



DISCUSSION  
PAPER

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WWF DISCUSSION PAPER:

# USING PUBLIC DATA PLATFORMS TO ASSESS DEFORESTATION RISKS WITHIN JURISDICTIONS

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*This discussion paper was prepared by Mona Wang, Jessica Furmanski, Karen Petersen, Akiva Fishman, Lloyd Gamble, and David McLaughlin on behalf of the Forests and Food Teams of WWF-US. It does not represent a policy position of WWF, but is intended to provide analysis for consideration by interested stakeholders and to promote additional discussion.*

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# INTRODUCTION

**T**ropical forest loss from agricultural conversion and illegal and unsustainable logging continue to threaten global climate, biodiversity and ecosystem services, sustainable economic development, and the long-term productivity of major commodity sectors. Recent efforts in the private sector to decouple deforestation from agriculture focus on supply chain traceability and sustainability certifications, while those by governments include land use planning (e.g., designation of grow and no-grow zones) and in some cases major land policy initiatives (e.g., Brazil's Forest Code). Increasingly, however, companies, governments, and NGOs are exploring more integrative public-private collaborations to address broad-scaled challenges like illegality, land insecurity, and land-based greenhouse gas emissions.

Addressing these challenges at the level of government jurisdictions provides an avenue for multiple stakeholders in a jurisdiction to work toward common agricultural production and forest conservation objectives at broader spatial scales. National governments are in some cases looking to subnational jurisdictions to operationalize significant land-based mitigation targets they proposed in the 2015 Paris Climate Agreement. At the same time, many companies are developing traceability systems for their direct supply chains while also thinking about how they can send market signals that catalyze greater uptake of sustainable production practices, engage more directly in the geographies where they source, and partner with governments in landscape planning initiatives such as jurisdictional REDD+.

Concurrent with these trends, innovations in the accessibility and usability of spatial data have made it more feasible to assess and address deforestation at broader scales, and to do so more comprehensively (e.g., in the case of palm oil, providing traceability to extraction mill and potentially to plantation level). Public data platforms such as Global Forest Watch (GFW) provide near real-time information showing where deforestation occurs and tools to analyze this information.

*Governments, companies, and NGOs alike are increasingly using these platforms to understand where deforestation is occurring; to focus their efforts on traceability and eliminating deforestation in supply chains; and to prioritize policy and/or conservation planning initiatives.*

The World Wildlife Fund-US (WWF-US), with support from GFW, developed the Jurisdictional Risk Assessment (JRA) to explore potential applications of these rapidly developing spatial data platforms and the added value they bring to different stakeholders to evaluate production-related deforestation. More specifically, using Indonesia as a pilot geography, we developed a set of key indicators that approximate deforestation risks at the district level based on historical deforestation trends and land classifications. We then briefly summarized our findings along with several important limitations.

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## METHODOLOGY

The JRA's analysis draws on data made publically available by GFW, as well as other datasets from peer-reviewed journals, to assess deforestation risk based on the extent and rate at which deforestation and deforestation activities are occurring. "Risk", as used in the JRA, captures only deforestation that is achieved in a manner that is not permitted (e.g., by use of fire<sup>i</sup>), or which takes place where certain laws and policies prohibit deforestation or conversion.<sup>ii</sup> Assessing the degree to which deforestation occurs in these areas helps to illuminate where background conditions may contribute to deforestation risk.

The full methodology can be found here.

## RISK DUE TO PALM OIL EXPANSION

Indonesia accounts for almost 54% of global palm oil production (USDA, 2016). As the global demand for palm oil is projected to grow, plantation area is expected to expand from its current 8 million hectares to 13 million hectares by 2020 (Indonesia Investment, 2016), further

increasing the pressures and threats on the country's forests, natural ecosystems, and endangered wildlife habitats. Although palm oil is not the only driver, it is a leading cause of deforestation in Indonesia. Using Indonesia as a pilot geography, the JRA evaluates the level of deforestation and deforestation activities in the major palm oil producing regions of Sumatra and Kalimantan, as well as in Papua, which represents a new frontier for palm oil interests.

## RISK AT THE DISTRICT-LEVEL

In Indonesia, District Heads (*Bhupatis*) exercise significant authority over the granting, development and enforcement of rules surrounding palm oil concessions (Daemeter, 2015). While the responsibility for forest and natural resource management has shifted in recent years (Steni, 2016), districts still largely decide where to locate palm oil concessions. As a result, the JRA's analysis focuses at the district level.

## KEY FOREST AREAS

The JRA consists of an evaluation of risk assessment indicators in the following categories that we refer to as Key Forest Areas: Primary Forests<sup>iii</sup>, Protected Areas<sup>iv</sup>, Peatland<sup>v</sup>, and Forest Estate [Production Forest (HP) and Limited Production Forest (HPT) areas]<sup>vi</sup>. These Key Forest Areas were selected either

<sup>i</sup> Indonesian Law No. 32/2009 prohibits land conversion by fire and compels companies to involve communities in fire prevention programs (World Bank, Indonesia Quarterly Review 2015).





<sup>ii</sup> Presidential Decree No. 32/1990, Ministry of Agriculture Decree No. 14/2009, Government Regulation No. 71/2014 which serve to protect riparian buffer zones, peatlands, and conservation areas; Forestry Law 41/1999, Presidential Instruction No. 10/2011 which suspend the granting of new palm oil licenses in primary forests and peatlands

because they cannot be legally converted for palm oil development (such as HP and HPT areas), or because they possess high ecological value due to their richness in biodiversity and provision of important ecosystem services through carbon storage, water purification, and endangered species habitat. These are places where poor management or conversion would result in significant environmental consequences.

## RISK ASSESSMENT INDICATORS

The JRA indicators are designed to assess the extent and rate of primary forest loss, observed fire density, and the extent of overlap with government-issued palm oil concessions within each Key Forest Area (Figure 1).

**FIGURE 1: SUMMARY TABLE OF KEY FOREST AREAS AND INDICATORS FOR JURISDICTIONAL RISK ASSESSMENT**

KEY FOREST AREA	INDICATOR
 <b>Primary Forests</b>	% of Primary Forest Loss (ha) (2009 – 2012) Trend in Rate of Annual Average Primary Forest Loss (2000 – 2012) Average Observed Fire Density in Primary Forests (2010 – 2015) % of Overlap between Primary Forest and Gov't Palm Oil Concessions (2010 – 2013)
 <b>Protected Areas</b>	% of Primary Forest Loss in Protected Areas (ha) (2009 – 2012) Trend in Rate of Annual Average Primary Forest Loss in Protected Areas (2000 – 2012) Average Observed Fire Density in Protected Areas (2010 – 2015) % of Overlap between Protected Areas and Gov't Palm Oil Concessions (2010 – 2013)
 <b>Peatland</b>	% of Primary Forest Loss on Peatland (all depth levels) (2009 – 2012) Trend in Rate of Annual Average Primary Forest Loss on Peatland (2000 – 2012) Average Observed Fire Density on Peatland (2010 – 2015) % of Overlap between Peat Land and Gov't Palm Oil Concessions (2010 – 2013)
 <b>Forest Estate</b>	% of Overlap between Forest Estate (HP, HPT) and Gov't Palm Oil Concessions (2010 – 2013)

<sup>iii</sup> JRA applied the Margono et al. 2014 dataset on primary forest cover and is defined as areas that had a) tree canopy cover density  $\geq 30\%$  in the year 2000, b) were  $> 5$  ha in size, and c) that had forest cover for at least 30 years prior to 2000.

<sup>iv</sup> JRA selected protected areas gazetted by 2009 from IUCN & UNEP-WCMC (2016).

<sup>v</sup> JRA applied the national peatlands map provided by Indonesia's Ministry of Agriculture (2011).

<sup>vi</sup> JRA applied production and limited production forest areas from the Indonesia land use classification (Ministry of Forests 2010).



**Risk assessment indicators are briefly described below:**

**Percent of Primary Forest Loss (2009 – 2012)** – reports the total percentage of original primary forest cover loss in the Key Forest Area from the beginning of 2009 to the end of 2012. Primary forest cover representing the year 2000 (Margono et al. 2014) was combined with tree cover loss through the ends of 2008 and 2012 (Hansen et al. 2013) to identify the total area of primary forest cleared between the beginning of 2009 and the end of 2012. The 2009 – 2012 timeframe (as opposed to a longer time period of 2000 – 2012) was used to capture the most recent, near-term primary forest loss data.\*

**Trend in Rate of Annual Average Primary Forest Loss (2000 – 2012)** – shows the longer-term direction of the trend in primary forest cover loss, indicating the extent to which the slope in the annual average rate of primary forest loss over the Key Forest Area was increasing, decreasing, or remaining stable over the 2000 – 2012 timeframe.

**Average Observed Fire Density (2010 – 2015)** – describes the frequency of fire observations per unit area of the Key Forest Area as an indicator of recent human and natural disturbances, averaged over the 6-year period. Fire observation data represent fires and warm spots observed by MODIS sensor (Moderate Resolution Imaging Spectrometer) and represent the center point of 1km<sup>2</sup> pixels where fire was observed during overpasses occurring at temporal intervals of 1-2 days.

**Percent of Overlap with Government-Issued Palm Oil Concessions (2010 – 2013)** – represents an indication of risk of conversion or encroachment from palm oil development in the Key Forest Area. The JRA used data provided by the Ministry of Forestry (2010), showing government-granted concessions, which represent the boundaries of current and planned palm oil plantations in Indonesia. This dataset is known to be incomplete and likely underestimates actual palm oil concessions area, but is currently the best known publicly available data source.



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\* The timeframe for this indicator uses tree cover loss data from Hansen et al. based on the methodology prior to the 2013/14 algorithm update.

\*\* Note: Risk for Forest Estate was based on one indicator: the % of overlap with government-issued palm oil concessions. This is because logging and timber concessions are allowed forms of land-use within the Production Forest classification under the Forest Estate (Rosenbarger et al. 2013). The extent of forest loss occurring within districts in Forest Estate area was not included, as any forest loss captured could be due to logging activities from commercial timber harvests, which are permitted land-use activities.

## RISK SCORING

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Higher calculated scores reflect higher deforestation risk levels. While not all deforestation risks analyzed can be directly attributed to palm oil production, the metrics were intended to filter out forest losses that were more attributable to other forms of land-use. For example, focusing on the overlap of relevant Forest Estate areas with government-issued palm oil concessions excludes deforestation associated with other types of concessions. The aggregated risk level for each Key Forest Area is derived from the combined (i.e., summed) values of each respective group of risk assessment indicators, as listed in Figure 1, but end-users interested in more detailed analysis are encouraged to review each indicator individually.

The aggregated risk level for each district within a Key Forest Area was determined by summing the normalized values of each relevant group of risk assessment indicators. With the exception of Forest Estate, whose value is based on only one indicator<sup>22</sup>, the following steps were applied to all Key Forest Areas to arrive at an aggregated risk level:

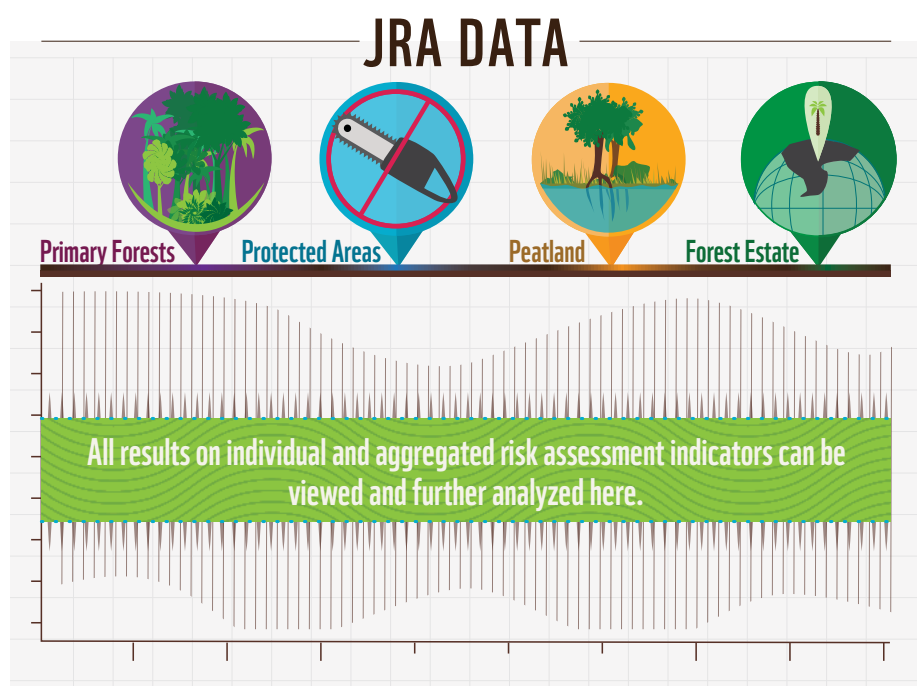
1. **Normalizing the raw values for each indicator.** Raw values for each indicator were normalized based on the range of its results to place them on a scale from 0 to 1. Doing so provides a consistent range of values for each of the indicators, making it possible to combine the values of distinct indicators without weighting certain indicators disproportionately.
2. **Aggregating the normalized values of the indicators relevant to the Key Forest Area.** All normalized values of the indicators were summed to provide an aggregated deforestation risk level.

The JRA associates higher risk levels with higher aggregated normalized values, and lower risk levels with lower aggregated normalized values. All risk levels in the JRA are relative to the risk in other districts covered by the analysis, not jurisdictions elsewhere in Indonesia or in other countries. Risk scoring presents district risk levels for each Key Forest Area along a continuous spectrum, leaving any potential classifications of risk levels to be determined by the end-users.



The results of the JRA summarize risk levels by Key Forest Areas. Risk levels shown in the maps below present risk levels by Key Forest Areas for districts evenly distributed into quartiles, and is just one of potentially many ways to present the results produced by the JRA.

It is important to note that lower risk as demonstrated by the results of the JRA should not be interpreted as low risk overall nor an absence of risk. As previously mentioned, districts with lower risk levels in the JRA are those with *lower* relative risk within the sample of districts included in this study, and should not be interpreted as having lower overall risk.





## DISTRICT RISK LEVELS FOR PRIMARY FORESTS

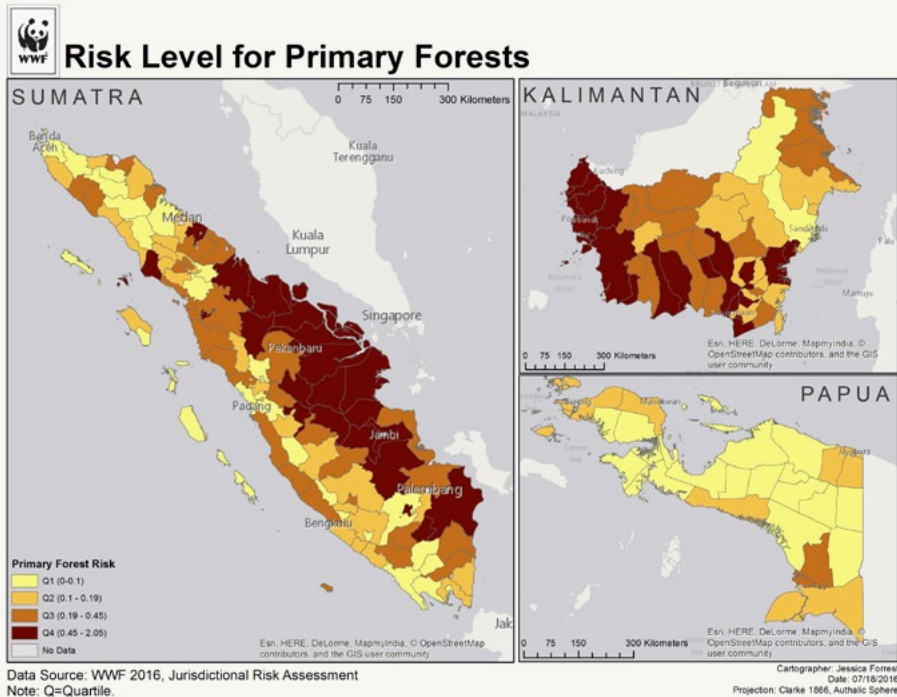
Figure 2 depicts district risk levels for primary forests broken down into quartiles, based on the aggregate value of the corresponding indicators for the Key Forest Area of Primary Forests. Districts in quartile 1 (yellow) are among the 25% of districts with the lowest relative risk to primary forests, and districts in quartile 4 (dark brown) are among the 25% with the highest relative risk level.

Upon closer analysis of the indicator “% of *Primary Forest Loss*”, results from the JRA show that almost 80% of districts (148 out of 185) lost up to 10% of their original primary forest cover between the years 2009 – 2012; a total of 16 districts lost up to 30% of their primary forest cover; 3 districts lost up to 40%; and 1 district lost almost 50% of its primary forest cover over the same timeframe. It is important to note that some districts may have had more original primary forest cover than others, ultimately impacting the hectares lost as compared to other districts.

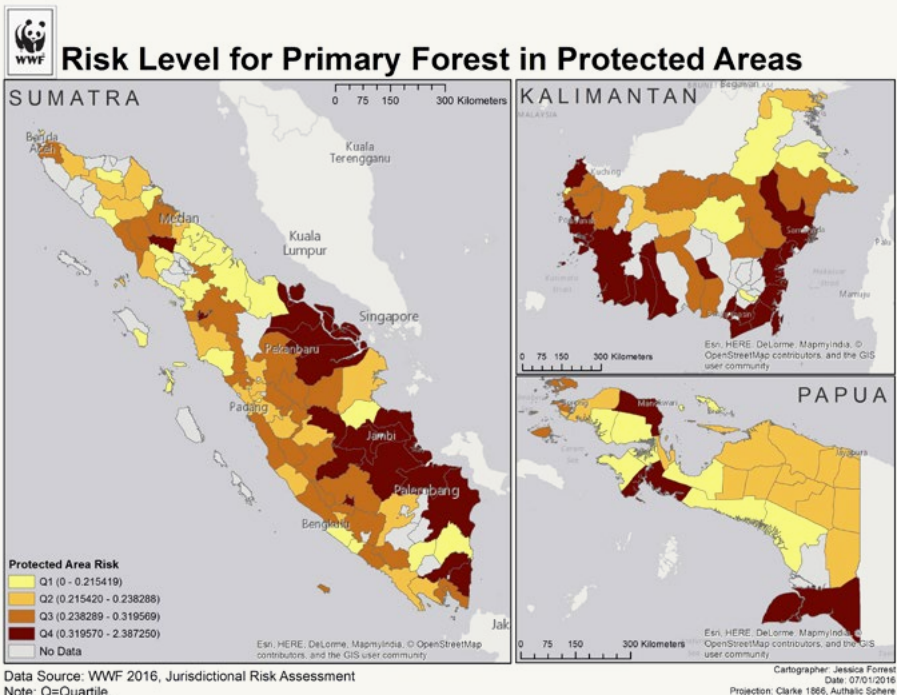
## DISTRICT RISK LEVELS FOR PROTECTED AREAS

Figure 3 represents district risk levels to primary forests in Protected Areas. District risk levels are organized into quartiles, with the bottom 25% of districts in quartile 1 having the lowest relative risk, and the top 25% of districts in quartile 4 containing the highest relative risk.

Closer analysis into the risk assessment indicator, “*Trend in the Rate of Annual Average Primary Forest Loss in Protected Areas (2000 – 2012)*”, shows that while about 30% of districts experienced a decreasing and stabilizing long-term rate of primary forest loss in their protected areas, most experienced an increasing rate of loss over the 12 year period – with a handful of districts (3%) with a comparatively sharper increase in the rate of loss. Results for the *Trends* risk assessment indicator are displayed according to the extent to which they were negative, zero, or positive.

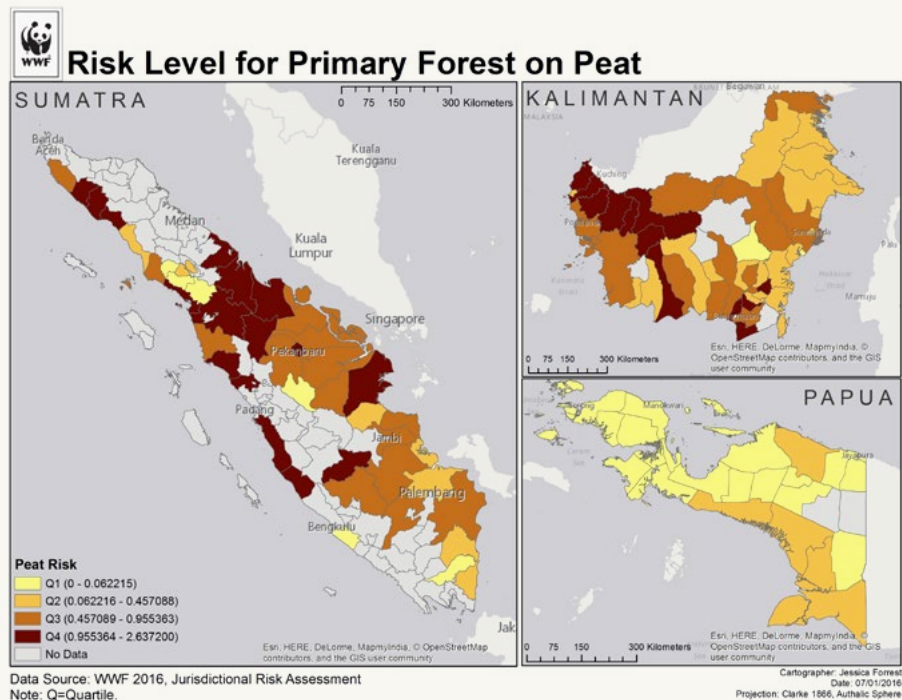


**Figure 2:** District Risk Levels for Primary Forests based on analysis from the Jurisdictional Risk Assessment. Risk levels are determined by the extent and rate of primary forest loss, observed fire density, and overlap with government-issued palm oil concessions occurring over primary forest areas.



**Figure 3:** District Risk Levels for primary forests in Protected Areas based on analysis from the Jurisdictional Risk Assessment. Risk levels are determined by the extent and rate of primary forest loss, observed fire density, and overlap with government-issued palm oil concessions occurring over Protected Areas.

## DISTRICT RISK LEVELS FOR PEATLAND

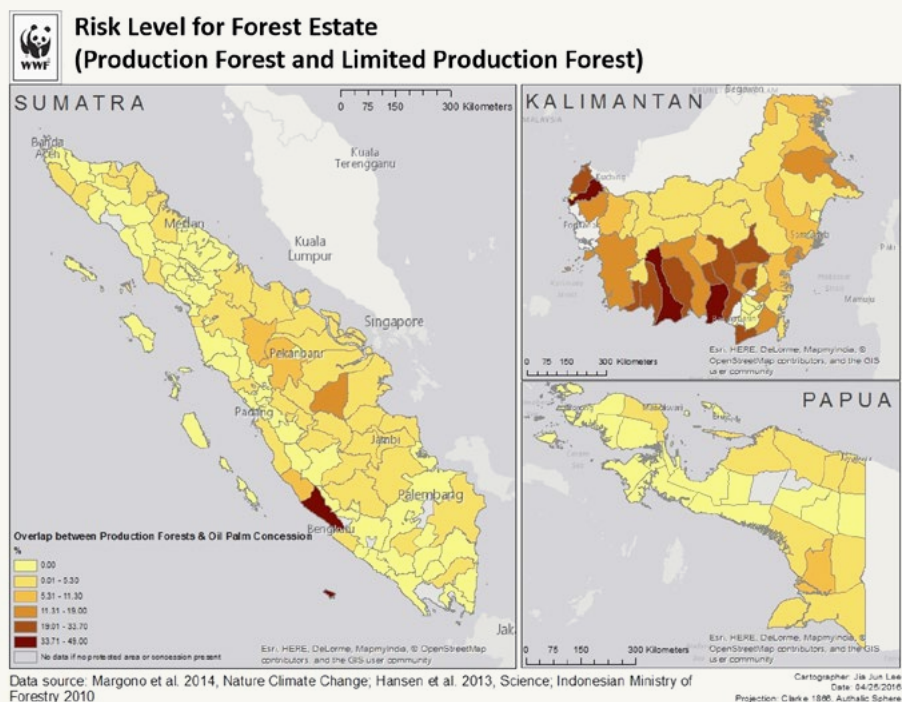


**Figure 4:** District Risk Levels for primary forests in Peatland based on analysis from the Jurisdictional Risk Assessment. Risk levels are determined by the extent and rate of primary forest loss, observed fire density, and overlap with government-issued palm oil concessions occurring over Peatland.

District risk levels to primary forests on Peatland are shown in Figure 4, with districts in quartile 1 among the 25% with lowest relative risk, and those in quartile 4 among the 25% with highest relative risk. Areas shown in Figure 4 with “No Data” are districts with less than 5 ha of primary forest on peatland area in the year 2009, based on near-term primary forest loss occurring in key forest areas between 2009 - 2012.

District Risk Levels for Peatland are derived from the aggregate values of a group of risk assessment indicators, one of which measures the average observed fire density on peatland for the period of 2010 – 2015. This indicator shows that 48% of districts had an average observed fire density with up to 100,000 counts of observed fires per unit area over the 6-year period. Approximately 3% of districts were observed with the highest density of average observed fires (between 400,000 and 1,100,000). The JRA assumes that fire observations on peatland correlate with actual fire occurrence in or near the peatland area.

## DISTRICT RISK LEVELS FOR FOREST ESTATE (HP, HPT)



**Figure 5:** District Risk Levels for Forest Estate (HP, HPT) areas based on analysis from the Jurisdictional Risk Assessment. Risk levels are derived by the extent of overlap with government-issued palm oil concessions on Forest Estate (HP, HPT) areas.

District Risk Levels for Forest Estate areas (HP, HPT) are shown in Figure 5 and are derived by the percentage of overlap between government-issued palm oil concessions and Forest Estate areas. Since only one risk assessment indicator was used to determine district risk levels for Forest Estate, district risk levels are only based on the percentage of overlap between government-issued palm oil concessions and Forest Estate areas.

Through a closer look, the results for District Risk Levels for Forest Estate areas show that about 45% of districts have up to 5% government-issued palm oil concessions - comprising either current or planned oil palm plantations - within their districts that overlap with HP and HPT areas. About 10% of districts (16 out of 170) show a 20 – 45% extent of overlap, and 2 districts show an overlap of 45-50%.



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## DISCUSSION

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The JRA draws upon a public data platform to provide insights to companies and governments about deforestation risks and to potentially inform strategies to address these risks. Preliminary results from applying the JRA to Indonesia demonstrate the extent to which primary forests, protected areas, peatlands, and the Forest Estate have been historically affected by deforestation and overlapping palm oil concessions. Quantifying these impacts enables comparison among districts that shows where deforestation risks have been more or less significant.

*While the results of the assessment could potentially help inform project development and promote due diligence efforts, it is important to note that the JRA should not be used as a standalone decision support tool for companies or governments. The JRA is intended only to complement the information that companies and governments already use in making these choices, as its approach to measuring deforestation risk is subject to several limitations.*

For one, it relies exclusively on remote sensing data to assess deforestation. Public data platforms have greatly expanded the potential

for spatial analysis, but there are numerous limitations, including gaps or inconsistencies in data layers (e.g., different time periods), inability to perfectly distinguish different land uses, and errors in some coverages. While there are critical benefits to the added perspective of a broadly-scaled spatial analysis, field validation remains an important complement to increase the robustness of remotely collected spatial information.

The JRA captures only a subset of all possible risk factors. It considers publically available forest loss data in connection with palm oil concessions, but does not include other drivers of deforestation such as pulp and paper development, mining, and infrastructure expansion. WWF also recognizes that social responsibility forms a crucial component of full sustainability. The JRA incorporates only biophysical factors available in geospatial datasets, and does not include data on important social conditions such as tenure security or human rights. As a result, it is only a partial risk-based assessment of past deforestation.

Another limitation, or observation rather, is the effect that specific time periods can have on the risk scores assigned to a jurisdiction. For example, in applying a 2000 – 2012 timeframe, we found that some district risk scores based on the percentage of primary forest loss were higher than when using a timeframe of 2009 – 2012, perhaps because forest loss within certain districts had already cleared most of the primary forest by 2009, leaving little to be deforested thereafter. The 2009 – 2012

timeframe was used because recent forest loss was assumed to be more relevant for informing efforts of addressing deforestation than earlier forest loss. However, even the most recent timeframe may underestimate risk resulting from nascent deforestation threats. For instance, while palm oil development has for many years driven deforestation in Sumatra and Kalimantan, it has only recently expanded into Papua, leading the JRA to indicate comparatively lower risk levels there. JRA outputs are expected to change as palm oil continues to expand in Papua.

Finally, the issue of scale is another important factor to consider when measuring risk at a jurisdictional level. Because all districts vary by size and contain varying levels of primary forests, protected areas, peatlands, and Forest Estate areas, smaller districts may be slightly predisposed to higher risk scoring. For example, risk scores based on the total *percentage* of primary forest loss for some smaller districts received slightly higher risk scores than larger districts, even though they experienced less primary forest loss in terms of total *hectares*. The JRA accounts for this issue by setting a threshold (i.e., including only districts where Key Forest Areas of at least 5

hectares are present); however, some caution is still advised in comparing jurisdictions of varying sizes in absolute terms.

*International ambition from the public and private sectors to reduce deforestation is growing. Combined with the rise of public data platforms, there is now unprecedented potential to inform initiatives that strive to decouple production and deforestation.*

Public data platforms will continue to expand the accessibility and analysis of spatial data to the public, and exploratory assessments like the JRA will likely continue to emerge as more data become available. While public and private sector ambitions to reduce deforestation and the increasing availability of spatial data present significant opportunities for end-users, they are clearly most powerful when complemented by other tools and information including a robust understanding of conditions on the ground and the perspectives of the many relevant stakeholders in a particular geography.



## 5

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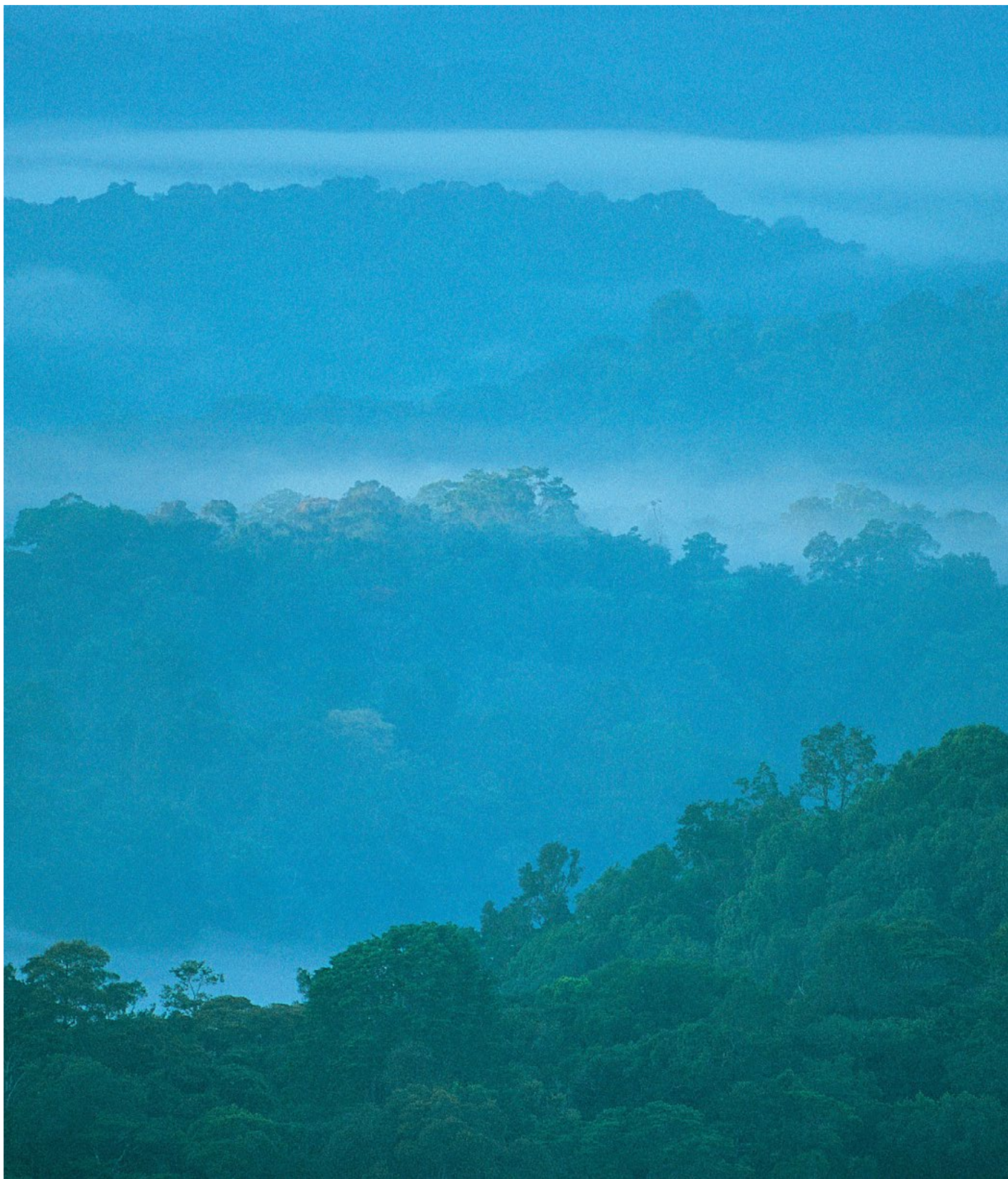
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Additional references used for the JRA can be found in the complete JRA Methods Write-Up.





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