



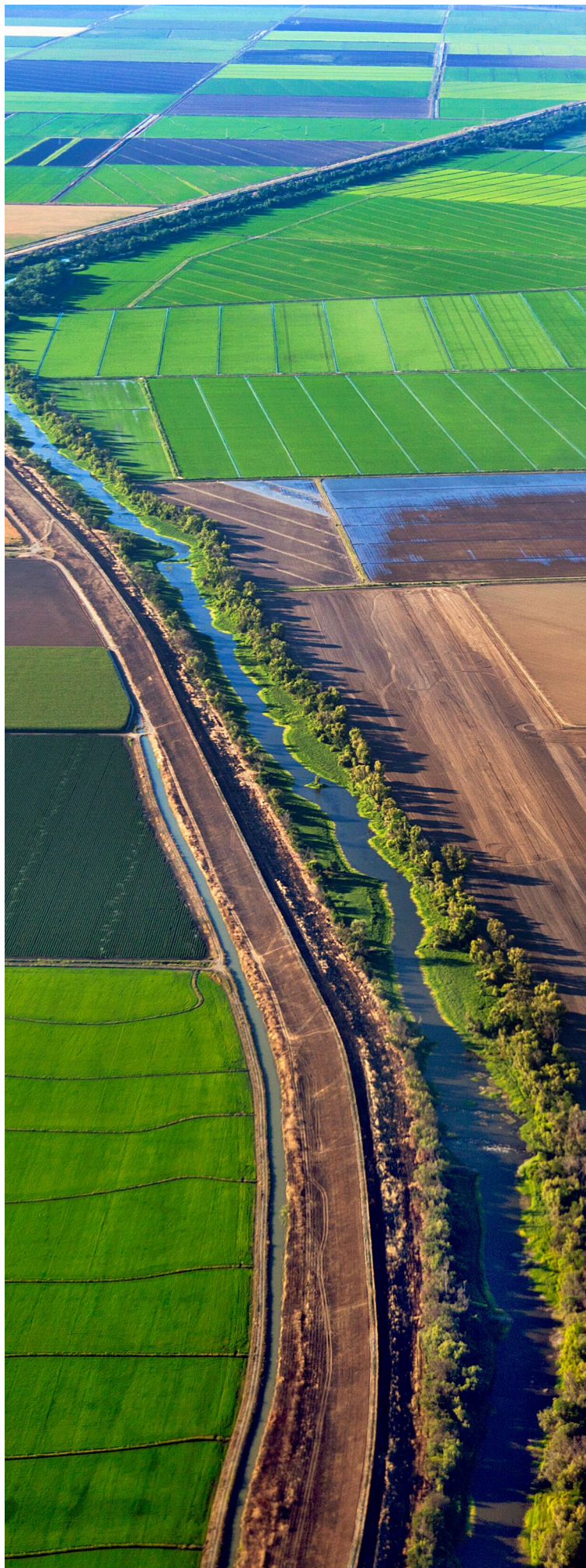
Summary Report

No Food Left Behind: Underutilized Produce Ripe for Alternative Markets



March 2nd, 2018 | Santa Clara University

World Wildlife Fund, Santa Clara University Food and Agribusiness Institute,
with facilitation from Global Knowledge Initiative



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Introduction: Conference Objective and Goals

The **No Food Left Behind: Underutilized Produce Ripe for Alternative Markets** conference was held on March 2nd, 2018 at Santa Clara University (SCU) in Santa Clara, California. The conference was convened by Santa Clara University's Food and Agribusiness Institute and World Wildlife Fund (WWF). The objective of the conference was to present new research findings on post-harvest food utilization to a broad set of interested stakeholders and start a conversation about how to create a produce supply chain in the United States that fully utilizes all edible and recoverable grown produce, maximizing the energy, water, and wildlife habitat that was sacrificed during its production. The primary goal of the conference was to facilitate a dialogue amongst produce supply chain actors, food rescue organizations, growers, technology industry representatives and nonprofit actors, and build consensus around the vision for an ideal future and the pathways or activities needed to get us there. Although it represents a significant economic and environmental issue, farm level food loss and under-utilization of specialty and commodity crop production in the US is not well understood and largely unmeasured. Given the data gap and lack of information, measuring and understanding farm-level losses is a first step towards corrective actions to recover and fully utilize this edible food.

Four institutions presented research findings: Santa Clara University (SCU), Global Cold Chain Alliance (GCCA), North Carolina State University (NCSU), and University of California, Davis (UC Davis), two of which were WWF-funded (UC Davis and GCCA). For the last year, WWF has been working with GCCA and UC Davis on post-harvest loss research for specialty crops. This conference brought in additional researchers from SCU and North Carolina State University to present their findings and begin a conversation with stakeholders from across the supply chain on how the system might be improved.



“Where is the future of food?”

Keynote Speaker:

Jason Clay, World Wildlife Fund, SVP Markets & Food

Jason Clay provided opening remarks, putting post-harvest loss into the context of the greater food system and tying it to WWF's mission to conserve nature and reduce the most pressing threats to the planet's biodiversity. As one of the largest human impacts on the world, food production currently accounts for 70% of biodiversity loss, 70% of freshwater use, 24% of greenhouse gas (GHG) emissions, exploitation of 90% of marine stocks, and the loss of 50% of the world's topsoil. By reducing food loss and waste, increasing sustainable production and shifting major markets and consumer choices to those more socially and environmentally sustainable, WWF works to “freeze the footprint of food”. To avoid additional land conversion to cropland, we must make better use of what we are already producing.

Clay opened the conference with the thought-provoking question, “Where is the future of food?” Due to temperature increases caused by climate change, the U.S. is beginning to see a shift in mid-west soybean, corn and wheat production north and eastward. What does this mean for specialty crops in California?

He hypothesized that the specialty crop region may shift from California to the mid-south Mississippi Delta where land is cheap, soil is rich, and the temperatures are suitable for the growing requirements of most specialty crops.

Lastly, Clay touched upon the objectives of the WWF Food Waste team, within the scope of Markets and Food, which include:

- Developing metrics
- Understanding why loss and waste exist
- Creating awareness about the impacts of food loss and waste
- Working with key sectors to transform markets
- Making it harder to waste food



Digging in: Research Presentations

Four researchers presented their data and findings. Each research group used a different methodology in their data collection. WWF sought to use different methodologies to eliminate biases and allow for differences and subtleties in data to reveal themselves. This is the first look into a representative sample of WWF's specialty crops studies from different regions across the U.S.

Research Presentation 1:

Global Cold Chain Alliance

The Global Cold Chain Alliance is a membership-based association that serves as a platform for communication, networking, and education for each link of the cold chain. Their field team collected on-farm post-harvest loss data using the Commodity System Assessment Methodology (CSAM), a measurement technique based on interviews, observations and in-field measurements from field to packhouse. Researchers gathered data on four specialty crops: peaches in New Jersey, tomatoes in Florida, potatoes in Idaho and romaine lettuce in Arizona.

A few key findings: Romaine lettuce in Arizona showed the highest rates for post-harvest loss in-field, while potatoes grown and processed in Idaho showed the lowest rates. Since romaine lettuce is directly packed in-field (cut, trimmed, and bagged), its packhouse losses are combined with in-field losses. Like romaine, fresh tomato loss rates during four harvests in a single season averaged quite high, hovering around 50%. The highest packhouse loss rates were fresh tomatoes. Examined across all four crops, the main drivers of culling were over-ripeness and product size. Destinations for loss ranged from produce left in field to being tilled under, dumped onto other fields, sent for livestock feed, or sent to donation centers. Throughout the in-field studies there were consistent observations of organic material being left in the field to be tilled under, not being sent to landfill. It is possible that the nutrients and resources put back into the soil from tilling under, minimizes the economic loss of harvesting for an alternative market or for donation.

Food for thought: Why (or when) did the consumer-facing product shift from full head of romaine to only heart? Why is it sold in 3 and 5 packs?

Research Presentation 2:

Santa Clara University
Food and Agribusiness Institute

SCU's Food and Agribusiness Institute (FAI) set out to measure the quantity of salvageable, unharvested produce in local, hand-harvested fields and identify the major reasons for loss. The team measured 20 different crops in 140 fields, from 2016 to 2017. Ranked from highest to lowest level of loss, the crops measured included: romaine hearts, watermelon, green/red cabbage, celery, napa cabbage, iceberg lettuce, romaine lettuce, kale, cauliflower, green leaf lettuce, bunch spinach, round tomatoes, roma tomatoes, broccoli, Brussels sprouts, green beans, cantaloupe, sweet corn, strawberries and artichokes. Reasons for loss included size extremity (too small or large), over-ripeness, mechanical damage and other defects.

Next steps: The FAI research team saw immense opportunity left in the field, and broke down possible next steps into three categories:

- 1 Economics and Policy - incentivizing waste reduction, making a case for making sustainability the easiest option, and focusing on labor markets
- 2 Addressing urban/rural divide
- 3 Engineering solutions: robotics in the field
- 4 Changing consumer expectations

FAI plans to explore the economic drivers, policies, and incentives that could lead to increased utilization of unharvested produce, ensuring that innovation benefits growers, food assistance recipients and the environment.



Research Presentation 3:

Lisa Johnson

North Carolina State University

Lisa Johnson, PhD candidate from NCSU, sought to create easy protocols and videos that could be used by growers or researchers to quickly determine the quantity of edible produce left in their fields. While creating these videos, she continued her research measuring produce left in field in North Carolina, determining the drivers of loss and seeking to understand grower decisions to leave produce in the field.

Johnson categorized produce left in the fields after harvest into three buckets: **marketable**, **edible**, and **unfit**. Marketable produce left in the field meets the current buyer specifications for quality and appearance, but growers are unable to harvest due to inadequate labor or cost. Edible produce is nutritious and safe to eat but has cosmetic deficiencies that do not meet quality standards, such as being off-size, misshapen, blemished, or discolored. Unfit produce is damaged, decayed or over-mature and unsuitable for human consumption.

Johnson measured post-harvest losses of cabbage, summer squash, cucumber, bell pepper, sweet corn, winter squash, watermelon and sweet potato in North Carolina. A range of 4-13 farms were visited for each of the listed crops, in 2-4 different locations. Produce was categorized as the following:

- **Marketable:** Sweet potatoes, bell peppers = High loss
Cabbage, summer squash = Minimal to no loss
- **Edible:** Cucumbers and cabbage = High loss
Sweet potatoes, summer squash = Minimal - Low loss

These results illustrate the need for a market for edible produce, leading farmers to continue to harvest and minimize "walk-by" fields. Across all measured crops, an average of 36%

loss occurred in field. This variability demonstrates the need for more research on specific crops instead of lumping all losses into "vegetable crop" losses.

In the qualitative portion of Johnson's research, 17 growers were interviewed in eastern North Carolina. These 17 growers operate about 20% of the total vegetable production acreage in the state. Johnson wanted to know how growers made the decision to stop harvesting, loss estimations, possible solutions, and familiarity of common gleaning and donation practices. General themes gathered from grower interviews included:

- Lack of value-added product opportunities besides fresh market
- Very high quality standards
- Economics of harvesting off-grade produce does not make sense
- Overripe produce is unusable
- Justification for harvesting off-grade produce when there's another planting coming in behind

After primary harvest, growers ask themselves the following questions before they decide to do a second harvest:

- What's my risk of rejection from buyers?
- Is the price high enough to support harvest costs?
- Are other fields of higher priority?
- Do I have a ready buyer?

To minimize losses, Johnson and the audience acknowledged the importance of connecting growers to alternative/emerging markets in their local region to make it economically worth their while to harvest what may not be initially considered marketable.



Research Presentation 4:

University of California, Davis

UC Davis used a qualitative approach to understand the reasons behind specialty crop loss on farm, the destinations of loss, grower perceptions, and the challenges growers face trying to maximize product efficiency from farm to packhouse.

Lead researcher Annie Gillman interviewed a total of 32 extension agents and 33 growers, visiting 21 farms that produce: leafy greens, fresh peaches, processed peaches, fresh tomatoes and processed tomatoes. Average loss estimates for each of the stated crops were categorized as:

- **Walk-by fields:**
 - When a field is left completely unharvested due to low market prices. If there is no demand for the product, then growers will “walk-by” the field to cut back on harvest and labor costs.
 - Estimated by growers to be quite low across all specialty crops studied
- **Pre-harvest culls:**
 - Items that have fallen onto the ground and are therefore deemed unsafe
 - Estimated as almost none except for fresh tomatoes, averaging around 25% and processing tomatoes ranging in the single digits due to uneven ripening, or what growers call a “split-set”
- **Post-harvest culls:**
 - When a product is purposefully sorted out for not meeting quality or appearance standards
 - These are harder to estimate since growers typically do not oversee the packing operations for most of the crops studied

UC Davis captured the following themes from grower interviews:

- Harvest simply depends on the market. If you can't sell a product, it's cheaper to leave in the field. If the market is not there, it's hard to justify going into the field.
- When there is a sudden change in weather it often leads to off-set times in crop maturity which becomes another contributor of loss.
- Food rescue and food bank donation is dependent on the infrastructure of that food bank to receive, distribute and store the product, otherwise the growers lose money.
- To make it economically worthwhile for growers, companies need to prove there is demand for off-grade product, pay for the marginal cost of harvesting it and establish the logistics to pick up and distribute it.
- If systems aren't in place, it's rare that a grower is going to find the time to create one when it's peak season.

UC Davis also developed life-cycle assessments (LCAs) for romaine lettuce, tomatoes, and peaches that captured the embedded water, energy and fertilizer required to produce and harvest a unit of each crop. The results showed that romaine lettuce required the most energy to produce, primarily driven by tractor diesel use. Fresh tomatoes had the highest water usage rates, mostly in the form of direct use versus irrigated. Fresh tomatoes also had the highest in-field losses compared to the other crops.

Given the resources needed to harvest, transport and store produce that could eventually end up as waste in a retail outlet or consumer home, **it raises the question of whether leaving produce in the field is truly inefficient.** This is a perfect example of why growers must be involved in defining solutions and actionable next steps. Sometimes the best loss is the first loss.



Efficient Delivering of Nutritious Food to 41 Million Americans with Minimal Waste: Opportunities and Challenges to Recovery

With an estimated 41 million Americans facing hunger, recovery and donation of underutilized produce from farms has the potential to close that gap and provide nourishing food to those in need. Sue Sigler (CA. Association of Food Banks), Cindy McCown (Second Harvest Food Bank) and Anne Swanson (Feeding America) joined forces to discuss the major challenges and opportunities around rescuing produce for secondary markets such as food banks. They focused on themes including human capital needs to harvest and process the produce, lack of funding for transport from farm to food bank, and current association requirements that can disincentivize donation (e.g., avocado growers must pay a penny for every item harvested regardless of destination, which adds to the cost of donation). They also discussed how the complexities and sheer magnitude

of the problem are often overwhelming and overlooked. While most agreed that Feeding America, the largest network of food banks in the country, can be part of the solution, they are likely only going to distribute a fraction of what is available, leaving room for many other players and pathways.

The group acknowledged that while there are many challenges that must be overcome they are making progress and have a few big successes. These include the provision of access and choice of fresh fruits and vegetables to under-served communities, including children and teens, and opportunities to further expand access to fresh produce at food banks across the country.



Moving Through the 3 Horizons: Current Challenges, Ideal Futures, & Potential Pathways

The afternoon was spent unpacking the challenges of achieving higher utilization rates of specialty crops and using a systems-thinking approach to identify prototyping opportunities. Participants met in small breakout sessions facilitated by the Global Knowledge Initiative and WWF to move through a series of activities. Though each group was given a distinct prompt, several common themes emerged throughout each conversation as they will in this summary.

Participants first explored the “First Horizon” – identifying the current state of challenges. This is the initial step in envisioning the range of potential futures that may manifest, and the innovative pathways to achieving them. Only once the state of a challenge is clarified can the possibilities for transformation emerge. Here’s a look at the current challenges identified by each prompted group.



Grower/buyer relationships, contracts and incentives

Current Challenges:

- Customers demand “fresh” and “high quality” – this translates into an expectation for visually appealing products showcased at the peak of freshness in supermarkets and with buyers
- Agreements can be cancelled when market availability and prices drop, buyers have most of the control
- Grower relationships are isolated and there is a low degree of pre-competitive coordination between farmers selling the same products
- Buyers are not responsible for loss utilization or lost grower/environmental inputs



Harvest, packaging, distribution and storage

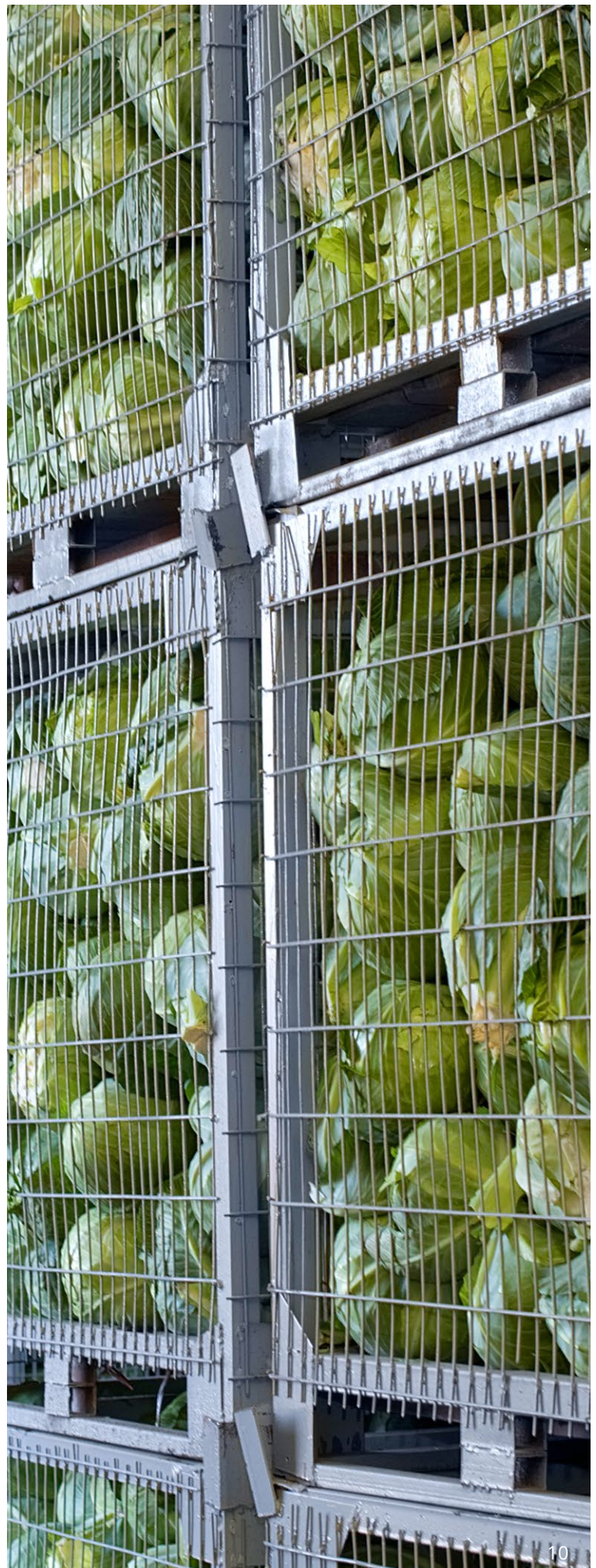
Current Challenges:

- A lack of compensation for farmers to engage in surplus management efforts or loss mitigation
- Absence of local and regional food system connectors that work to absorb surplus food
- Large-scale agriculture has undermined the true cost of production to regional food sheds
- A lack of processing and small-scale development for small-scale agriculture and a decrease in on-farm processing sites
- Inadequate space in distribution centers or trucks to stock multiple grades
- Rising fuel, storage, and processing costs
- Inconsistent language and miscommunication between supply chain actors
- Too strict of quality standards
- Labor shortages and higher wastage rates from mechanical harvesters as opposed to hand picking
- A lack of business and financial analyses/cases
- Buyers are not responsible for loss utilization or lost grower/environmental inputs - accountability and incentives are not aligned

Alternative markets

Current Challenges:

- Confusing tax incentives
- Disconnect between what the farmer considers sellable and what could sell in an alternative market
- In-season communication between growers and external stakeholders
- Produce shortages in food banks
- Insufficient cold storage and capacity for sorting produce in food banks
- Harvests are only donated when there is glut
- Environmental destruction from consumer expectations of accessibility to produce variety throughout the year
- Food safety regulations make value returns more costly



Government, policy, and regulation

Current Challenges:

- Confusing tax incentives
- A lack of clarity around donation laws, food safety laws – mainly the requirements within the Food Safety Modernization Act around donating food for animal feed, and liability protections makes growers hesitant to donate their excess crops to humans or animals
- Consumer awareness of food waste is lacking and there is not enough government funding allocated to changing this
- A lack of harmonization between levels of government (state, local, and federal) and across agencies within the government leading to confusion and a lack of coordinated efforts to address the problem
- Government funding overemphasizes commodity crops. There is a need for more funding mechanisms, like crop insurance and research funding, to be directed towards specialty crops
- Current tax incentive structure (15% of wholesale value) is not large enough to encourage growers to harvest off-grade produce and a lack of tax incentives for transport make it challenging to make the economics work
- Producers continue to struggle with labor issues, making it a challenge to harvest anything beyond their contracts



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Possible Futures Emerge

Out of the breakouts, common themes for four potential futures emerged. Below each future are some of the key components that could contribute to its realization, and several possible activities that could put us on a pathway to achievement.



FUTURE 1

Food Full-Cost Accounting

Imagine a future in which food is priced to incorporate all externalities, full costs of production, and is subsidized based on health benefits.

FUTURE STATE

All inputs, including the true cost of water, a living wage for farm workers, ecosystem service benefits provided by natural habitats on farm land and proper land stewardship, and environmental degradation caused by food production (i.e., soil erosion) are built into the price of food using the principles of full cost accounting.

ACTIVITIES

- Develop methodologies that can put a price on ecosystem service benefits like carbon markets — giving grocers and retailers credits for purchasing low ecosystem impact products
- Work on a certification/stamp growers can receive when they limit their ecosystem damage to a certain amount, similar to the Rainforest Alliance stamp
- Develop a tax incentive for grocers or retailers who purchase more environmentally friendly products
- To ensure sufficient labor, the government would provide a path to citizenship for a certain number of years working in the agricultural industry

FUTURE STATE

To reduce input costs and contain some of the rising prices due to full cost accounting, governments mandate landfill bans, institute wide-scale composting, and streamline the use of compost on regional farm land to replace synthetic fertilizer use.

ACTIVITIES

- Develop federal or sample legislation that could be used at a state or municipal level to legislate landfill bans for organics
- Actively work with states to pass the legislation
- Develop tax incentives or other mechanisms to encourage use of compost over fertilizer to develop a demand market for large composting facilities needed under new legislation

FUTURE 2

Healthy Food for All

Imagine a future in which consumers are changing demand by eating their daily recommended servings of fruits and vegetables based on health professional recommendations, and access to this produce is ubiquitous, improving the overall population's health and nutrition.

FUTURE STATE

Fruits and veggies are more affordable than processed foods, thanks to programs that allocate funds to specialty crops based on the My Plate requirements, while low-nutritional items are no longer subsidized or prioritized.

FUTURE STATE

Government has created one form of alternative market to purchase excess produce and distribute to those in need and in food deserts.

FUTURE STATE

The public is well educated on their nutritional needs.

ACTIVITIES

- Work to understand the required process for lobbying for this change
- Develop a training specifically for logistics companies and supply chain actors on how to adopt the Sustainable Development Goals made by the United Nations and the GSM Association

ACTIVITIES

- USDA uses SNAP funding to purchase surpluses – limited examples exist today but there is currently a mechanism to research further
- SNAP funding and other government and organizational funding exists for food delivery and access in food deserts

ACTIVITIES

- Work with celebrities who are already in this space for nutrition (e.g. Gwyneth Paltrow) and get them to tie their websites and blogs to agriculture
- Health coaches in food banks
- TV campaigns around junk food + processed + sugar = the new tobacco
- Education curriculums on healthy food, farming practices and seasonality



FUTURE 3

Supporting Farmers Large and Small

Imagine a future in which the large-scale industrial agriculture system co-exists with regional food systems, reshaping the way cities and regions are supplied with fresh fruits and vegetables.

FUTURE STATE

Industrial, large-scale growers meet commodity and unmet demands and fully utilize all their resources.

ACTIVITIES

- Promote farming as a career in the U.S., trainings for farmers to understand natural resource use, defining what's truly "edible", and how to run a business
- Raise awareness of Apeel + other preservation tech groups that extend the shelf life of produce, allowing for produce to be picked when riper
- Help fill the existing labor gap that can lead to loss, develop a training and development program for recent high school or college graduates who want to help provide a vital service back to the country, a new "AgriCorps". Participants in the program would receive college tuition assistance and other benefits for their participation in a rotational program.
- Improve grower and buyer communication platforms that enable highly-coordinated supply chains. This starts by establishing shared values within the buyer community, promotes shared responsibility for whole farm purchasing and food distribution.
- Continue expanding marketing campaigns for all produce grades and expand sales of all grades in commercial settings
- Concurrent harvesting that allows for off-grade produce to be harvested in tandem with market standard grade crops
- Pre-competitive cooperation — farmers plan pre-competitively to achieve higher utilization and less market saturation during peak harvest times
- Algorithmic pricing based on known factors, dynamic pricing for freshness or other qualities (on a scale)
- Mine data for consumer buying habits-- coordinate demand with growers (supermarket cards)
- Map existing stranded assets to food desert locations that could fill needed gaps along the supply chains and further integrate the full agricultural production chain

FUTURE STATE

Small to medium sized farms produce the lion's share of specialty crops during optimal growing season and are fully integrated with supply chains to feed regional markets.

ACTIVITIES

- Work with states to encourage regionally-focused sourcing of fruits and vegetables when in season
- Increase value-added opportunities in regional food systems
- Promote and work directly with local food hubs and help them to establish relationships with more growers. Duplicate existing models (e.g. central VA. local food hub). Increase amount of local food hubs
- Scale ugly produce and seconds CSA model across the U.S.
- Promote more regional processors of nutritious, shelf stable foods on farm. Creation of local, mobile food banks and more value-added opportunities in regional food systems
- Investigate the opportunity to use stranded assets for more local/regional food production in vertical and aquaponic farms for items such as greens that have high levels of loss on farm and across the value chain due to their fragility
- Create a lending library of mechanical harvesters for smaller farmers who cannot make large investments in equipment
- Promote high-tech vertical, urban-based farms as a larger player for certain crops like leafy greens
- Elevate transparency of "walk-by" field product availability and an online harvest marketplace with dynamic pricing and availability by region
- Pilot fruit and vegetable subscription services or weekly consumer preferences across retail platforms to provide better data and upfront seasonal forecasting which can be used by buyers to better anticipate demand
- Take advantage of shifting geographies/urban environments to recreate our ag system. Farmers can grow crops to be consumed in their regions — where culturally appropriate and seasonally acclimated

FUTURE 4

Food Safe and Donation Sound

Imagine a future in which all food donation barriers have been eliminated.

FUTURE STATE

Industrial, large-scale growers meet commodity and unmet regional demands and fully utilize all their resources.

ACTIVITIES

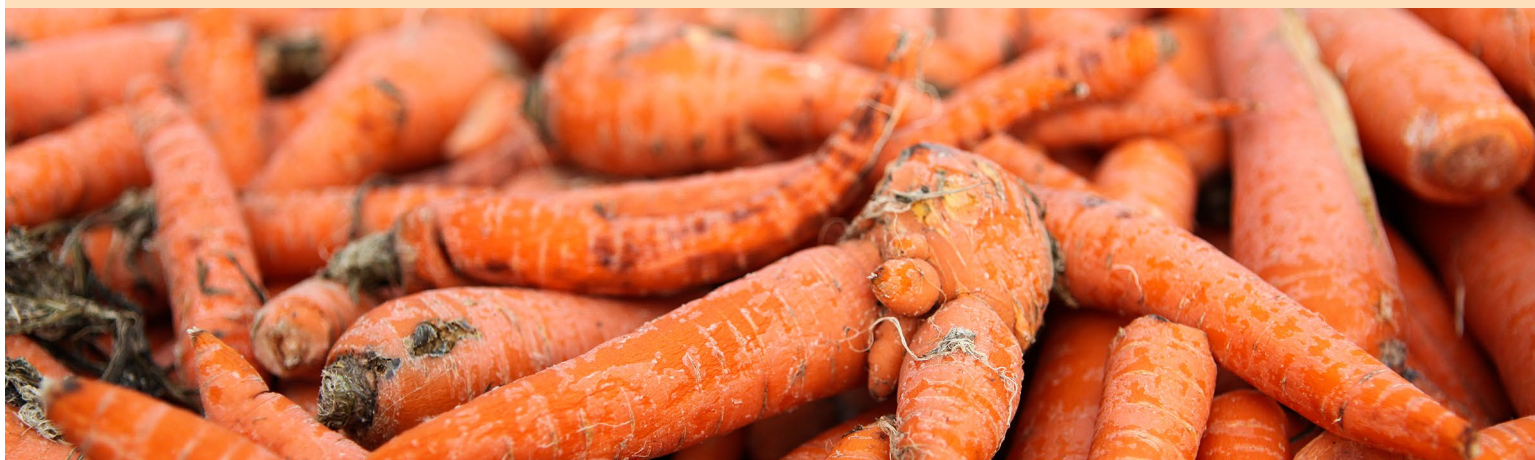
- Research and development through public/private partnership funding would need to be conducted at various universities across the country
- Investigate technologies that could contribute to this future such as: embedded granular microbial testing that provides alerts on food packaging and cartons when their presence is detected, allowing contaminated supplies to be removed immediately and chain of custody to be quickly determined

FUTURE STATE

Small to medium-sized farms produce the lion's share of specialty crops during optimal growing season and are fully integrated with supply chains to feed regional markets.

ACTIVITIES

- Developing a working group with representation from all necessary agencies — global and domestic — to come to consensus
- Work with local, state, and national food safety experts to develop clear guidance and communication strategy
- Develop a robust and targeted education campaign to inform key stakeholders of improved food safety standards including the new detailed guidance



Ron Clark on a Solution Already in Practice

Ron Clark spent 15 years sourcing “ugly” produce for the California Association of Food Banks, an extensive background that’s proved fruitful in co-founding Imperfect Produce. Their mission lies in providing healthy, nutritious food with cosmetic inefficiencies directly to consumers’ doors by reducing what would be considered “loss” on farms. Clark closed the conference by explaining “concurrent harvesting”, a method that rescues perfectly nutritious and edible row crops that may be qualified as “seconds” while market grade produce is also harvested. It is a way to create second grade, field-packed produce for the marketplace. This means the grower

is still compensated for each step: harvesting costs, packing costs, cooling costs, and storage and loading costs. Imperfect Produce is just one company that is creating an alternative cost-competitive market for those seconds.

This multi-faceted solution is currently being implemented on a few farms, but there is tremendous potential to scale it up. Not only would this program compensate growers for currently underutilized product, but it would slowly “redefine beauty in produce” for consumers.



Conclusion

This convening of stakeholders and actors along the value-chain, and those invested in food rescue and improving food insecurity, is rare and valuable.

As we move forward collectively in our own organizations and institutions to address the issue of loss throughout the supply chain, we encourage you to communicate with one another in this shared space. The flow of communication within this group and out into our networks has the potential to embolden others to share new innovations, data, or stories from the field. This connection can multiply our influence for effective and sustainable change in food loss and waste.

This convening was just the beginning of the conversation, and there is much work to be done. WWF's food waste team will be closely examining the feasibility of several of the activities discussed and how their implementation and impact could contribute to changes in our food system. The team will also examine which actors align with each action and could help to carry the action forward. We may convene sub-groups to assess appetite for moving actions forward. For example, where the work relates to government actions, we will work closely with both the Harvard Food Law and Policy Clinic and others with influence over public policy and agency policies to start to assess the feasibility of the recommendations.

We hope these recommendations will add to the body of knowledge in this space and encourage more stakeholders to act within their spheres of influence. We look forward to working with all of you as we lay the foundation for innovation and next steps in addressing post-harvest loss in the U.S.