put together a 5-minute video illustrating what their office has been doing to become more environmentally friendly. The results were astounding; not only were the mini-movies wildly entertaining, but each team had done an extensive look at a wide variety of things they were doing to reduce their environmental footprint. Topics included: recycling paper and other materials, carpooling and biking to work, taking reusable containers to lunch places for take-out instead of accepting the usual Thai styrofoam containers, regulating air conditioner temperatures, turning off lights and computers, and keeping agency vehicles well maintained. The wide-range of activities gave each other new ideas of things they could be doing, while the fun nature of the videos not only kept everyone's attention to raise awareness, but gave everyone imprinted memories which they use to continually self-monitor each other around the office.

The awareness raising not only led field staff to take initiative, but it also encouraged managers and the administrative team to begin tangible policy changes and tracking. We've realized that our next steps would be to set up a system to more tangibly track reductions in, or maintenance of, energy levels such as electricity, water and fuel use, purchasing of paper, and solid waste output, to name a few.

Source: Christie Getman, Head of Programs, American Red Cross Thailand

© Chanita Thalang/American Red Cross



In addition, depending on the results of your staff assessment, you may need to train, educate, and motivate your staff to participate in greening efforts, especially if your strategy is going to rely on behavior modification. Your staff are your vehicle for greening and you should offer them leadership and rationale for pursuing green practices. Training can come in the form of formal presentations or through a green team, which will be described below. A staff meeting and/or a "greening memo" could be distributed to kick things off. New hires at the WWF US headquarters are shown a presentation on recycling that includes the image on this page to ensure that they know what can be recycled. Letting your employees know why greening is important and why your organization is pursuing green practices is essential to a successful greening plan.

A Reward System Example

A kind of reward or recognition system may also help encourage participation in greening. American University, in Washington, D.C., for example, awards an "Apple rating" of up to four apples for each class if it meets the university's standard on reduction of paper and energy consumption. Three main considerations are that course materials are primarily electronic or reusable, air conditioning is minimized, and natural light is maximized. The apple rating does not carry any financial or other benefits but it does present a light-hearted incentive for professors and students to consider the environmental impact of their classes.

4.2 Developing a Green Team

A green team is a group of office employees who spearhead the implementation and maintenance of greening practices. Green teams can be a highly effective way to engage staff and catalyze or generate enthusiasm for greening practices. The green team can take many forms and carry out many activities, especially those related to behavioral greening strategies or monitoring. A green team can be responsible for carrying out all of the steps of G2O2 or for focusing on the implementation aspect. It can also be a vehicle for communication, creativity, generation of new green practices, identification of new areas to target, institutional memory, or encouragement of green practices in the personal lives of employees. Depending on your approach, green teams can be formal, with meetings, agendas, and successive goals, or they can consist of volunteers who coordinate greening above and beyond their normal duties.

By providing clearly marked, separate receptacles for recycling and waste disposal, an organization can reduce the amount of waste entering into landfills. Office Green Teams can conduct training programs and develop awareness campaigns to educate employees about how to get involved in recycling. Many of the practices that are encouraged in the workplace are often transferred to people's daily lives. © Achala Navaratne/WWF

5 MONITORING AND REPORTING

The best way to observe progress is to systematically record data in a consistent fashion at defined intervals for each SMART indicator. Periodic review of the results of each time period should be conducted so that you can analyze results, draw conclusions, and set future goals. These reports will ultimately demonstrate the effectiveness of each practice in attaining your organization's specific and overall goals.

SUMMARY OF MONITORING AND REPORTING STEPS

1. Set up monitoring system for each SMART indicator.
2. Report periodically and analyze results.
3. Adjust goals and targets

5.1 Spreadsheet Templates

Spreadsheet templates are useful tools for ongoing data collection and can be tailored for each practice with running totals and costs included. The units and frequency of measurement should be defined for each practice. Consistency and accuracy are paramount, but simplicity is also important to keep the results clearly organized and to save employee time on monitoring activities. Depending on how your organization is structured, it may be appropriate to have monitoring take place separately in each department or as a whole. Compartmentalized monitoring may allow you to tighten performance in more specific ways, but requires greater management of monitoring activities.

Spreadsheet Template Example

For example, here is a simple table that could be used for monitoring electric consumption.

MONTH	LOCATION	kWh USED	kWh MONTHLY TARGET	COST	MONTHLY BILL	MONTHLY TARGET MET? [ARE kWh USED BELOW kWh MONTHLY TARGET?]
JANUARY 2010	1st floor	4100	4000	$ 0.06/kWh	$ 246	No
	2nd floor	5500	5600	$ 0.06/kWh	$ 330	Yes
		9600	9800	$ 0.06/kWh	$ 576	Yes
FEBRUARY 2010	1st floor	4000	4500	$ 0.065/kWh	$ 260	Yes
	2nd floor	5300	5000	$ 0.065/kWh	$ 344.50	No
		9300	9500	$ 0.065/kWh	$ 604.50	Yes

Using a chart like this, the WWF US headquarters recorded a reduction of electrical consumption by nearly one-third from 1999 to 2008 as measured by kWh. Many greening practices emphasize reducing consumption, so it is important to track some quantitative element that will directly record your organization's performance, such as amount of paper used or number of pounds of trash. Microsoft Excel spreadsheets simplify the visualization of trends and improvements through their graphing functions. If you are monitoring operational investments, you may wish to have an accounting sheet that is specific only to greening costs, and to separate it from other accounting costs sheets to measure investments and compare savings.

Another Spreadsheet Template Example

It is not always possible to calculate environmental impacts quantitatively. For example, the use of environmentally friendly cleaning supplies will not produce data to demonstrate the reduction of pollution in your local watershed. In this case it is important to remember that your green practice has lowered total contributions to pollution. Thus, your monitoring activity should emphasize the scope of use, the brands, the chemical toxicity, and any other relevant information. Such information should be available from the brands you purchase. An example of a monitoring table is shown below.

MONTH	NUMBER OF BOTTLES OF BRAND X CLEANING SOLUTION (BAD) USED	NUMBER OF BOTTLES OF BRAND Y CLEANING SOLUTION (BETTER) USED	PERCENTAGE OF BRAND Y CLEANING SOLUTION (BETTER) USED [(NUMBER OF BOTTLES OF BRAND Y / TOTAL BOTTLES PURCHASED)*100]	MONTHLY TARGET MET? [MONTHLY TARGET SET BY ORGANIZATION: 50% OF BOTTLES ARE BRAND Y (BETTER)]
JANUARY 2010	25	0	0%	No
FEBRUARY 2010	2	23	92%	Yes

It is necessary to monitor progress at the level of detail at which you are willing to make changes. For example, an organization can track electrical consumption by floor using a submetering system. Dividing in this way requires some extra time but will potentially allow much more detailed analysis and clarity for targeting adjustments. An overall statistical analysis may reveal a general reduction in electrical usage, but subdivided monitoring allows you to home in on the performance of individual areas and troubleshoot more accurately. It may help you determine how you will combine strategies. For example, you may find that purchasing energy-efficient copying equipment may save you a certain amount of electrical usage, in addition to modifying employee behavior by promoting the policy that all computers are turned off at night.

5.2 Reporting

Collecting data at regularly scheduled intervals and creating a summary report may help you capture the "bigger picture" of your efforts and analyze progress and challenges. You may find it useful to present this information to your board of directors, staff, donors, or other interested parties. Displays of the results of your work can focus on financial results, areas of lessened environmental impacts, reduction of consumption, etc.

Summary reports can demonstrate the savings created by your greening. The following table is a simple example of how you can display the results of your greening activities.

GREENING COST CATEGORIES	ONE-TIME INSTALLATION COSTS TO IMPLEMENT GREENING ACTIVITIES ($)	DIFFERENCE BETWEEN OPERATIONAL COSTS BEFORE AND AFTER GREENING ACTIVITY (CHANGE IN $)	OVERALL COST SAVINGS ($)	SAVINGS %
ELECTRICITY	(For example, cost of fluorescent light bulbs = $1,000)	(For example, costs to consider include cost difference between purchasing fluorescent bulbs and purchasing conventional bulbs, and reduced operational costs)		
GAS				
WATER				
PRODUCTION MATERIALS				

Or for demonstrating reduction of impacts, based on whatever data are available:

ENVIRONMENTAL IMPACT CATEGORY	QUANTITY PRODUCED AFTER GREENING ACTIVITY	QUANTITY PRODUCED BEFORE GREENING ACTIVITY	TOTAL REDUCTION	REDUCTION %
EMISSIONS				
TOXICS				
RECYCLING				
LANDFILL WASTE				

For example, the WWF annual report tracks the environmental impact of the paper that is used to produce the 12,000 copies of the annual report, or the equivalent of 20,000 pounds of paper. The publication is printed on 100 percent post-consumer waste, FSC-certified paper. The paper manufacturer provides an “eco-audit” that shows the conservation impact of using this paper instead of virgin fiber paper – and using emission-free, wind-generated electricity:

Trees saved	Pounds of net greenhouse gas emission prevented	Pounds waterborne waste not created	BTUs energy not consumed	Gallons of wastewater flow saved	Pounds of air emissions not generated	Pounds of solid waste not generated	Miles not driven
112	10,407	324	79,655,200	47,768	5,407	5,285	5,857

Reporting is an opportunity to stop and review progress and achievements and to identify future plans. A review should be made of the objectives, targets, and performance and should evaluate the effectiveness of your greening efforts and the need for changes. Compilation and analysis of this data allows you to identify areas for improvement of the system. It will allow you to home in on root causes of environmental impact and to implement corrective measures and preventative actions. You may want to write a short narrative that describes the results and supplement it with statistics.

5.3 Reaching Targets and Making Adjustments

There is always a certain amount of trial and error that will play into your setting of targets. G2O2 data-collection practices can help you experiment and find problem areas. As your data collection progresses and your defined performance period continues, you may be able to foresee your level of success and you may want to adjust your organization's performance. In some cases you may realize that your goal was too ambitious or not ambitious enough in terms of time or performance level. In other cases you may realize that your greening potential was much higher than you thought and you need to raise the bar! As goals are reached successfully, performance levels should be adjusted to maximize "greenness" of the workplace.

Success in this area will rely on the diligence and commitment of responsible parties and managers to proactively monitor progress, think about results and the organizational greening goals, and show leadership and creativity in making adjustments on the fly. Monitoring offers you concrete results from your greening efforts and an opportunity for praise for your organization or the individuals responsible for carrying out your greening plan. Tying these results to your greening effort is important if you are to keep them going or to make adjustments.

6 ACTION ITEMS

This section provides a variety of examples of greening practices that are widely implemented and have a significant impact on greening. They are divided and subdivided into general areas of greening on the left. Examples are given that correspond to G2O2's three strategies of organizational policy, operational investment, and operational behavior. Your creativity and budget are the only limits to what kinds of greening practices can be included here or extrapolated from these ideas.

The purchase of solar panels is an operational investment that can help reduce energy expenses and improve an organization's environmental footprint. Organizations can also implement policies, such as minimizing the HVAC hours of operation and encourage employees to turn off lights and computer monitors when they are not in use. This photograph shows solar panels in the parking lot at Jaen University, Andalucía, Spain. © Claire Doole/WWF-Canon

	OPERATIONAL POLICY	OPERATIONAL INVESTMENT	OPERATIONAL BEHAVIOR
ENERGY			
ELECTRICITY	1. Reduce HVAC hours of operation 2. Require electric utility to use renewable energy sources	1. Install solar panels 2. Purchase energy-efficient equipment 3. Maximize the use of natural lighting 4. Purchase carbon offsets	1. Turn off equipment, lights when not in use 2. Adjust computer power settings 3. Dress in layers
GAS	1. Regulation of heating, hot water 2. Switch to alternative energy sources	1. Purchase solar-powered water heaters 2. Install superior building insulation	1. Use thermostat conservatively 2. Climate "self regulation" (sweaters, etc.)
VEHICLE FUEL (CARS, TRUCKS, PLANES, BOATS)	1. Institute commuter program 2. Locate worksite near public transportation; install bicycle parking 3. Develop policy on videoconferences, telecommuting 4. Require the purchase of carbon offsets for every air ticket purchased	1. Use fuel-efficient vehicles 2. Purchase videoconferencing equipment 3. Negotiate with air travel vendor to purchase carbon offsets for every air ticket purchased	1. Use of public transport, carpool, bicycles 2. Minimize fleet use 3. Use Skype, WebEx, or another free communication device to reduce travel for meetings
PAPER			
OFFICE USE	1. Commit to minimizing paper use 2. Set up internal recycling program and interface with public programs	1. Maximize post-consumer content paper 2. Purchase equipment for long-term electronic storage of documents 3. Purchase printers and copiers that have double-sided printing function.	1. Minimize printing and copying unless necessary, print double-sided always 2. Recycle paper 3. Maximize use of electronic documents instead of hard copies
PUBLICATIONS	1. Screen paper vendors, sourcing of wood, and industrial processing methods	1. Purchase post-consumer recycled paper 2. Purchase paper processed with minimal toxic chemicals such as chlorine 3. Purchase paper made from certified sustainably harvested forests, such as those under the *Forest Stewardship Council* (FSC) 4. Use soy-based ink	1. Print fewer publications 2. Add line at the end of emails that says "Please do not print this email unless necessary." 3. Provide access to soft copies of publications

	OPERATIONAL POLICY	OPERATIONAL INVESTMENT	OPERATIONAL BEHAVIOR
OPERATIONS			
FACILITIES AND ADMINISTRATION	1. Institute environmental management system such as *ANSI, LEED, ISO* standards systems 2. Operate with environmental conservation in mind at all times		
PROCUREMENT	1. Consider the entire life cycle of all supplies and products purchased or used by vendors in house 2. Screen and contract vendors based on environmental criteria	1. Purchase energy-efficient office equipment such as *Energy Star*-rated appliances 2. Purchase nontoxic and biodegradable cleaning supplies 3. Buy goods in recycled, reusable, and recyclable packaging 4. Use reusable supplies such as washable flatware and glasses 5. Purchase recycled furniture manufactured with recycled and non-toxic materials 6. Source locally within a 500-mile radius	1. Encourage employees to reduce consumption of disposables
RECYCLE AND REUSE	1. Institute or enhance the recycling program in your office 2. Maximize reuse and recycling 3. Educate employees on recycling procedures	1. Provide recycling receptacles if not provided by a public agency (contact your recycling company to see if the vendor will provide receptacles) 2. Negotiate with vendors or building management to recycle goods not accepted by public recycling programs, such as compost, electronics, or ink cartridges	1. Ensure that all employees recycle paper, plastics, metals, packaging, etc. on daily basis 2. Ensure proper sorting of materials 3. Reuse packaging materials
OFFICE ENVIRONMENT	1. Regulate heating/cooling for efficiency and conservation 2. Use native landscaping	1. Design architecture of new or remodeled buildings to maximize the efficiency of light, heat, air quality, water 2. Purchase indoor plants that can naturally cool offices and reduce airborne bacteria and noise	1. Promote dressing in layers

	OPERATIONAL POLICY	OPERATIONAL INVESTMENT	OPERATIONAL BEHAVIOR
INFRASTRUCTURE	1. Prioritize considerations for the environmental impact of buildings 2. Strive for certification by a green building system such as LEED, ANSI	1. Invest in sustainable building design and materials 2. Lower environmental impact through careful site selection for new buildings 3. Follow the US or World Green Building Council guidelines on construction or remodeling	1. Advocate for environmental design when considering remodels or new site construction
PRODUCTION			
PRODUCTION MATERIALS	1. Use the *Life Cycle Assessment* methodology to make decisions about materials and processes 2. Commit to using materials with the lowest life cycle impact in production possible	1. Purchase sustainably extracted or manufactured materials such as certified timber, fly ash concrete, or water from sustainable sources	
PACKAGING	1. Set policy on materials used in making packaging 2. Design products for packaging to be reused as a material instead of waste	1. Purchase reusable, low-input packaging materials, such as blankets or recycled cardboard	1. Encourage reuse/recycling of packaging 2. Encourage less consumption where possible
PROCESSES	1. Adopt a "waste as resource" approach to production		

7 PUBLIC RELATIONS AND CORPORATE SOCIAL RESPONSIBILITY

The opportunity to showcase operational greening may be a motivation in itself for greening or it may be an added benefit. You can show your constituents, consumers, or stakeholders that your organization values the environment and therefore respects the needs of all people and of future generations. You can demonstrate that you are proactively trying to reduce pollution, limit further environmental degradation, mitigate climate change, and take action against the exploitation of our natural heritage.

Your greening efforts may be directly tied into your organization's work and may enhance your success. For example, the work of humanitarian organizations or community development organizations should recognize that the environment plays a crucial role in disaster risk reduction and livelihood generation. By addressing environmental issues, you can help to ensure that the mission of your organization is better reflected in your operations.

Integration of your principles and mission with your operations is a sophisticated and admirable way to conduct business. With publication of your successes, not only will you gain a competitive edge, but you have the potential to become a role model for other organizations. Your experiences may be helpful for your partner organizations; they will be encouraged to undertake greening efforts and you will have promoted superior practices in your industry. G2O2 can be easily passed to the next interested party and your organization can become a vector for greening.

WWF

GUIDE TO BASIC RECYCLING

PAPER	• **Only Paper** • **Examples:** white or color paper, sticky notes, glossy or coated paper, magazines, newspaper or clean cardboard (stapled items accepted) • **No** used paper towels or napkins
MIXED RECYCLABLES	• **Clean plastic, cans, all clear and color glass bottles** • **Examples:** yogurt containers, plastic food trays (frozen, or deli style), plastic bags, plastic utensils, plastic drinking cups, aluminum, tin and steel cans • **No** dirty plastics, tinfoil, food wrappers
TRASH	• **Non-Recyclable Items** • **Examples:** used paper towels or napkins, tinfoil or other miscellaneous food wrappers, food, biodegradable plates cups and utensils • **No** recyclable items

ANNEX 1: ADDITIONAL RESOURCES

The following organizations and publications provide a variety of resources that elaborate on the concepts presented in this module.

Organizations

Energy Star: Energy Star connects you with a broad range of tools and resources to help you implement a successful building energy management strategy. The Portfolio Manager is especially helpful. *www.energystar.gov*

Green Building Programme (GBP): As part of the European Commission, GBP aims at improving the energy efficiency and expanding the integration of renewable energies in non-residential buildings in Europe on a voluntary basis. The programme asks owners of non-residential buildings to realise cost-effective measures that enhance the energy efficiency of their buildings in one or more technical disciplines. *www.eu-greenbuilding.org*

International Facility Management Association (IFMA): IFMA is the world's largest and most widely recognized international association for professional facility managers, supporting more than 19,000 members in 78 countries. IFMA provides a variety of tools and publications for improving sustainability in facility operations and management, especially in the area of energy efficiency. *www.ifma.org*

International Organization for Standardization (ISO): ISO is a network of the national standards institutes of 161 countries. The ISO 14000 family of standards addresses various aspects of environmental management including life cycle assessments, environmental auditing, and environmental performance evaluation. *www.iso.org*

Leadership in Energy and Environmental Design (LEED): LEED is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across all the metrics that matter most: energy savings, water efficiency, CO2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. *www.usgbc.org/leed/*

World Green Building Council (WGBC): The WGBC provides an international forum, and champions proven tools that significantly accelerate market transformation from traditional, inefficient building practices to new-generation high-performance buildings; provide "branding"; and transform the skills and knowledge of the industry as a whole. *www.worldgbc.org*

World Wildlife Fund: An international conservation organization that can assist organizations with reducing their environmental footprint and greening their operations. *www.wwf.org.*

Publications

American Society of Heating, Refrigerating and Air-Conditioning Engineers. 2008. *Commercial Building Energy Audits.* Atlanta.

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Fussler, Claude, and Peter James. 1996. *Driving Eco Innovation: A Breakthrough Discipline for Innovation and Sustainability.* Washington: Pitman Publishing.

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Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Graedel, Thomas E. 1998. *Streamlined Life-Cycle Assessment.* New Jersey: Prentice Hall.

Halliday, Sandy. 2008. *Sustainable Construction*. Oxford: Elsevier.

Hitchcock, Darcy, and Marsha Willard. 2006. *The Business Guide to Sustainability.* London: Earthscan.

McDonough, William, and Michael Braungart. 2002. *Cradle to Cradle*. New York: North Point Press.

Roseberry, Rachel. 2008. *A Balancing Act: An assessment of the environmental sustainability of permanent housing constructed by the international development community in post-disaster Aceh.* University of Sussex.

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ANNEX 2: EXAMPLE ORGANIZATIONAL GUIDELINES

Mercy Corps

Mercy Corps is a global humanitarian aid agency engaged in relief efforts for communities impacted by emergencies ranging from natural disasters and war to health and environmental crises. The organization promotes access to financial services and facilitates microfinance mechanisms as a primary component of alleviating poverty and moving communities out of crisis. The following Greener Office Guide presents informal guidelines developed by Mercy Corps.

> *We do have a green team and this helps push forward carbon footprint mitigation, video conferencing, linking expense claims to carbon costs. We are less strong on policies. This, however, is because making a greening policy gets into the finance and operational parts of an agency, and their stability makes fast changes less quick than one would like. That said, the green team "volunteers" find it relatively easy to point to better energy behaviors, which seem to be particularly well adopted when linked to cost savings.*
>
> *Dr. Jim Jarvie*
> *Director – Climate Change, Environment and Natural Resources*

Mercy Corps' Greener Office Guide

Resource-intensive activities are readily associated with factories and manufacturing processes. However, the modern office environment also places significant demands on diminishing resources.

Obvious are the physical resources of office information and communication technology (ICT) equipment, furniture, and paper products. Less tangible are the resources of energy to power office equipment and space conditioning; water through all phases of supply to drainage; and fuel and facilities associated with travel, transport, and freight.

Attached to the everyday use and/or consumption of the resource is its carbon footprint. In other words, the manufacture or provision of any resource gives rise to greater or lesser emissions of greenhouse gases, with their far-reaching and potentially catastrophic effects on global warming and climate change.

Effective and efficient use of the planet's finite resources contribute to a sustainable future, reducing the potential for global warming and climate change while enhancing the financial viability, the bottom line, of the organisation.

Carbon reduction and resource management are interdependent. For the office environment the following need to be addressed:

1. management commitment
2. energy
3. lighting
4. office ICT equipment
5. office furniture
6. paper products

7. heating, ventilation, and air conditioning (HVAC)
8. water
9. travel and transport
10. freight
11. waste disposal
12. carbon reduction policy statement

Occasionally the "green field" situation will arise for which all conservation opportunities appropriate to a new development can be considered for inclusion. More generally, it will be necessary to improve and conserve within the constraints of an existing imperfect office arrangement. Specific options for resource conservation under each of the above headings are considered below.

1.0 Management Commitment

1.1 Important management initiatives require authority and direction. If it is the serious intention of management to boost energy efficiency, reduce waste, increase recycling, review transport arrangements, reduce the carbon footprint of their organisation, and actively instill carbon reduction awareness among staff, careful consideration should be given to nominating someone (or a group of engaged employees) to be responsible for the management of these "Carbon Reduction" processes.

2.0 Energy

2.1 The efficient use of energy begins with the reduction in its use to the minimum necessary for the maintenance of specified systems.

2.2 The "Carbon Reduction" Manager will track energy use, research new products and promote what's needed to take advantage of utility pricing incentives.

2.3 "Green energy" incorporating a proportion of power developed from renewable resources (such as wind-generated electricity) offers a reduced carbon footprint, normally at a modest price premium. The carbon-conscious energy manager will endeavour in a competitive energy supply market to source the highest green-energy content for the lowest price premium.

2.4 Carbon emissions from the use of electrical equipment are calculated directly from the grid electricity emission factor and the kWh annual electricity use. The emission factor for grid electricity as carbon dioxide equivalent is estimated to be around 0.6 kg CO_2/kWh. To put this into context, the electricity consumed by a 1 kWh rated electric heater running for one year will cause to be emitted to atmosphere around 5.3 tons of CO_2!

3.0 Lighting

3.1 Lighting technology has advanced significantly over the years, giving improved illumination for reduced energy consumption. Progress continues to be made. Fluorescent tubes are narrower and are available with more efficient, even dimmable, electronic ballasts.

3.2 In the "new build" situation, careful selection of lighting technology will repay dividends in terms of the annual running costs of replacement and energy consumed.

3.3 Compact fluorescent lamps (CFLs) are much more efficient than the incandescent lamps of dated technology. A 25 watt CFL has the same light output as a 100 watt incandescent lamp and will last typically 10 times longer. They do cost more than the standard incandescent lamp. They are best installed in places where the light is usually on, when their payback time is short.

3.4 An old-fashioned 100 watt incandescent lamp when lit for one year will be responsible for annual emissions of around 530 kg CO_2. The equivalent CFL uses one quarter of the electricity and causes around 130 kg CO_2 to be emitted – distinctly benefiting the environment and the bottom line!

3.5 Let's consider installing 100 CFLs in place of the old incandescents. The lamps would last 10 times longer, use only one quarter of the electricity, and substantially reduce CO_2 emissions (based on emission factor for grid electricity of 0.6 kg CO_2/kWh) as the table shows:

INCANDESCENT	POWER K/ANNUM	EMISSIONS TONNES CO_2/ANNUM	EQUIVALENT CFLS	POWER kWh/ ANNUM	EMISSIONS TONNES CO_2/ANNUM	EMISSIONS REDUCTION TONNES CO_2/ANNUM
100 x 25 watt	21900	13	100 x 6 watt	5256	3	10
100 x 40 watt	35040	21	100 x 10 watt	8760	5	16
100 x 60 watt	52560	32	100 x 15 watt	13140	8	24
100 x 100 watt	87600	53	100 x 25 watt	21900	13	40

3.6 Turn off lights when they are not needed. Appropriate stickers should be positioned beside the switches to encourage this practice.

3.7 Occupancy sensors detect the presence of people in a room. When the room is unoccupied, they turn off the lights. This should definitely be considered for a "new build" situation, particularly where the room occupation is periodic.

3.8 Allow for best use of natural lighting.

3.9 Latest technology should be thoroughly investigated before exterior lighting is specified – a number of options exist (mercury vapour, high-pressure sodium, metal halide) and some may not be appropriate. Exterior lighting generally has a high energy specification. The most effective option is to use only as many exterior lights as necessary and only operate them when they are needed. A simple photocell, time clock, or both can lead to significant savings.

4.0 Office ICT Equipment

4.1 Minimise power consumption of ICT equipment by switching it off (after saving work if appropriate!) when not in use.

4.2 The "sleep mode" facility should be enabled where this is provided.

4.3 Printers, copiers, and fax machines should be specified to include "sleep mode" facility, as they are normally made available 24 hours a day but are in use only intermittently.

4.4 A typical 22" widescreen flat panel monitor in operating mode will consume around 65 watt of electricity, with an annual emission rate of 0.4 tonnes of CO_2. If a "sleep mode" of 2 watt is provided, the benefit of an emission reduction on an annual basis to around 0.01 tonnes of CO_2 is obvious.

4.5 A copier with duplexing facility set to automatically make double-sided copies will cut paper costs, improve the bottom line, and conserve trees all at the same time.

4.6 Raise staff awareness of the need to **switch off when not in use** by providing stickers, notices, and posters to spread the message.

5.0 Office Furniture

5.1 Office furniture should generally be fit for purpose and, in the case of computer stations, be compliant with the Health and Safety (Display Screen Equipment) Regulations 1992 as amended by the Health and Safety (Miscellaneous Amendments) Regulations 2002.[1]

5.2 Subject to the restrictions imposed by 5.1 above, with regard to the provision of office furniture, consider the **reduce, reuse, recycle** options that may be available, taking into account possible internal and external sources of supply.

5.3 Check to ensure that furniture based on wood is manufactured using sustainable sources of supply.

6.0 Paper Products

6.1 The paperless office is still more promise than reality. With today's technology it is (almost!) possible, so "think before you print." For efficient paper use, follow the environmental standard: **reduce, reuse, recycle.** Improving in each of these areas will introduce paper cost savings and cut the need for storage space.

6.2 If hard-copy printing is unavoidable, restrict the number of copies and header pages to the minimum necessary; optimise page margins, font size, line spacing; use duplex (double-sided) printing; minimise the number of pages needed by using the "file/print review/shrink to fit" facility.

6.3 Review and edit draft documents, individually or with colleagues, on screen rather than on paper before committing to print.

6.4 Avoid the use of a dedicated fax header sheet.

6.5 Arrange with a local contractor for the collection and recycle of used paper and card stock, so you can conserve energy and natural resources. Coloured materials are less easily recycled, so keep their use to a minimum, using pastel shade colours if possible.

6.6 Consider using recycled paper.

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1 Note: these regulations are from the United Kingdom national government

7.0 Heating, Ventilation, and Air Conditioning (HVAC)

7.1 Heating with HVAC

1. take control of the HVAC time on/off and temperature controls
2. maintain the HVAC system regularly
3. consider insulation and draft-proofing
4. encourage appropriate dress

7.2 Ventilation and air conditioning with HVAC

1. take control of the HVAC time on/off and temperature controls
2. maintain the HVAC system regularly
3. maintain window openings
4. consider external window awnings, tinted window films, shading
5. consider internal window shades and blinds
6. consider reflective roof and external wall paints and coatings
7. consider deciduous tree shading and eco-roofing (vegetative material)
8. reduce heat loading by remembering to switch off when not in use
9. in extreme conditions, consider ventilating overnight
10. in extreme conditions, consider adjusting working hours

8.0 Water Conservation

8.1 The ecological and cost benefits associated with water conservation arise in a number of ways:

1. reduce water consumption, reducing the energy and cost to supply
2. reduce water consumption, reducing the energy and costs to discharge to sewage
3. take control of the water heating time on/off and temperature controls
4. consider instant water heating at point of use, with "no tank," mains supply
5. consider use of self-close sink taps with aerators, low flush toilet cisterns
6. ensure that leaks are fixed, plumbing systems maintained

9.0 Travel and Transport

9.1 Travel to work arrangements

1. actively promote this opportunity for employees to minimise their carbon footprint
2. from most favoured to least favoured, the alternatives are:
3. home working
4. walk

5. cycle (consider visible, accessible, secure cycle parking; shower/locker facilities)
6. public bus or rail transport
7. pooled car
8. shared car
9. flexible hours of work may promote use of public transport

9.2 Work travel arrangements

1. is the work travel necessary? Consider the following alternatives:
2. email; telephone call; conference call; videoconferencing
3. while meeting the needs of commitments made, and imposed time constraints, every effort should be made to minimise the carbon footprint(s) associated with the journey(s) to be made
4. overnight stays contribute to the work travel related carbon footprint
5. all costs associated with work travel directly affect the bottom line

9.3 Carbon emissions related to travel

1. emissions associated with domestic and international flights are estimated to be as follows:

FLIGHT TYPE	AVERAGE JOURNEY DISTANCE KM	EMISSIONS AS G CO_2/PASSENGER KM	EMISSIONS AS TONNES CO_2/PASSENGER FLIGHT
DOMESTIC	425	158	0.07
SHORT-HAUL INTERNATIONAL	1200	130	0.16
LONG-HAUL INTERNATIONAL	7000	105	0.74

2. emissions associated with various petrol and diesel car travel options (based on average travel of 15000 km/annum), and medium motorcycle (based on average travel of 9000 km/annum) are estimated to be as follows:

VEHICLE TYPE	ENGINE/LABEL SIZE	FUEL CONSUMPTION KM/LITRE	EMISSIONS AS G CO_2/KM	ANNUAL EMISSIONS PER VEHICLE TONNES CO_2
PETROL CAR	<1.4 litre/small	12.6	183	2.7
	1.4-2.0 litre/medium	10.7	216	3.2
	>2.0 litre/large	7.8	296	4.4

VEHICLE TYPE	ENGINE/LABEL SIZE	FUEL CONSUMPTION KM/LITRE	EMISSIONS AS G CO_2/KM	ANNUAL EMISSIONS PER VEHICLE TONNES CO_2
DIESEL CAR	<1.7 litre/small	17.5	151	2.3
	1.7-2.0 litre/medium	14.0	188	2.8
	>2.0 litre/large	10.0	263	3.9
MOTORCYCLE	125-500 cc/medium	24.6	94	0.8

3. emissions associated with bus and train public transport are estimated to be as follows:

PUBLIC TRANSPORT	EMISSIONS AS G CO_2/PASSENGER KM
BUS	40
TRAIN	40

4. Carbon emissions that are inevitable may be offset by funding against Mercy Corps humanitarian aid projects currently taking place in those developing countries that are most at risk from the impacts of global warming and climate change.

10.0 Freight

10.1 Avoid "little and often" reinstatement of office supplies; centralise the buying function

10.2 Within the need to seek the competitive advantages of quality, delivery and price when buying, consider advantages to be gained by buying locally and in appropriate "bulk"

11.0 Waste Disposal

11.1 Source reduction is defined as making less of a product, and may be the result of (1) "lightweighting" (e.g., producing less glass or plastic because bottles are made thinner and lighter), (2) more efficient use of a material (e.g., double-sided photocopying), (3) extending the life of a product, or (4) material substitution (e.g., substituting cans for bottles, or vice versa).

Recycling is defined as remanufacturing a material to make more of the same material, or a different material (e.g., office paper can be recycled to make office paper or tissue paper).

11.2 A policy to **reduce, reuse, recycle** should be implemented by management as the necessary carbon reduction precursor to waste disposal

11.3 The management of waste is a critical business operation; recycling must be maximised at reasonable cost through accredited contractors

11.4 As appropriate, statutory legislation governing the many including technical aspects of waste disposal must be understood and adhered to

11.5 Office consumables that may be collected for recycling are as follows:

1. paper
2. cardboard
3. metal cans
4. glass containers
5. plastics containers

12.0 Carbon reduction policy statement

12.1 Saving energy, conserving water, reducing consumption, recycling waste, and reviewing transport options are individual elements of sustainability. The listing is not exhaustive. A broad policy statement that addresses how sustainability will be promoted within an organisation will make it easier to co-ordinate resources, personnel, and operations.

12.2 As a definitive measure of the extent to which the "Carbon Reduction" policy is being successfully implemented, a template for the calculation of the carbon footprint of the organisation or its functional part should be prepared and analysed annually for trends.

United Nations Environment Programme (UNEP)[2]

The United Nations Environment Programme (UNEP) coordinates environmental action and policy measures within the United Nations central body. UNEP currently focuses on six main environmental challenge priorities, including climate change, disasters and conflicts, ecosystem management, environmental governance, harmful substances, and resource efficiency. The following guidelines are promoted as part of the UNEP operations.

Energy efficiency measures

ENERGY DEMAND	SUGGESTED IMPROVEMENTS
LIGHTING – EXTERNAL	Standalone renewable powered lamps, security lampposts
LIGHTING – INTERNAL	Light emitting diode lighting (reduced wattage)
	Occupancy/movement sensors
	Optimal use of natural lighting
	Have lighting requirements reviewed by experts, determine if lights can be reduced in wattage and number while still meeting desired lighting levels, undertake an assessment of daylight factors
COOLING	Centralized system
	Air-conditioning key/occupancy isolators
	Temperature zoning of buildings
	Free cooling
	Use of air ducts/earth tubes
	Ensure air tightness
	Insulation on internal partitions
	Solar cooling – use photovoltaic (PV) for electricity
	Optimize building orientation (to maximize shading or passive solar)
	Solar tinted glass
	Refrigerants

2 UNEP. 2010. *Assessment of Energy, Water and Waste Reduction Options for the Proposed AMISOM HQ Camp in Mogadishu, Somalia and the Support Base in Mombasa, Kenya*. Technical Report. Geneva.

ENERGY DEMAND	SUGGESTED IMPROVEMENTS
VENTILATION	Zoning of buildings
	Use of variable-speed drives on fans
DOMESTIC HOT WATER	Use of solar heating
	Insulated thermal immersions (tanks)
	Reduced water consumption
	Use of smart controls
SERVER ROOMS	Temperature control and layout
KITCHEN APPLIANCES	A+ rated appliances
	Thermal isolation
	Kitchen energy management plan
SMALL POWER	A+ rated appliances
	Timers on printers/photocopiers and recreation equipment
	Small PV chargers for mobiles and nonessential IT equipment
CONTROLS/ BUILDING MANAGEMENT SYSTEM	Centralize control with simple management system, ensure that local controls have sufficient occupancy and temperature controls
TRANSPORT – OPERATIONAL RESTRICTIONS ON VEHICLES	Restrict vehicle idling
	Introduce speed limiters
	Regular maintenance program
PUMPS AND FANS	Any large fans or pumps should have a variable-speed drive
RENEWABLES AND LOW-CARBON TECHNOLOGIES	Photovoltaic cells (also see solar cooling), keep within draft specification
	Solar thermal (see solar cooling and hot water sections)
METERING	Install meters on main plant and across important areas of site and use of intelligent building management system
THERMAL MODELING	Use thermal modeling at key times within the design stage to ensure optimal building layout

Water efficiency measures

WATER DEMAND	SUGGESTED IMPROVEMENTS
SHOWERS	Use of aerated showerheads.
	Install mixer valves to better control temperature regulation.
TOILETS	Reduce cistern capacity.
URINALS	Use single-flush urinals.
	Use waterless urinals.
HAND WASHING	Install flow regulators.
KITCHEN WASHING	Install flow regulators.
DISH WASHING	Install A-rated machines.
FOOD PREPARATION	Install flow regulators on taps.
LAUNDRY	Install A-rated machines.
METERING	Install meters on locations within the complex where water use is prevalent – ablution blocks, kitchen, toilets.

Waste reduction and disposal measures

WASTE SOURCE	ALTERNATIVE DISPOSAL ROUTES
OFFICE – PAPER	Reduce, reuse, and recycle. Efficient use should be encouraged in printers, reuse for general use (e.g., jotting pads), education.
OFFICE – CARTRIDGES IN PRINTERS, PHOTOCOPIERS	If space allows, these should be stored and returned to the manufacturer. If no space provision, send to landfill.
CARDBOARD – OFFICE AND GENERAL	Cardboard can be bundled, compacted, and sent for recycling in return journeys of provision lorries.
DOMESTIC WASTE PUTRESCIBLE	Biodegradable waste composting, food waste macerators should be used in the kitchen module.
HAZARDOUS WASTE – BATTERIES	Use rechargeable batteries, solar power packs. Other hazardous wastes should be stored and sent for proper disposal on the return leg of provision lorries.

WASTE SOURCE	ALTERNATIVE DISPOSAL ROUTES
HAZARDOUS WASTE – PETROL PRODUCTS	Store in appropriate containers, or use incinerator. Investigate use of biodegradable products.
RECORDING	Accurately record the volumes of waste being produced, and analyze waste streams.
LANDFILL DESIGN	Make space available for a small landfill (associated with waste-reduction measures listed above).

ANNEX 3: LIFE CYCLE ASSESSMENT

Life Cycle Assessment (LCA) – The LCA refers to the idea that all the moments in the "life" of a product should be considered when assessing environmental impacts. The natural environment has survived for billions of years because of the intrasystem recycling dynamic that relieves it of the need to receive new inputs and permanently dispose of wastes. With this in mind, the most sustainable products and processes will not require "new" inputs from the natural environment and will not create any waste that cannot be reincorporated as inputs for the next product. In the LCA, one considers the choices of and extraction methods for raw materials and any environmental changes that result; the processing of extracted materials; the materials' transport, packaging, and disposal; and the final destination of the molecules that the materials consist of.

The LCA concept applies to everything, including products such as food, resources such as gasoline or ethanol, buildings, published materials, etc. The term "post-consumer recycled content" is related to the LCA concept and has become especially popular in consideration of paper products. Post-consumer recycled paper is made of materials that have already passed through the entire life cycle of the previous paper product. That product's disposal leads to the material's use as an input for new paper and eliminates the need to fell additional trees. In addition, alternative methods of paper processing reduce the production of wastes and pollution during the product's creation.

Source: Scientific Applications International Corporation. 2006. *Life Cycle Assessment: Principles and Practice.* Publication prepared for Office of Research and Development, United States Environmental Protection Agency. Cincinnati, Ohio: EPA.

GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form

and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source*:* World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future.* Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists

when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.