

# FROM SOURCE TO SINK:

## Reducing Commodity Agriculture's Impacts on Natural Lands



## HIGHLIGHTS:

- ▶ Large-scale industrial agriculture is the single largest driver of deforestation.
- ▶ Loss of forests and peatlands contributes to around 15% of global carbon dioxide emissions. Added to agricultural production, land use accounts for over a quarter of total annual greenhouse gas emissions.
- ▶ A few key agricultural commodities: beef, palm oil and soy are the major causes of deforestation. The products are exported all over the globe and demand will grow as populations grow and economies develop.
- ▶ Initiatives to reduce deforestation for key commodities include moratoria and multi-stakeholder roundtables, which have met with varying success.
- ▶ The decision to clear forests for commodity agriculture occurs at the individual farm level, with a short time horizon. A suite of financial tools are introduced, aimed at providing upfront economic incentives for agricultural operators to protect forests.

## LAND USE AND CLIMATE CHANGE

There is irrefutable evidence that human activities have been causing excessive amounts of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases (GHG) to build up in the atmosphere.<sup>1</sup> As a result, the Earth's average surface temperature has already increased by 1.7 degrees Fahrenheit and this warming is disrupting the planet's entire climate system. Average water temperatures are increasing, rainfall patterns are changing, and extreme weather events such as droughts, floods, storms, and heat waves are becoming more severe.<sup>2</sup>

Land use, as defined by deforestation and other land use change as well as agricultural production, accounts for over a quarter of total GHG emissions annually, making it one of the largest global sources of emissions (Figure 1, Deforestation and Agriculture emissions). Land-use activities make significant contributions of heat-trapping gases to the atmosphere from the burning or clearing of forests, applying fertilizers to soil and raising livestock. This report focuses on the deforestation component of agriculture's contribution to climate change.

There is a growing awareness that curbing deforestation is an essential piece of the climate mitigation puzzle. Influential reports highlight deforestation abatement as the most cost-effective option for reducing anthropogenic emissions<sup>3</sup> and proposals to curb deforestation have emerged as important components of the U.S.' and U.N.'s strategies to stabilize the climate.<sup>4</sup>

### Forests and Carbon Dynamics

Forests cover about one third of the Earth's land base. When trees grow, they convert the carbon from CO<sub>2</sub> into organic carbon.<sup>5</sup> Intact forests and other ecosystems that remove carbon from the atmosphere are known as "carbon sinks" because they absorb and store carbon.<sup>6</sup>

Tropical forests store 320 billion metric tons<sup>7</sup> of carbon<sup>8</sup> but also absorb an estimated 4.8 billion tons of carbon dioxide each year<sup>9</sup>, equivalent to more than one tenth of total global annual carbon dioxide emissions. Other natural terrestrial ecosystems, also contain important carbon stores both above and below ground. When burned, peatlands release vast quantities of carbon to the atmosphere, a total of 0.3 billion

tons C per year according to latest research.<sup>10</sup> The loss of forest and peatlands together account for around 15% of total carbon dioxide emissions.<sup>11</sup> Tropical forest locations are shown in Figure 2 and carbon stored in forest biomass in key countries are shown in Figure 3.

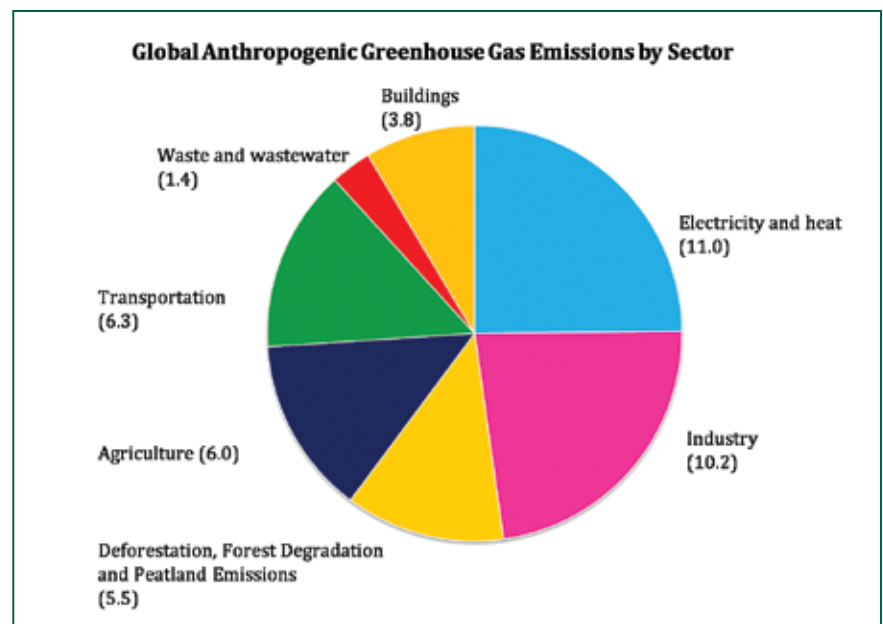
Land-based GHG dynamics, such as forests and agriculture, differ from those of non-land-based sectors such as power generation, transportation and manufacturing in that they can have either a net positive or a net negative contribution of GHGs to the atmosphere, depending on how they are managed.<sup>13</sup> Today, it is well understood that land use, land use change, deforestation and forest degradation contribute significantly to the problem of climate change.<sup>14</sup> The opportunity exists, however, for players in land-based industries to be part of the solution by adopting practices that keep forests intact and turn fields into carbon sinks.

### Agriculture, Expansion into Forested Areas, and Greenhouse Gases

Large-scale mechanized commodities production is a growing threat to the world's forests and therefore its climate.<sup>15</sup> The majority of global land use change emissions come from the clearing of tropical forests to make way for agriculture, including livestock production<sup>16</sup> and large-scale agriculture has overtaken small-scale agriculture as the key driver of deforestation<sup>17</sup>. Tropical forests are generally not cleared for the

**Figure 1.** Global anthropogenic sources of GHGs (Billion tons CO<sub>2</sub>e). Data Sources: Deforestation, Forest Degradation and Peat Emissions figure van der Werf *et al.* 2009. CO<sub>2</sub> emissions from forest loss. *Nat. Geosci.* 2:737-738; all other figures Herzog, T. 2009. *World Greenhouse Gas Emissions in 2005*. WRI Working Paper. World Resources Institute. Data is for 2005. Forest degradation is the process of transforming a primary forest to a degraded forest through disturbance and removal of biomass, for logging and other purposes. Peatland soils are made up of partially decayed organic matter that accumulated over thousands of years. Draining the soil exposes and dries the organic matter, creating a high potential for fire. Figures for Agriculture include only methane and nitrous oxide emissions; industry emissions include fugitive emissions.

**Figure 1**



**Figure 2.** Forest cover in the tropics. Intact forest areas (definition and methodology, Potapov *et al.* 2008. Mapping the world's intact forest landscapes by remote sensing. *Ecol. Soc.* 13) are shown in dark green, all areas with tropical forest in 2000 are shown in lighter green (Global Land Cover 2000 database. European Commission, Joint Research Centre. 2003).

**Figure 3.** Range of estimates of forest biomass of top seven countries (Gibbs *et al.* 2007. Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environ. Res. Lett.* 2<sup>12</sup>).

value of the timber, since only a few trees per hectare (ha) might be prized species<sup>18</sup>; instead, forests are cleared for ranches, plantations and crop production, much of which is exported.

Today, an increasing global demand for food, feed and biofuels makes the relatively cheap and available land in many forest-rich developing nations attractive for industrial agriculture to move in. Indonesia and Brazil, the nations with the largest areas of forest loss, have been calculated to be the third and fourth biggest GHG emitters among nations despite their status as developing countries.<sup>19</sup>

**Major Global Commodity Drivers of Deforestation**

With a projected global population of 12 billion by 2050, food production will need to almost double in developing countries<sup>20</sup>, which poses a grave threat to tropical forests. A large proportion of the agricultural expansion in this decade has been to produce a few key commodities, namely oil palm, soy and beef.<sup>21</sup> Growing global consumer demand is increasing export markets for these products. In Indonesia and Malaysia, at least 55% of oil palm expansion from 1990-2005

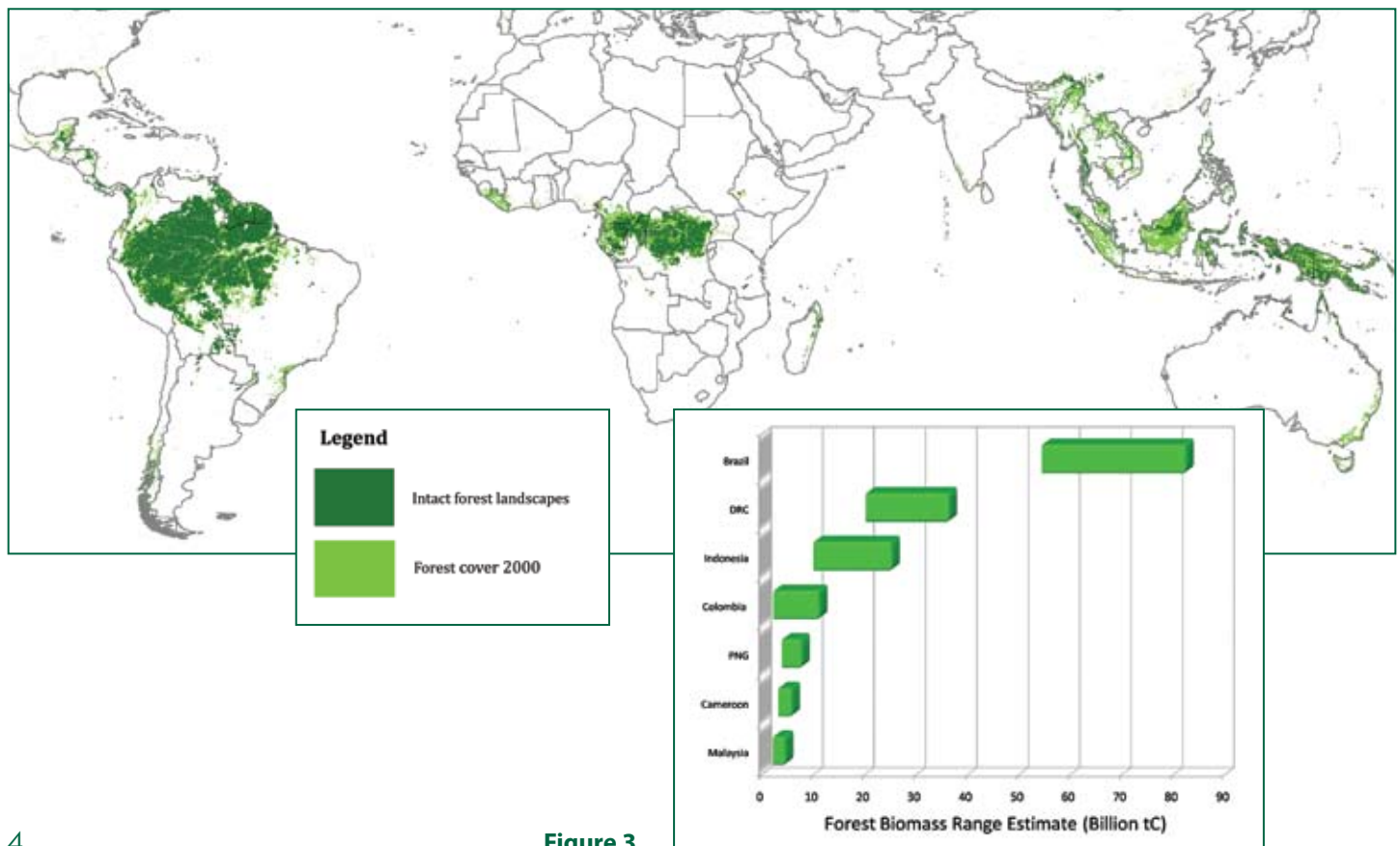
occurred through loss of forest.<sup>22</sup> In the Amazon region, the majority of deforestation is for pastureland.<sup>23</sup>

**Livestock Production**

Livestock's ecological footprint is daunting. More than a quarter of the Earth's land surface is used for grazing, and one third of all cropland is used to grow feed for animals.<sup>24</sup> Cattle release the highly potent GHG methane during digestion<sup>25</sup> and the total global GHG impact of livestock production aggregates to almost one fifth of total global GHG emissions<sup>26</sup>.

Brazil has the world's largest commercial cattle herd and is the top exporter of beef.<sup>27</sup> Around 80% of all deforested land is used for cattle grazing<sup>28</sup> which produces around half of Brazil's total greenhouse gas emissions<sup>29</sup>. The biggest export markets for this beef are the EU, Russia and Venezuela<sup>30</sup>, with almost a quarter of production exported. Leather exports also provide significant revenues; the EU (particularly Italy), China and Vietnam are the biggest importers of leather originating in the Brazilian Amazon<sup>31</sup>, from where leather is processed and exported all over the world as shoes, handbags and other products.

**Figure 2**



**Figure 3**

Cattle ranching in the Brazilian Amazon is carried out with an average grazing density of only 1.08 animals per hectare.<sup>32</sup> Improvements in the production system potentially provide scope to greatly increase cattle production without the need for any additional land. For example, agricultural residues and silage can be included in cattle diets, and grazing densities can be increased by three to six times.<sup>33</sup> The land area of cattle ranching is so vast in the Brazilian Amazon that with just a moderate level of intensification, to just over two cows per hectare, an area the size of California could be freed for other purposes.

### Soy Production

Soy's high protein content makes it a good animal feed and soy imports worldwide have risen greatly since the mid-1990s, in tandem with the global demand for meat.<sup>34</sup> Eighty percent of the world's soy is produced in the United States, Brazil and Argentina.

Brazil produces most of the world's non-genetically modified soy because the cultivation of genetically modified (GMO) soy was illegal until 2003. A price premium of up to 10% for non-GMO soy in Europe, along with growing demand from China, helped to drive a large expansion of soy production in Brazil<sup>35</sup>, particularly in the Amazon. Currently, over 40% of Brazil's soy production is exported<sup>36</sup>.

Although ranching is the predominant use for newly deforested land in the Amazon, this land use interacts heavily with soy farming, as soy operations occupy land that is already cleared, raising land prices and the profit expectations for those who clear forest.<sup>37</sup>

### Palm Oil Production

Global demand for vegetable oils is rising, due to shifting diets and increasing demand for cosmetics and biofuels<sup>38</sup>, and global trade in palm oil has expanded 16 fold since 1988. Palm oil is used in small amounts in a range of food and non-food products, from soap and cosmetics to peanut butter, in the U.S and Europe<sup>39</sup>. New trans fat labeling requirements in both the EU and the U.S. made palm oil, which is trans fat free, appealing to many processed food producers.<sup>40</sup> Globally, over 80% of palm oil is exported; in Indonesia, a key country of deforestation concern, over 75% of palm oil is exported<sup>41</sup>.

The deforestation impact of rising palm oil consumption is concentrated in Indonesia and Malaysia, where 87% of the world's palm oil is grown<sup>42</sup>. However, Colombia, Ecuador and Papua New Guinea have also seen large increases in production in the past ten years<sup>43</sup> and similar increases in Brazil and other tropical areas are expected.

**Oil palm plantation, Landak, Indonesia.**



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### Biofuels

Biofuels industries have existed in the U.S., Brazil and Europe for many decades, but they only garnered both widespread acclaim and alarm in recent years, when changes in government policies in the U.S. and Europe dramatically increased demand for renewable fuels and fuel additives. Concerns about GHG emissions from, and the toxicity of, conventional transport fuels, as well as the national and global security risks generated by the transport sector's near-total dependence on petroleum based fuels, instigated the creation of biofuel mandates in both Europe and the U.S. in recent years.

While there is large potential for second generation biofuels production from non-food feedstocks and non-arable land, currently nearly all biofuels are made from food commodities. Liquid biofuels currently use about 4% of global grain production.<sup>44</sup> While the amount of land currently used for biofuels is relatively small, growth in biofuel production has been rapid. There is an ongoing debate about the extent to which biofuels are responsible for direct and indirect land use change<sup>45</sup>, how to quantify those changes, and if and how to account for those emissions in energy policies<sup>46</sup>.

## MOVING TOWARDS SOLUTIONS

In order to shift the described pattern of deforestation for industrial agriculture, policies and innovations should be geared towards making it financially preferable for countries, companies or farmers to rehabilitate degraded land and to increase yields on existing agricultural lands, rather than cut down forests or otherwise destroy ecologically valuable and carbon rich natural ecosystems. We describe and assess existing initiatives, often targeted at large producers, major trading companies and multinational brands, and present potential financial tools aimed at agricultural operators that can result in incentives to protect forests.

### Peatland cleared and drained, Riau, Indonesia



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### Land Use and International Policy on Reducing Emissions from Deforestation and Forest Degradation (REDD)

Climate policy is rapidly evolving at the international level as well as in the United States. Nations will negotiate a new international climate change mitigation treaty, as the current commitment period for the Kyoto Protocol ends in 2012, and a framework to reduce deforestation is likely to be part of the new agreement.<sup>47</sup> This would be a major step forward beyond the 1997 Kyoto Protocol's Clean Development Mechanism (CDM), under which afforestation and reforestation projects qualified for carbon credits, but avoided deforestation did not. Reducing

emissions from forest loss may be one of the most cost-effective ways of reducing global GHG emissions.<sup>48</sup>

## DEMAND-SIDE PROGRAMS

### Positive Buyer Actions: Sustainability Roundtables & Certification

Positive buyer actions are based on identifying responsibly produced products and adjusting purchasing preferences accordingly. Consumer awareness is generally facilitated through labeling schemes or socially networked communications. Producers may get price premiums for certified products or they may receive market access advantages like preferential purchasing from large buyers. Voluntary certification schemes have been credited with improving practices on farms and in forestry operations.<sup>49</sup>

Sustainability roundtables are generally made up of a broad representation of relevant stakeholders who come together to develop codes of standards (often referred to as Principles and Criteria) or best practice guidelines, as well as certification schemes.

Roundtables and certification systems are most effective when company members are motivated by pressures exerted by civil society groups for reforms. Tactics such as demonstrations in front of company headquarters and boycotts trigger awareness of risks to their brand reputations.<sup>50</sup> This fear can bring about real changes in companies' sourcing policies, and roundtables have the potential to garner significant market shares.

Some of the certification schemes for agricultural commodities include provisions aimed at preventing deforestation, but none as yet deal with GHG emissions as such. It is important to note that many of these roundtables do not withhold their certification for all forest loss, but only the loss of forests classified as High Conservation Value (HCV). Roundtables exist for all of the commodities described above<sup>51</sup>, although the standards and certification systems are in various stages of development and only palm oil has reached the stage of certifying production.

The Roundtable on Sustainable Palm Oil (RSPO) was initiated in 2002 by WWF and industry stakeholders. Destruction of HCV forests, increasing incidence of forest fires, and conflicts between

local communities and commodities producers and traders were key concerns.<sup>52</sup> The RSPO criteria for certification include a cut-off date of November 2005, after which certification is not allowed for operations that cleared areas classified as primary forest of High Conservation Value. The first RSPO certified palm oil, produced by United Plantations in Malaysia was delivered in November 2008 but as of November 2009, only 20 percent of certified palm oil had been sold.<sup>53</sup> A contentious issue has been that GHG accounting is not included in the principles and criteria; a measure to include it was voted down in 2008 and 2009.

Agricultural commodity roundtables have been able to gain wide membership and several involve significant market share. However, many have been criticized for agreeing to weak standards and to date there has been a limited market premium for certified products.

### **Negative Buyer Pressure: Boycotts and Moratoria**

Among the tactics implemented by certain civil society groups are “markets campaigns” to shine a spotlight on industrial and agricultural operations that imperil environmental and social values. These types of activities can be one of the most powerful ways to motivate companies to change their policies on what and where they purchase materials in their supply chains.<sup>54</sup>

#### **Soy Moratorium**

In 2006, Greenpeace published a report entitled “Eating up the Amazon”, which described the social and environmental problems caused by soy production, and named major supermarkets and fast food restaurants, to which soy from the Amazon had been traced. The report gained international publicity and put commodities traders under pressure to address the concerns or risk losing significant market share.<sup>55</sup> Later that year, the Brazilian Association of Vegetable Oil Industries (ABIOVE) and the National Association of Grain Exporters (ANEC) announced a two-year moratorium on trading soy grown in the Amazon forest biome if the fields were deforested after an agreed date.<sup>56</sup> The agreement also called for efforts to map and monitor soy cultivation, develop strategies to encourage farmers to comply with the Brazilian Forest Code and to

stop purchase of soy from any farmers found to be using slave labor. Monitoring in 2008-9 found less than 2% of farms in the biome had violated the deforestation agreement and traders agreed not to purchase from these farms.

The moratorium has been extended until July 2010 and while its long-term future is uncertain, the achievement of a productive dialogue with tangible results may provide a useful model for other commodities and regions.

### **Forest clearance for plantations, Riau, Indonesia**



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#### **Cattle “Moratorium”**

Following the release of widely publicized reports providing evidence of illegal deforestation for cattle ranching in the Amazon<sup>57</sup>, Brazil’s Minister of the Environment, Carlos Minc, announced plans to prosecute individuals and companies involved in illegal deforestation<sup>58</sup>. In 2009, the Federal Public Prosecutor’s Office in Pará State initiated criminal actions against ranchers and meat packing companies producing beef and leather originating from ranches in violation of deforestation restrictions and other laws. This led several meat packing companies to sign agreements not to buy cattle from newly deforested areas and to require farmers to comply with land and environmental regulations. However, hundreds of thousands of cattle ranches are involved in the cattle industry in the Amazon, and experts estimate that up to 90% of them have deforested more than the permitted amount, or removed the required forest buffer zones around streams.

Since a means of identifying most of the ranches where cattle are bred does not yet exist, these agreements are not implementable at the present time. A number of multi-stakeholder initia-

tives are underway to change this, including the development of sustainability standards.<sup>59</sup> The Brazilian Sustainable Livestock Working Group, whose members include ranchers' associations, major processors and international retail brands, has agreed to a 'zero deforestation' policy and to address methods of mapping and monitoring ranch properties; the group is also investigating ways of implementing a system of traceability.

#### ***The Future of Moratoria?***

While soy and livestock products have offered opportunities for effective "moratoria", other products do not lend themselves to this strategy. For example, the opportunities for consumers to demonstrate a preference for 'forest friendly' palm oil are limited. Palm oil is found in small quantities in a vast array of consumer products, making it difficult for a consumer to identify its use or to avoid such products, and impeding the clear association of specific products with an impact on deforestation.

Moratoria can be effective methods of preventing deforestation for agriculture and can be put in place rapidly. However, they are temporary measures that give time for long-term plans and standards to be implemented, rather than themselves embodying permanent solutions.

#### **Ranch practicing moderate intensification in Acre, Brazil**



© National Wildlife Federation

## **SUPPLY-SIDE PROGRAMS**

Demand-side programs have had varied success to date, but all have limitations. If consumers are either unwilling or unable to affect the agricultural operator's profitability, then supply-side programs, aimed at incentivizing agricultural operators away from land clearance, may be more effective and appropriate. There are a range of potential programs and tools to accomplish this goal, a few of which are mentioned below.

#### ***Economic Incentives for Increasing Yields***

Agricultural operators are often given a range of incentives for specific practices intended to increase yields. But few of these benefits have been shaped specifically to promote the necessary investments to reduce the GHG emissions associated with deforestation by increasing yields on lands currently in production. The most straightforward mechanism would be through government subsidies or low cost finance for the investment in question, which might include purchase of improved equipment, coupled with enforcement of laws against further deforestation. But this policy option is often not available due to lack of government resources for both the financial and law enforcement components.<sup>60</sup>

#### ***Economic Incentives for Restoring Degraded Lands***

The cheap availability of forested land and immediate financial benefits accrued by clearing forests and selling the marketable timber has made moving to new land more attractive than investing in long-term sustainable management of agricultural land throughout the tropics. Restoration of abandoned and degraded lands to long-term productivity will be essential for producing sufficient food for a growing population, much less for adding biofuels to existing production priorities, without imperiling the world's remaining natural habitats.

Agricultural operators can be financially rewarded by governments to restore degraded lands for production. This would entail creating a set of financial incentives such that the magnitude and timing of cash flows from restoring degraded lands is similar to those that would have been generated by opting to clear forestland.

### **Mitigation Banking**

Mitigation banking would involve the imposition of a fee on individuals and institutions for a permit to clear natural ecosystems. The resulting income generated would be used to protect other areas of natural habitat. Mitigation banking has been utilized for wetlands, and might also be appropriately applied to forestlands and other biodiversity and carbon-rich biomes. Such a scheme would essentially subsidize sustainable production and reward the provision of environmental services by taxing unsustainable production.

### **Financial Instruments**

A range of financial instruments could provide the tools to accomplish the supply side policies mentioned above. Most of the tools described below depend on the expectation (but not necessarily the current existence) of the development of future revenue streams associated with Payments for Ecosystem Services (PES), REDD and other forms of carbon credits. They can address issues associated with the timing of eventual cash flows and risk mitigation, to enable the monetization of ecosystem services and benefits by:

- Addressing cost and revenue differentials between various land-use alternatives for cultivation (i.e. use of cleared forest land vs. restoring marginal lands)
- Providing upfront economic benefits or cash flows via structured or referenced credit products
- Allowing for the deferral of upfront costs and the time lag associated with cultivation ramp-up via simple credit products
- Providing risk management alternatives in the interim

A suite of instruments are introduced below to provide an idea of their potential range and scope.

### **Conditional Credit Products**

The development and deployment of simple credit products, that could be made available via either private or government funders, could enable upfront capitalization of prospective streams of PES or carbon credit based cash flows. Parties on both ends of such credit products, i.e. borrowers and lenders, could potentially benefit

(via reduced risk and cheaper cost of credit) if credit facilities are underwritten with these future revenue streams in mind.

### **Bridge Loans**

Institutional capital providers could provide land-development bridge loans to companies that are faced with the decision of whether to cultivate on (a) cleared forest land, or (b) revitalized marginal lands. One key economic benefit of the deforestation alternative is the upfront revenue generated from the sale of cleared timber. By issuing low-cost till-to-harvest bridge loans to agricultural producers who choose to cultivate on formerly marginal lands instead of clearing forest land, the availability of such credit can replace the lost revenue from timber sales.

**Lowland rainforest, West Kalimantan, Indonesia**



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### **Farmland Mortgages & Leases**

Land or natural resource mortgages, where land and equipment intended for the acquisition, revitalization and cultivation of marginal lands are pledged as collateral for financing, could make cultivation on marginal lands more attractive and help offset some of the upfront economic benefits associated with cultivating on cleared forestland. Both public and private lenders could implement policies of this kind.

### **Working Capital Lines of Credit**

Revolving lines of credit are often extended to agricultural operators to meet ongoing capital needs associated with cultivation and harvesting. Provision of such credit facilities conditionally based upon land-use decisions, i.e. pledges of “no deforestation” by agricultural operators,

could both act as a deterrent to land clearance and could provide a means of enforcement. This effect could be magnified by provision of lower interest rates conditioned upon the implementation of a variety of sustainable practices.

#### **Conditional Loan Guarantees**

Loan guarantees issued by public or private entities could provide lenders with a certain degree of risk mitigation and protect against borrower defaults. Such loan guarantees would be conditional, based on specific land-use decisions of the operators. They could be provided by creditworthy counterparties, including multilateral organizations, development banks, municipalities, governments, and private sector entities that benefit from reduced deforestation and enhanced agricultural yield.

**Oil palm plantation,  
West New Britain,  
Papua New Guinea**



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#### **Risk Mitigation**

There are inherent uncertainties associated with the development of new policies to reduce deforestation and/or climate change, and these uncertainties create risks to agriculture operators. Such risks include the timing, rules and potential prices of environmental commodities such as carbon credits. Of course, there is even a risk they will not be created at all.

These risks are often disproportionately allocated to agricultural operators, who are making key decisions about land use in the near term, and often lack information or confidence in the eventual availability of such financial benefits. This may lead to inaction on the part of agricultural operators, or worse, provide unintended

incentives for adverse and potentially counterproductive current actions, such as deforestation, which provide known and short-term benefits. These risks should be shared with (or may even be better borne entirely by) other parties within and external to the agricultural supply chain. Financial instruments can be devised to re-allocate risk among stakeholders within the overall framework, involving downstream corporations, municipal and national governments, banks, carbon investors or speculators, multilateral development organizations, and institutions responsible for policy creation and implementation.

*Additional financial tools and more details are presented in the long version of this report.*

## **CONCLUSION**

Commodity agriculture is a key driver of deforestation in the tropics and the resulting GHG emissions are an accelerating threat. Conserving the carbon value of standing tropical forests is essential to avoiding dangerous climate change. If this carbon value can be recognized in an international climate agreement, and if the potential for future financial benefits are believed by those making current land use decisions, forests can be more easily protected. Existing mechanisms to reduce deforestation for industrial agriculture have met with spotty success, but they have largely not addressed climate change. Moreover, most have not aimed to address the short-term time horizon of decisions by agricultural operators. This paper has introduced a suite of financial tools that could target agricultural operators, and in particular, could offer near term benefits to bridge the period from now until the eventual development of effective anti-deforestation policies. The goal would be to make it financially viable for agricultural operators to protect forests on their lands, or to improve productivity on their existing agricultural land or restore degraded and marginal land. The viability of these tools will need to be determined through their application in a real-world context and may vary in different geographical, political, economic and social landscapes. But they may prove a valuable way to overcome the common problem of short-term financial motives leading to the loss of long-term valuable resources.

## END NOTES

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