LEAVES | Leveraging Agricultural Value Chains to Enhance Tropical Tree Cover and Slow Deforestation

BACKGROUND PAPER

PROFOR
INNOVATION AND ACTION FOR FORESTS

Soybeans in the Brazilian Amazon and the Case of the Brazilian Soy Moratorium

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EXECUTIVE SUMMARY

Soy is a high-yielding, high-quality source of vegetable protein, an important ingredient in animal feed. Demand for soy will continue to rise as economic growth leads to greater meat consumption in emerging economies, currently led by China. The expansion of soy production to meet this demand is an important threat to native ecosystems in seasonally-dry regions of the tropics and sub-tropics where most of the expansion is taking place.

The Brazilian Soy Moratorium (BSM) is the focus of this report. The BSM is arguably the world's most successful value chain intervention to date for addressing tropical deforestation. It illustrates both the potential and the pitfalls of value chain interventions.

What is the BSM?

The BSM is an agreement among trading companies, NGOs (international and national), retailers, and banks to not purchase or finance soy grown in fields that were deforested after 2008 in the Amazon Biome of Brazil. Although it has no authority to enforce the agreement, the Ministry of Environment supports the BSM. Approximately 80% of the soy market participates in the BSM.

Is the BSM working?

Yes and no. From the perspective of **corporate risk management**, the BSM is arguably the world's most successful value chain intervention to date for addressing tropical deforestation. From the perspective of **regional** trends in deforestation, the BSM is a poignant illustration of the main lesson from this report: value chain interventions are important but, alone, are insufficient for solving tropical deforestation regionally (Figure 1). Deforestation rates are on the rise in the Brazilian Amazon as the largely punitive and restrictive measures that were put in place by the Brazilian Government to suppress deforestation lose their effectiveness. Ominously, the preponderance of "negative" measures to slow Amazon forest clearing—including the BSM—may be contributing to a growing opposition to these measures by very powerful farm sectors. There is an urgent need to recognize and reward responsible, conservation-minded farmers, winning their support for strategies to slow deforestation.

Why did deforestation in the Brazilian Amazon decline?

To understand the impact of the BSM and how that impact could be enhanced, it is important to review the causes of the historical decline in deforestation in the Brazilian Amazon beginning in 2005. The main reasons that deforestation slowed down are an extensive array of governmental measures and technological advances that increased the risks to farmers and companies of deforestation in the Amazon region while reducing the need for new deforestation. The decline was the result, first and foremost, of a massive governmental strategy of command-and-control measures to eliminate illegal deforestation. The BSM was launched when the Brazilian Government had already implemented the "Plan for the Prevention and Control of Amazon Deforestation", PPCDAm, orchestrated across 13 government agencies including the *Banco Central* and *Policia Federal*. (see review in Nepstad et al. 2014). The federal government's 67% expansion in protected areas in the Amazon region, beginning in 2004, reduced the amount of forested land that was available to land grabbers—*grileiros*—by diminishing the likelihood of eventual titling. The global downturn in demand for soybeans contributed to a contraction in the area of soy production in Brazil in 2005. Finally, there was an excess of land available for new soybean cultivation in 2004; both cattle and soybean sectors didn't need new deforestation at the end of 2004 to increase production. This diminished demand for new deforestation was reinforced by the increases in cattle productivity.

Is there leakage associated with the BSM?

- Soy effect on land prices continues: The high profitability of soy production on suitable Amazon soils has pushed land prices upward, providing new sources of capital to cattle ranchers who sell or rent their land to soy producers.

- Market leakage: Amazon soy expansion has not been suppressed by the BSM, because of the abundance (thus far) of suitable cattle pastures for conversion to soy; market leakage, in which the suppression of production drives prices up, stimulating forest conversion outside of the target region, is therefore unlikely
- Actor leakage: Some Brazilian soy producers are moving to Bolivia, although impact not quantified; leakage to the Brazilian Cerrado is often cited, although rigorous evidence is lacking.

Is the BSM replicable?

The success of the BSM can be traced to:

- an effective campaign by Greenpeace
- a viable option for soy expansion without deforestation (onto cattle pastures)
- low opportunity costs for farmers (since relatively few soybean farmers had forest cover on their farms that they could legally clear)
- a corporate champion for the agreement (Grupo Amaggi), because of IFC loan
- simple rules that were straightforward to verify
- reliable monitoring of soybean field compliance with the agreement

A Cerrado soy moratorium in Brazil is less likely because of the large amount of native Cerrado that can be legally cleared and the technical challenges of reliably monitoring Cerrado vegetation, among other factors.

The way forward

- Embed the BSM in jurisdictional strategies, such as the Produce, Conserve, Include Strategy of the State of Mato Grosso
- Design and implement a system for recognizing and rewarding farmers who have maintained more forest or Cerrado vegetation than the legal Forest Code requirement
- Translate the goals of the PCI Strategy into annual milestones and rules for jurisdictional sourcing agreements
- Build the PCI milestones and rules into the jurisdictional sourcing agreements that are under development through bilateral negotiations between Brazil (Aprosoja/Abiove) and the EU (FEFAC) and between Brazil (Aprosoja/Abiove) and China (initially, with the Chinese Soy Industries Association)
- Replicate the Mato Grosso PCI Strategy in other states in Brazil, Paraguay and Argentina where soy-driven deforestation is occurring

What are key insights or questions that emerged from your work?

Winning the battle; losing the war

- The BSM has achieved a nearly zero deforestation free soy sector in the Amazon region; however, the general trend of regional deforestation is upward

The importance of linking supply chain strategies with public policies

- The BSM would have gained far more acceptance from the farm sector if it would have explicitly exempted those farmers with forests that can be legally cleared from market exclusion until a compensation mechanism is created

The missing "governmental" case

- The impact and longevity of value chain impacts can be greatly enhanced through harmonization with public policies and programs

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1. Introduction: Brazil's Ascension as A Soybean Superpower

Soybean, *Glycine max,* a member of the legume family native to east Asia, is the world's pre-eminent source of vegetable protein. It is the highest-yielding vegetable protein, is a rich source of essential minerals, and contains a protein amino acid profile that is similar to eggs and meat that tolerates high temperatures. This is the principal reason soy production is the protein source of choice in animal feed. (Byerlee et al. 2016)

Global soybean production has soared in recent years pulled primarily by the rise in meat consumption in emerging economies led by China. As China has lifted tens of millions of people out of poverty, the growing demand for poultry and pork has driven China's imports of soybean from around zero in 1992 to nearly 100 million tons—one third of the global crop—in 2017. (Byerlee et al. 2016)

This surge in demand for soybeans corresponded to technological advances in Brazil that have facilitated the transformation of a large share of the two-million-square-kilometer (km^2) Cerrado grassland-woodland complex into a major new global breadbasket. When supplemented with large amounts of lime and fertilizer, the acid-infertile soils of the Cerrado support soybean yields that are among the highest in the world with more than half of the soy harvest followed by a second crop of cotton, corn, or other fast-yielding grain.

Soybean expansion into the northern reaches of the Cerrado and the Amazon region of Brazil began in the 1990s in Mato Grosso, a 903,000-km^2state that straddles the Cerrado, the Amazon forest, and the pantanal wetlands. Mato Grosso is far from Brazil's major ports in São Paulo and was untested for soy production. However, farmer immigrants from the south of Brazil, technology, and infra-structure came together to make it Brazil's biggest agricultural and livestock producer today and one of the world's most important laboratories for managing the expansion of agricultural commodities into species- and carbon-rich tropical forest ecosystems. Soybean cultivation has also expanded in the Amazon forest biome onto the flat, well-drained Oxisol formations around Paragominas and Santarem in the State of Pará as well as into Rondonia. However, topography, soils, and inappropriate climate conditions act as a natural impediment to further expansion. Only about 100,000 km^2 of Amazon forests, about 3% of the remaining forest area, can be profitably converted to soybean cultivation in the Amazon forest biome. (Nepstad et al. 2008)

Farmers with knowledge of soybean production and a pioneering spirit arrived in Mato Grosso beginning in the 1970s from Brazil's southern agricultural states of Parana, Rio Grande do Sul, São Paulo, and Santa Catarina. They were lured by the prospect of land acquisition and other government incentives. Soybean varieties and cultivation techniques were developed by the Fundação Mato Grosso, Brazil's Agricultural Research Corporation (EMBRAPA), and plant-breeding companies. Storage facilities and soybean crushing plants were built, and all-weather roads were constructed. The first Amazon ports for soybean export were built in Itacoatiara near Manaus, Porto Velho in Rondonia, and Santarém in Pará. The Brazilian private soy conglomerate, Grupo Amaggi, began transport of soybean from Porto Velho to Itacoatiara up the Madeira River to reduce transport costs. (Friend and Lima 2011)

A series of economic teleconnections in the early 2000s brought the Mato Grosso soybean explosion onto the global stage. The European outbreak of Bovine Spongiform Encephalopathy (BSE), commonly known as mad cow disease, induced the European Union in 2001 to prohibit the use of cattle carcasses in animal ration. Overnight, this measure generated an increase in demand for soybean as the animal rations industry scrambled to substitute what had been an important source of protein. This increase was superimposed on explosive growth in China imports of the legume. (Nepstad et al. 2006a)

Figures 1 and 2 show Brazilian soybean (whole bean) production and export in 2000 and 2016. The massive growth in Brazil's soybean production and exports has gone to the rapidly-growing Chinese market. China imported 39 million tons of soybean from Brazil in 2016, with 11 million tons coming from Mato Grosso. In 2016, Europe imported only 5.5 million tons of soybean from Brazil. This market shift to China has weakened the market signal for sustainable, zero deforestation soybean.

Figure 1. Brazil Soy Exports in 2000

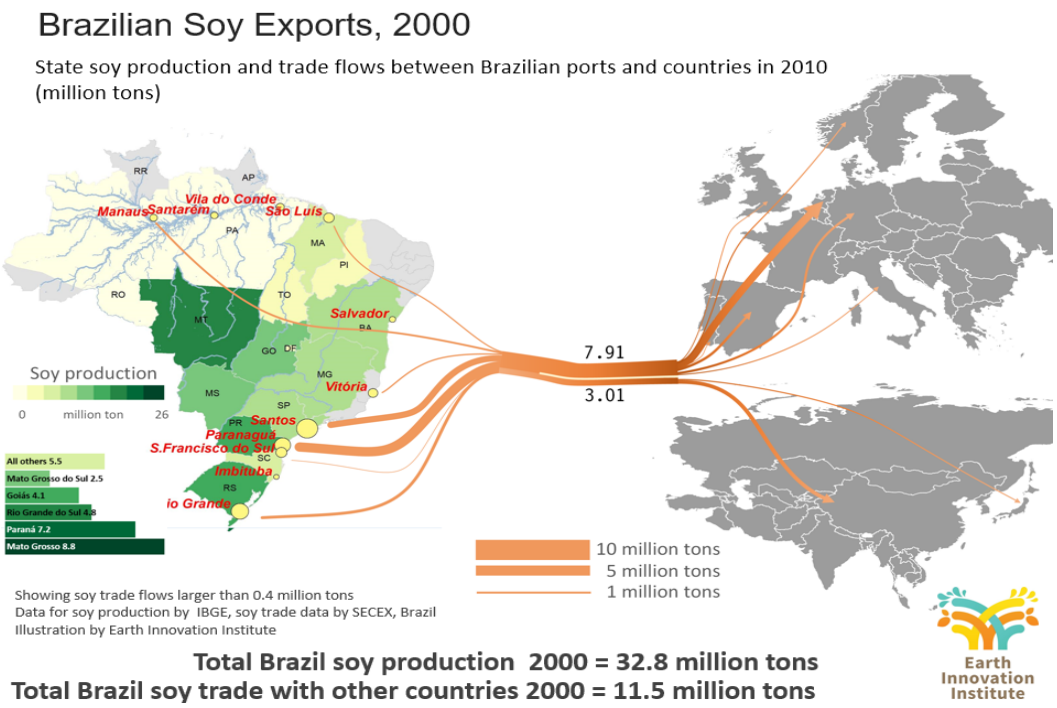
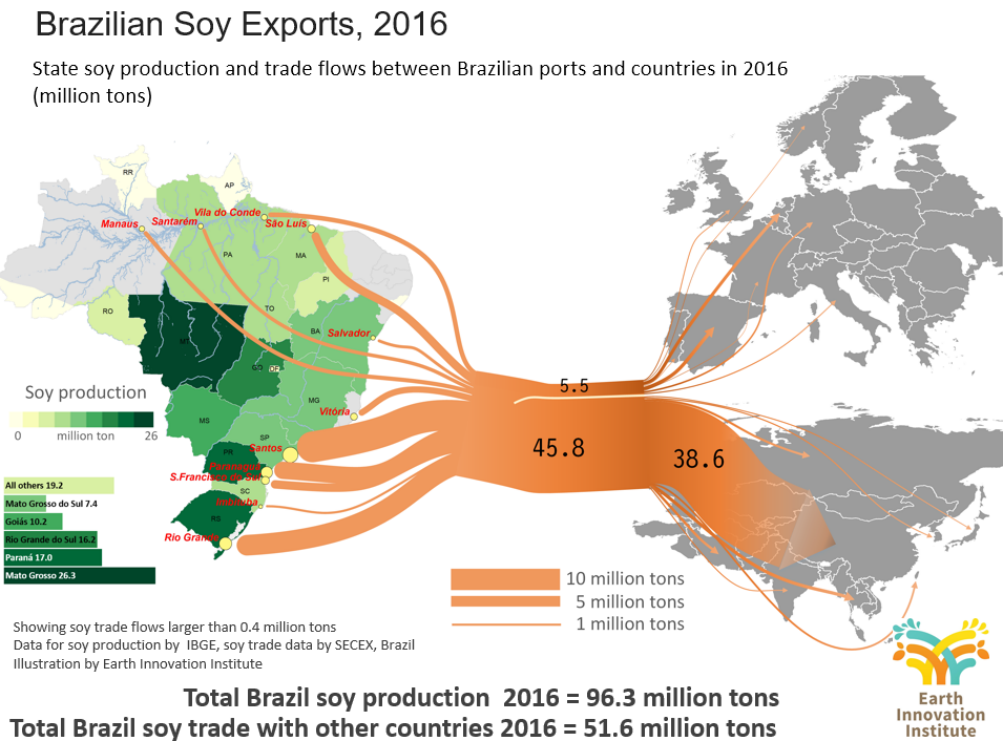


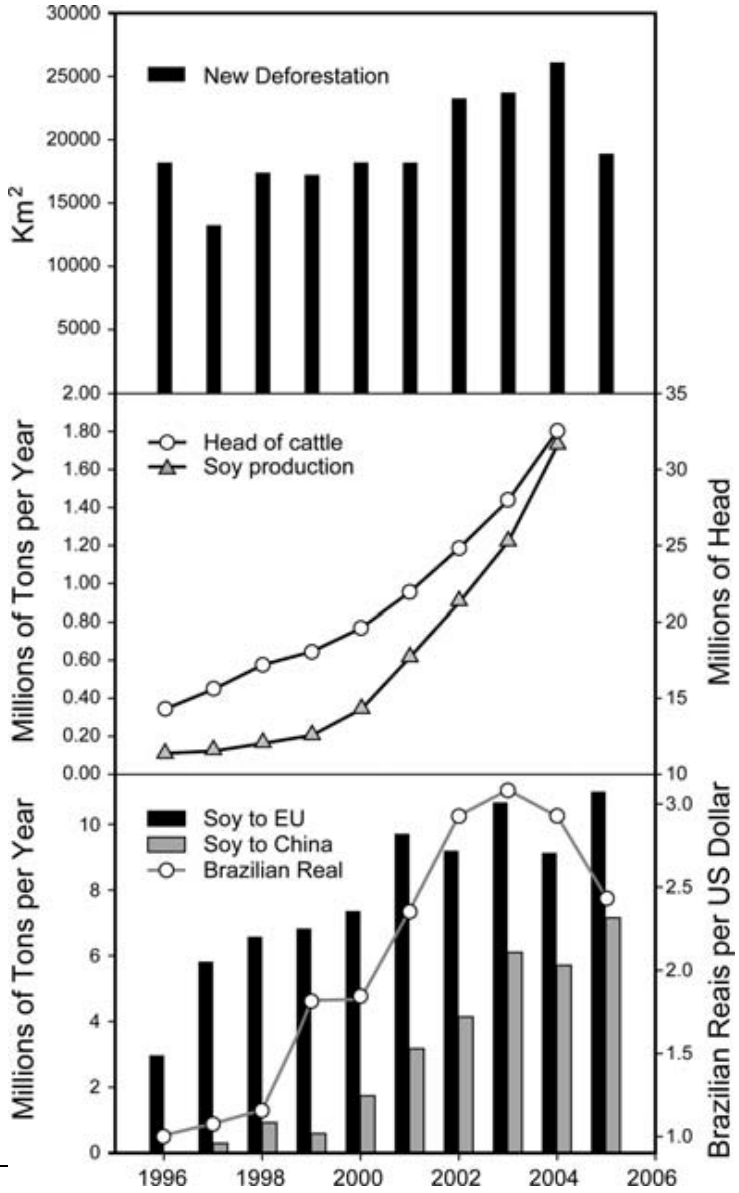
Figure 2. Brazil Soy Exports in 2016



In 2002, following the election of President Luiz Inácio Lula da Silva in Brazil, capital flight pushed the value of the Brazilian Real against the U.S. dollar to record lows (Figure 3). With most of its costs incurred in the Brazilian currency and soybean sales transacted in dollars, profit margins in the Brazilian soy sector soared. The technology, production know-how, storage, and transportation infrastructure that were in place in Mato Grosso, combined with an abundance of land available for conversion to soybean, led to a rapid expansion in the area of soybean cultivation in the state. (Nepstad et al. 2006a) This expansion was championed by Mato Grosso's newly-elected Governor Blairo Maggi, son of André Maggi and President of the Grupo Amaggi, the soy conglomerate whose father had built and the world's largest producer of soybeans.

Figure 3 shows trends in annual Amazon deforestation, the Amazon cattle herd, Amazon soy production, total soy exports from Brazil to the European Union (EU) and China, and the value of the Brazilian Real in US dollars. Cattle herd and soy production were calculated for those municípios in the Brazilian Amazon with at least 50% original forest cover, excluding those municípios in which original vegetation is primarily Cerrado woodland. From Nepstad et al. 2006a.

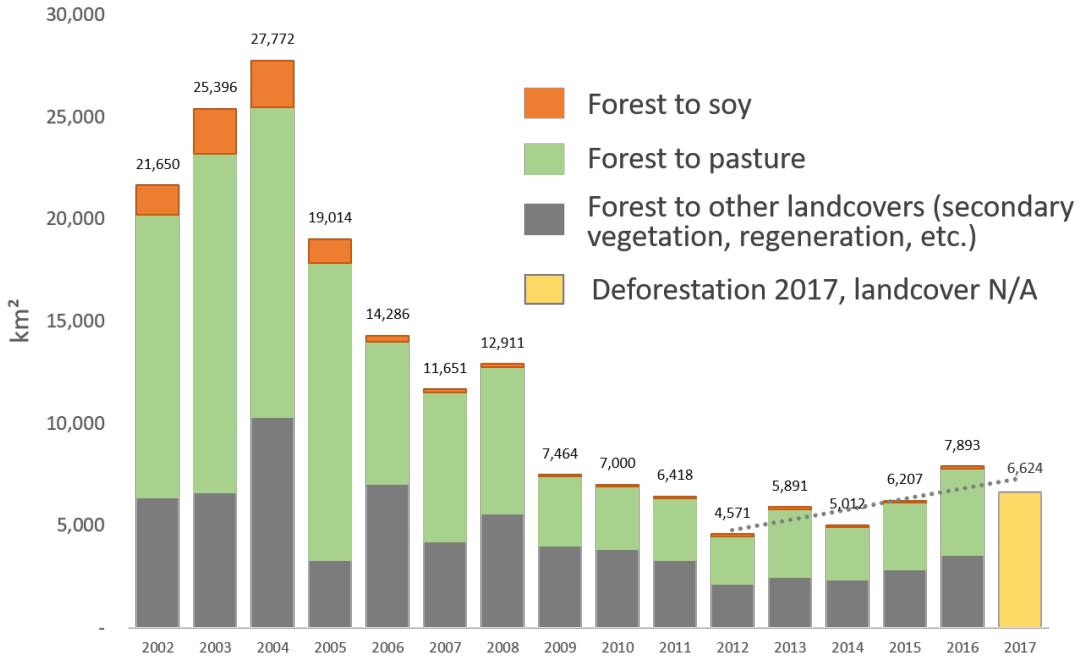
Figure 3. Trends in Deforestation, Cattle Heard, Soy Production, Soy Exports, and Exchange Rate of Brazilian Real to the U.S. Dollar[1]



[1] Nepstad et al 2006

From 2002 through 2004, the area of annual deforestation in the Brazilian Amazon was higher than any other period except for 1995. Figure 4 shows the annual deforestation and the landcover it is converted to—soybean cultivation, cattle pasture, or other landcover types—in the Brazilian Amazon from 2002 to 2017. The Brazilian Soy Moratorium established a deforestation "cut-off date" in 2006 that was then changed to 2008. Only one percent of soy production in the Brazilian Amazon sold to participants in the BSM is associated with forest clearing after the cut-off date. However, regional deforestation rates are on the rise.

Figure 4. Annual Deforestation and Converted Landcover in the Brazilian Amazon from 2002 to 2017

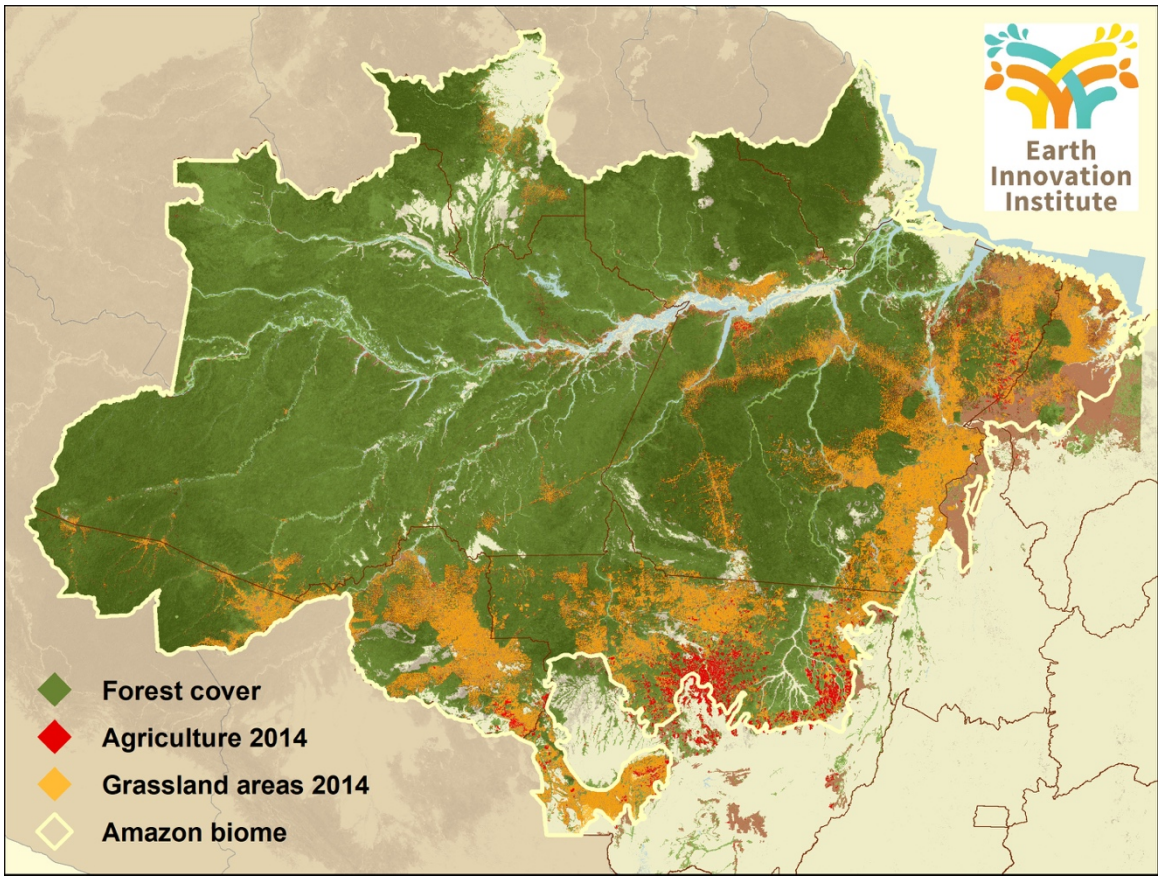


Estimations by Earth Innovation Institute using spatially explicit data from Prodes, TerraClass, LAPIG and IBGE Brazil
Grassland areas projected for 2014-2016
Figures on soy 2012 onwards by AgroSatelite and Soy Moratorium report

Nearly half of this clearing took place in the State of Mato Grosso. Figure 5 shows land cover change in the Brazilian Amazon as of 2014. Areas in red are where agriculture—mostly soybean production—has replaced forests. Cattle ranches are far more dispersed, concentrated along the major highways. Approximately 3% of the remaining forests of the Brazilian Amazon have suitable soils and climate for conversion to soybean cultivation. The economic power of soybean cultivation was translated into rising deforestation rates both through the direct conversion of forests to soybean fields and through the effects of soybean on land prices. Flat, well-drained cattle pastures that had been acquired for free or at very low prices were suddenly worth two or three thousand USD per hectare. The owners of cattle ranches who decided to sell their land to soy producers suddenly were in a strong

financial position to acquire new landholdings further out on the agricultural frontier. (Nepstad et al. 2006a, Arima et al. 2011)

Figure 5. Land Cover Change in the Brazilian Amazon as of 2014



In summary, the perfect storm of events—a surge in global demand, a devaluation of the Brazilian Real, a Mato Grosso soy sector poised to expand cultivation, and an abundance of suitable land - converged in the early 2000s to bring the Brazilian soy sector's expansion into the Amazon region onto the world stage as represented and championed by the *Soy King*, Blairo Maggi. (Rohter 2003) On one level, the financial uncertainty that accompanied Lula's election, which was driven by his strong leftist leanings, inspired capital flight both abroad and into the nation's foremost asset for riding out periods of economic uncertainty, namely land.

2. The Social and Ecological Impacts of Soybean Expansion in the Amazon Region

Brazil's high rate of Amazon deforestation from 2002 to 2004 triggered a strong reaction in both the international and national social and environmental communities because of the global significance of the Amazon forest as a symbol of the cultural and biological diversity of tropical rainforests and as an important source of greenhouse gas emissions. During this period of time, seventeen percent of global emissions of carbon to the atmosphere caused by human activities were associated with the clearing and degradation of tropical forests, and Brazil was the global leader in this type of emissions. (Solomon et al. 2007)

The furor over rising deforestation was magnified by soybean cultivation itself. The notion of agro-industrial expansion into the Amazon region to produce a commodity that is dependent on agrochemicals and fossil fuels and that is destined largely for animal feed industries in Asia and

Europe elicited a strong negative reaction from national and international environmental and social justice networks. An objective evaluation of the impact of soybean cultivation expansion in the Brazilian Amazon demands a separation of two major issues including the perils of agro-industrial food production systems and the ecological and social impacts of soybean expansion into the Amazon region. This report focuses on the second issue, even though the first issue is of vital importance to human civilization.

The social and ecological impacts of soybean production in the Amazon should be assessed against the most significant alternative land use, cattle production. This paper focuses on three major dimensions of this comparison by exploring the following three questions. First, does soybean cultivation and the associated production of corn, millet, cotton or livestock cause higher rates of deforestation than cattle ranching? Second, does it lead to greater environmental impacts? And third, does it lead to greater social impacts?

There are three important features of soybean expansion in the Amazon region that must be understood to assess its influence on deforestation. First, soybean production is far more lucrative than cattle production. Profitability varies greatly from year to year, but averages about USD$300 per hectare versus roughly USD$50 to USD$100 per hectare per year for cattle production. (Vera-Diaz et al. 2009, Margulis 2004) Second, soybean has much stricter soil and climate conditions than cattle ranching and can be profitably grown on only a small fraction of the Amazon that is still forested, which is approximately 100,000 km^2 or 3% of the 3.5 million km^2 of remaining Amazon forest. (Nepstad et al. 2008) Third, soybeans are currently expanding onto cattle pastures cleared prior to 2008.

These features of soybean cultivation indicate that the effect of soybean expansion on deforestation is almost entirely indirect, through its displacement of cattle pasture and capitalization of those who sell their cattle ranches. (Arima et al. 2011; Nepstad et al. 2006) This effect will decline over time as the land area that is suitable for soybean cultivation—soils that are flat and well-drained with a reliable dry season—are brought under cultivation.

Other environmental impacts of soybean cultivation in the Amazon include the pollution of streams, rivers, and air through the application of dozens of agrochemicals to combat fungus, weeds, and insect pests. Chemical contamination from soybean cultivation in the Amazon region has not yet been thoroughly documented. (Schiesari et al. 2013)

Several changes take place when a cattle pasture is converted to soybean production. First, most cattle ranches depend upon stream impoundments to provide a year-round water supply for cattle herds. The impoundments interrupt the continuity of streams and rivers blocking the movements of migratory fish and other aquatic species. (Macedo and Castello, 2015) When cattle use natural water courses, they promote erosion, increase sedimentation, degrade riparian zones, and introduce fecal matter to the stream system. In contrast, soybean producers eliminate livestock access to streams and rivers and often allow riparian zone vegetation to recover. They often strive to maintain streamwater free of sediment and organic matter because the effectiveness of agrochemicals can be reduced through contaminants.

The effects of pasture conversion to soybean fields can also influence the water balance of Amazon landscapes. The most extensive field research on the effects of forest conversion to soybean cultivation in the Amazon found that streamflow increases four-fold relative to the forest through a decline in evapotranspiration. However, that conversion has little or no effect on the chemical composition of streamwater. (Neill et al. 2017) Streamflow probably increases slightly when cattle pastures are converted to soybean fields.

Another important change that accompanies the conversion of cattle pasture to soybean fields is a decline in flammability. Soy fields are less flammable than cattle pastures and fire is used far less

frequently to maintain soybean fields compared to its use for managing cattle pastures. Soybean farms may have a lower occurrence of forest fire than cattle ranches, although this remains to be tested. (Nepstad et al. 2008)

Soybean producers are more dependent on European markets than cattle growers, which may increase their investments in compliance with the Forest Code. (Stickler et al. 2013) With legal compliance, which in the Amazon Biome means a minimum of 80% forest cover and the preservation of riparian zones and steep slopes, the potential for sustaining wildlife increases. Ecologically viable populations of tapir, peccaries, and primates were found on large-scale farms in northeastern Mato Grosso. (O. Carvalho, unpublished data) Some farms enforce restrictions on hunting, further enhancing the role of the farm as wildlife habitat.

Soybean cultivation has far higher risks of chemical contamination and accidents from heavy machinery than cattle operations. Good farm management practices can greatly reduce the risk of contamination and accidents.

The regional economic growth associated with soybean cultivation is higher than for cattle ranching because of the secondary and tertiary industries that arise in support of agroindustry. These industries include farm machinery sale and maintenance, the sale of fertilizers, agrochemicals, and seeds, crop-dusting, irrigation, truck fleets for transporting soy, and road maintenance. It is probably because of this increase in economic activity that most indicators of human well being are higher in regions dominated by soybean cultivation than in those dominated by cattle ranching. (Martinelli et al. 2017; VanWey et al. 2013)

3. Taming Soybean Cultivation in the Brazilian Amazon: The Road to Sustainability

3.1 Context: The Prevalence of Voluntary Approaches to Sustainable Agriculture

The governments of agricultural production regions usually have constitutionally-defined responsibilities to defend the public good through the regulation, licensing, support (through infra-structure and technical assistance), and finance of their farm sectors. This responsibility includes the protection of the lives and the livelihoods of citizens through interventions that improve food security, food safety, safety in the workplace, air quality, and water quality.

In recent decades, an important assumption has shaped the global agricultural sustainability agenda. This assumption states that governments cannot be counted on to adequately exercise their responsibilities. Governments are viewed as ineffective leaders of the necessary transition to sustainable development, either because of institutional inefficiencies or because of policies that are more focused on economic growth than on social and environmental sustainability. This concern is particularly strong for the conversion of native ecosystems to agriculture. As this paper shows, the critical premise of sustainability is now undergoing a transition as the limits of voluntary approaches to sustainability become clear and as many governments begin to take more active roles in promoting sustainable agriculture and sustainable development. (Nepstad 2018)

The main approach to the promotion of sustainable production systems for timber and agricultural commodities is voluntary certification of agricultural value chains. Multi-stakeholder dialogues involving producers, processors, retailers, the finance sector, and non-governmental organizations develop principles and criteria for each commodity and the rules by which producers or processors can become certified under these principles and criteria. According to the theory of market transformation, these international sustainability standards will go to scale—from a niche share of the

market to the norm—once a critical threshold of market demand for certified sustainable products is reached. At this threshold, the risk that uncertified producers will encounter barriers to the sale of their products is unacceptably high. Market transformation has yet to be reached for any commodity.

Beginning in 1993 with the creation of the Forest Stewardship Council, sustainability standards have been developed for timber (FSC), palm oil (Roundtable for Sustainable Palm Oil (RSPO)), sugar cane (Bonsucro), cotton (Better Cotton Initiative), soybeans (Roundtable for Responsible Soybeans (RTRS)), cacao (Rainforest Alliance), coffee (FairTrade, Rainforest Alliance), and many other commodities. (Clay 2012) These certification standards have extensive memberships including thousands of companies that grow or buy commodities that can drive tropical deforestation. The high costs of certifying and auditing farms and mills and the price premiums for certified commodities, which are often below farmer expectations, means that highly profitable farms and mills that are already close to meeting the principles and criteria of sustainability standards are those that are seeking certification. (de Freitas 2017) In other words, the farms and mills with the lowest social and environmental performance are the least likely to seek certification because of the costs involved.

In response to the growing evidence of this certification paradox, many sustainability standards are innovating. The RSPO has launched a set of jurisdictional certification pilots, including one described in the LEAVES palm oil report. Bonsucro has shifted to become a learning platform. RTRS is taking regional approaches to sustainable soy production such as the ITAIPU hydroelectric reserve initiative.

3.1.1 Mato Grosso's Shift to Sustainable Soy: Voluntary Approaches

The story of soybeans in the Brazilian Amazon biome unfolded primarily in the State of Mato Grosso where 95% of Amazon soybean production takes place. The soybean-producing region south of Santarém, in northwestern Pará State, is also significant because of the Cargill port established in Santarem, which became a target of NGO campaigns. In this report, we focus our attention on Mato Grosso.

With the success of the Mato Grosso experiment to extend soybean cultivation into the Amazon biome, the Brazilian soy sector came under intense international scrutiny. Even though only approximately 10% of the national soybean crop of Brazil is grown in the Amazon forest biome today, most global attention has been focused on this segment of the sector. In the New York Times article entitled "Relentless Foe of the Amazon Jungle: Soybeans", on September 17, 2003, newly-elected Governor Blairo Maggi is characterized as the leader of the Brazilian soy sector and an enemy of the Amazon forest. (Rohter 2003)

This is the broader context of a series of agreements, campaigns, and measures taken to reduce the negative ecological impacts of soy expansion into the Amazon region. The soy sector itself had been preparing for this scrutiny as early as 2002 motivated by the high level of dependence on the European Union market for Brazil soy. This dependence has since declined as Chinese imports of Brazilian soy have skyrocketed.

3.1.2 The International Finance Corporation Loan to Grupo Amaggi, 2002

One of the earliest moments in the transition of Brazil's soy sector to sustainability began in 2002 when Grupo Amaggi received a loan from the International Finance Corporation (IFC) to expand its storage facilities in Mato Grosso. As with any IFC loan, Grupo Amaggi was required to set up an environmental department and a system for monitoring the social and environmental performance of its soy suppliers in order to comply with the terms of the loan. This meant tracking 700 to 1000 farms in the Amazon and Cerrado regions of Mato Grosso. This IFC loan became the target of attacks from environmental NGOs arguing that an investment in the soybean sector in the Amazon region would provoke greater deforestation. A peer-review study of the loan identified several potential positive effects for the environment associated with the IFC loan. (Stickler and Almeida 2008) The loan eventually figured prominently in the creation of the Soy Moratorium, as reviewed below.

3.1.3 Roundtable for Responsible Soy, 2004

Beginning in 2004, the World Wildlife Fund spearheaded the creation of a new global roundtable for establishing an international sustainability standard for soybean production, which was motivated by the expansion of soybean cultivation into the Amazon region. Formalized in 2005, the RTRS required four years to complete the standard in part because of the Brazilian soy sector's position that the standard needed to be accompanied by a mechanism for compensating Brazil soy producers who were striving to comply with the Forest Code. In the Amazon region of Brazil in particular, the change in the percentage of a landholding that must be maintained under forest cover from 50% of the property to 80% of the property had put legal compliance out of reach for many farmers. (Stickler et al. 2013) The mechanisms established for helping landholders comply with the stricter requirement such as relaxation of reforestation requirements if government approved ecological-economic zoning plans were established and for compensating forest cover deficits on a farm with forest cover beyond the legal requirement on another farm were not implemented in most Brazilian states. Most of the cost of compliance with the RTRS in Brazil was associated with the costs of complying with the Forest Code. (PWC 2011)

In 2009, at the launch of the RTRS standard, the Brazilian soy farmers' association, Aprosoja, and the Brazilian vegetable oil industries association, ABIOVE, announced their departure from the RTRS citing the lack of a compensation mechanism and the last-minute introduction of a zero deforestation criterion as the causes. This loss of support from the world's fastest growing soy sector, which was also the only soy sector advancing into the Amazon, weakened the RTRS. It is important to note, however, that neither Aprosoja nor ABIOVE imposed its decision on its members including farmers and soy traders/processors.

Certified farms are producing about three million tons of soybean that are certified under the RTRS, which is roughly one percent of global production.

3.1.4 Brazilian Soy Moratorium, 2006

The high rates of Amazon deforestation from 2002 to 2004 and the connections between this rise and the expansion of soybean cultivation destined for international markets created ripe conditions for a Greenpeace attack.[2] (Greenpeace 2006) In 2006, Greenpeace campaigners dressed as chickens marched in front of McDonald's restaurants in Europe calling media attention around the world to the connection between the restaurant's Chicken McNuggets and soybean cultivated near Santarém, Pará and traded by Cargill. (Figure 6) The campaign was treated as a crisis by the Brazilian soy sector as well as by international traders such as ADM, Bunge, Cargill, and Dreyfuss that operated in Brazil. Grupo Amaggi, a Brazilian soy company, reached out to Greenpeace to propose a joint agreement to reduce the deforestation associated with soybean production. Grupo Amaggi held a comparative advantage in such an agreement since it had already established a system for monitoring its suppliers as a requirement for the IFC loan of 2002. On July 25th, 2006, ABIOVE, represented by Grupo Amaggi, announced the Brazilian Soy Moratorium (BSM) one day before Greenpeace and other NGOs made the same announcement. The signatories to the BSM, including companies that purchased 80% of the annual soy crop from the Brazilian Amazon, pledged to only purchase soybeans from the Amazon forest biome from fields that had been cleared of forest prior to July 26th, 2006. This cut-off date was later changed to July 2008. The *Grupo de Trabalho da Soja* (Soy Working Group) became the advisory body for implementing the BSM, presided over by Greenpeace and ABIOVE.

[2] It is important to note that even in the period of high deforestation, from 2002-2004, soybean was the direct driver of only a small fraction of deforestation, even in Mato Grosso (Morton et al. 2006). Its role as an indirect driver was large.

Figure 6. In 2006, Greenpeace launched a campaign linking Amazon rainforest destruction with Chicken McNuggets in European McDonalds restaurants

One of the critical technical innovations for the implementation of the BSM was the monitoring system. Crops have different phenological patterns that can be detected through analysis of time sequences of MODIS satellite-born sensor imagery. The BSM employed this technology to map the areas of soy cultivation across the Brazilian Amazon. The soy field maps were then overlaid on maps with the dates on which the forest that preceded the soy field was cleared. Field testing and airborn testing of the accuracy of the maps was conducted for a subsample of the soybean cultivation area. (Rudorff et al. 2011, 2015)

The BSM quickly achieved success in removing deforestation from the value chain of soybeans cultivated in the Amazon forest biome of Brazil. Approximately 99% of the soybean cultivated in this region and purchased by signatories to the BSM has been deforestation-free since 2007. (Nepstad et al. 2014) With regional deforestation declining and the production of soybeans in the Amazon forest biome of Mato Grosso increasing, the soybean sector has been described as decoupled from deforestation. (Macedo et al. 2012)

The BSM was never endorsed or supported by Aprosoja. In discussions with soy sector leaders, the reason most frequently cited is that the BSM does not differentiate between farmers with forests that can be legally cleared and farmers who had already cleared up to or beyond the legal requirement. The BSM offered no recognition or commitment to compensate those soy farmers who had maintained more forest on their farms than required by the Forest Code and who were losing the right to legally clear this forest through the BSM. Aprosoja chose not to actively fight the BSM, however, perhaps because the number of Amazon soy farmers with more than 80% of their farms in forest cover is quite small.

Given the low opportunity cost of the BSM for soy farmers—the relatively small level of foregone profits from soy expansion into forests that can be legally cleared—why do farmers oppose the BSM? The simple answer is that it is a matter of principle. Brazil's Forest Code sets the highest bar in the world for farm-level forest conservation. (Stickler et al. 2013) By not explicitly recognizing legal compliance with the Forest Code and the importance of compensating farmers for losing their right to legally clear forests, the BSM missed an opportunity to win farmer support. (unpublished data, based on discussions with farm leaders)

This farmer perspective is shaped by a long history of often contentious interactions with government environmental regulatory agencies. In Mato Grosso, the Sistema de Licensiamento Ambiental de Propriedades Rurais (System for Environmental Licensing of Rural Properties, or SLAPR, a precursor to the Rural Environmental Registry, or CAR), which had been implemented since 2000 by the State

Government, had introduced greater inefficiency and "informal economies into farm operations. (Rajão et al. 2012) The BSM was perceived as a new form of restriction being imposed upon farmers—a restriction that was blind to whether or not farmers had achieved a "*Licensiamento Ambiental Unico*" (Unified Environmental License)—the major instrument of the SLAPR. Moreover, the BSM was interpreted as favoring farmers who had cleared more forests than allowed by the Forest Code and whose farms were therefore far more valuable than farms of equivalent size with smaller areas of cultivation.

The degree to which the BSM contributed to the regional decline in deforestation is a complex question that is best evaluated through an assessment of the full range of interventions that were made to slow deforestation as provided below.

3.1.5 SojaPlus

SojaPlus is a system designed by Aprosoja and ABIOVE to support Brazilian soy farmers to comply with the law and implement best practices for managing farms and cultivating soybeans.[3] This farmer-support system was not designed as a sustainability standard, although it figures prominently in large-scale sustainable soy sourcing agreements under negotiation, such as the FEFAC soy sourcing guidelines developed through dialogues between Aprosoja/ABIOVE and the EU Animal Ration Industries Federation (FEFAC). It departs from the logic of an international standard by rejecting the notion of a binary assessment of farm sustainability and by emphasizing instead a process of improving sustainability and good farm management gradually over time with a focus on legal compliance. SojaPlus has now been extended to 1528 farmers in 4 states of Brazil. SojaPlus was conceived in 2008 and formally launched in 2011.

3.1.6 Corporate Deforestation Pledges

The BSM was an important milestone in the international commodity value chain agenda. It demonstrated for the first time that the clear establishment of value chain risk (the Greenpeace campaign), which was followed by a collaborative implementation dialogue (the Soy Working Group) and simple, verifiable rules (July 2008 cut-off date for deforestation), could result in a rapid reduction of that risk across an entire sector. In demonstrating the feasibility of an approach that is far simpler than international sustainability certification schemes, the BSM contributed to a wave of corporate zero deforestation pledges. These pledges began in 2010 with the announcement by the Consumer Goods Forum that its 300 member companies would achieve zero net deforestation in their supplies of palm oil, soybean, beef, timber, and pulp. (Consumer Goods Forum 2010) In 2014, the New York Declaration on Forests (NYDF) mobilized new corporate, NGO, and governmental pledges to remove or diminish the deforestation embedded in their value chains. Forest Trend's Supply Change initiative has identified approximately 700 company pledges ranging from membership in a roundtable standard to unilateral pledges by a company to become a zero deforestation industry. (Donofrio et al. 2017)

Supply Change and the NYDF assessment have found that the implementation of these pledges on the ground has lagged far behind the pledges themselves. (Conway et al. 2017)

3.2 Governmental Initiatives to Slow Deforestation in the Brazilian Amazon

Brazil's strategy for preventing and controlling deforestation in the Amazon region is one of the most prominent examples of a nation taking control over an extensive forest frontier to radically slow the rate of forest conversion. It featured an orchestrated effort across 13 Ministries, the *Banco Centra,* and the *Polícia Federal* with a division of responsibilities between national and state-level agencies.

The decision to tackle deforestation in the Amazon was made by the then recently-elected President Luiz Inácio Lula da Silva (Lula). When he took the oath of office in January 2002, he was soon faced with an important challenge to his ambition of elevating Brazil's profile internationally, the

[3] http://www.sojaplus.com.br/site/br.

skyrocketing deforestation numbers in the Amazon. He had chosen Marina Silvia as his Minister of Environment. Minister Silvia was a prominent grass-roots leader schooled through Chico Mendes' historical struggle to win the land rights of Acre State's rubber tappers. The top environmental priority of the Lula Administration quickly became the reduction of deforestation in the Amazon.

Minister Marina Silva did not need to start from scratch. Many of the tools for controlling Amazon deforestation were already in place because of progress made or initiated under President Fernando Henrique Cardoso and other administrations including annual, reliable reports on the area of forest cleared during the previous year.[4] (Nepstad et al. 2014; Assunção et al. 2014) The government's Forest Code of 1965, revised in 2001, established the minimum area of forest cover that private land-holders must maintain. (see Text Box 1) The federal government's Amazon Region Protected Area (ARPA) program had already established targets for expanding the network of protected areas and sustainable-use reserves in the Amazon region. The Brazilian Space Research Agency (INPE) had been developing a real time approach to deforestation detection called DETER that was launched in 2004. The Environmental Crimes bill of 1998 had provided the government with the power to prosecute infractions of environmental legislation.

[4] See INPE/PRODES, http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes.

Text Box 1. The Brazilian Forest Code and the Soy Moratorium

The Brazilian Forest Code (BFC) is an extremely ambitious, complex, and controversial law. It is one of the only laws in the world that creates restrictions on how much forest landholders must maintain or restore on their privately-held properties. Created in 1965 in response to the shortage of fuelwood in southern coastal Brazil, the BFC establishes two types of minimum forest cover on rural properties. The Legal Reserve is a percentage of the property that must be maintained under forest, ranging from 80% in the Amazon forest biome, 35% for Cerrado in the Legal Amazon, and 20% for Cerrado outside of the Legal Amazon.[5] Permanent Preservation Areas are forest areas in addition to the Legal Reserve and include riparian zones, steep slopes, stream headwaters, and hilltops.

In the Amazon region, the Forest Code has been highly uncertain since 1996. The Legal Reserve was raised from 50% to 80% in 1996 by President Fernando Henrique Carodoso through a Provisional Measure (*Medida Provisoria*) in response to a massive surge in deforestation in 1995. This change was disputed bitterly for five years until it eventually became law in 2001. In 2000, the State of Mato Grosso, Brazil's largest agricultural producer in the southeastern Amazon, decided that the transition forest—roughly half of this giant state's forests—was not part of the Amazon forest biome. The message to the state's farmers was that farms in the transition forest needed to maintain only 50% of the property under forest. This State determination was deliberated for five years by the federal government, which overturned the decision in 2005. Then in 2011, the farm sector launched a campaign to fundamentally change the BFC. Although the restrictions on forest clearing contained in the BFC remained largely intact, a major concession was given to farmers. Those who had cleared illegally prior to 2008 were given amnesty. The Brazilian Supreme Court ruled in March of 2018 that this revision was constitutional ending 22 years of uncertainty surrounding the law.

The controversy surrounding the BFC can be traced to fundamental differences in perspectives that exist between farmers and agribusinesses on the one hand and environmental groups on the other. Environmental groups have positioned the BFC as the single most important legal protection of Brazil's forests and have accused landholders of having broken the law by clearing more forests than permitted by the BFC. Many farmers interviewed see the BFC as a source of coercion and graft. The phrase "*criar dificuldades para vender facilidades*" (create obstacles to sell solutions) refers to the pressure that is placed on farmers who are striving to comply with the BFC by environmental enforcement officials, who often find a way to threaten the landholder to extract a bribe. They also cite the failure of state agencies to implement the measures designed to support farmers to comply with the higher Legal Reserve requirement that became law in 2001. Farmers are frustrated that they are vilified as forest clearing criminals when the role of the State is rarely mentioned.

With the world's most ambitious private-land forest conservation law, many Brazilian farmers feel that legal compliance should be the main criterion of sustainable production. The Brazilian Soy Moratorium is opposed by many farmers because it is blind to the BFC. Even Amazon soy farmers who have set aside more than 80% of their farms in compliance with the BFC are not allowed to legally clear any forests. As a result, their farms are worth less than similar sized farms that cleared more than allowed by law since cleared land is worth more than forested land. In other words, the BSM punishes legal compliance.

The Lula Administration's approach was to launch a national strategy, the Plan for the Prevention and Control of Amazon Deforestation (PPCDAm), to reduce Amazon deforestation in 2004. The PPCDAm was orchestrated by the President's Chief of Staff and signaled to all agencies that the strategy had received the highest level of priority. Law enforcement efforts were escalated, and sting operations cracked down on illegal activities and organized land- and timber-grabbing groups, "black lists" of high deforestation counties (*municipios*) were established in which farmers lost their access to public farm credit programs, promoting collective action to reduce forest clearing across entire *municipios.* Individual farms were "embargoed" because of non-compliance, meaning that the

[5] The Legal Amazon of Brazil is the area contained within the States of Acre, Amapá, Amazonas, Maranhão (ca. half), Mato Grosso (northern portion), Pará, Rondônia, Roraima, and Tocantins (northern portion). It contains all of the Amazon forest biome of Brazil and some areas of Cerrado woodland/savanna.

purchase of cattle or soy from that farm could incur a fine of R$500 per kilogram of product. (Nepstad et al. 2014)

With the assassination of the American nun Dorothy Stang in 2005, international pressure on Brazil increased further. Plans for protected areas and sustainable development reserves that had been under design for years were rapidly implemented in an effort that would eventually increase to more than 50% the percentage of Amazon forests under some form of protection. (Campos and Nepstad 2006; Schwartzman et al. 2006)

In 2006, with annual Amazon deforestation starting to fall, Minister Marina Silva announced a proposal to establish a tropical forest fund for receiving performance-based donations or payments to help Brazil and other tropical nations advance their strategies to slow deforestation. In 2007, the Government of Norway responded with a major commitment to the Amazon Fund, based on a Brazilian target of reducing Amazon deforestation by 70% by 2017. This target was subsequently increased to 80% by 2020 as Norway finalized its pledge of one billion dollars to the Amazon Fund. The funds were not a sure thing. They would only flow if Brazil continued to slow deforestation. (Nepstad et al 2009)

In 2009, Brazil launched the National Climate Change Policy (NCCP) that formalized the 2020 deforestation reduction target and established the legal and programmatic framework for achieving it. One of the most ambitious features of this new legislation was the "Agricultura de Baixo Carbono" (Low Carbon Agriculture) program, which established national goals of recuperating degraded cattle pastures and restoring forests as it launched a land-use investment loan program of approximately US$2billion per year.

In 2017, the National REDD Strategy was completed within the NCCP with an Amazon Forest Reference Level approved by the UN Framework Convention on Climate Change, a national registry of emissions reductions (InfoHub), and an agreement for the distribution of emissions reductions among the national governments and state governments of the Amazon.

3.2.1 Mato Grosso's Contribution to Slow Deforestation

Brazil's PPCDAm program and its law enforcement efforts are being implemented with shared responsibilities between federal, state, and municipio governments. This decentralization process is known as *Pacto Federativo*. Each Amazon state developed its own state-level Plan for the Prevention and Control of Deforestation.

The Amazon states, led by Mato Grosso, also brought new innovations to the table. Mato Grosso's System for Environmental Licensing of Rural Properties (SLAPR), launched in 2000, was the first to establish a spatial database of private properties to determine legal compliance with the Forest Code. (Azevedo & Saito 2016) This pioneering system was created with support of the G-7 Pilot Program to Conserve the Brazilian Rainforest (PPG-7), was managed by the World Bank, and inspired the creation of the MT-Legal initiative in 2009, which provided a streamlined approach to registering all rural properties in the state-level system. SLAPR and MT-Legal were the pre-cursors of the Cadastro Ambiental Rural (the Rural Environmental Register (CAR)), which is now a mandatory requirement of the New Forest Code for all rural landholders in Brazil. The CAR has revolutionized legal enforcement of the Forest Code and the creation of incentive systems promoting legal compliance such as the embargo of farms that are not in compliance with the law and cutting them off from markets.

In 2009, Governor Blairo Maggi announced his administration's pledge to reduce deforestation 89% below the 1996-2005 average by 2020 and the measures that would be taken to achieve that reduction. Mato Grosso achieved an 88% reduction in 2012. Maggi also set in motion the legislative process for establishing a state-wide REDD law. In 2012, Mato Grosso voted into law the Mato Grosso REDD

System that created a legal framework for driving the reduction in deforestation and for receiving performance-based payments.

In 2015, Mato Grosso innovated again with the creation of the Produce, Conserve, Include Strategy (Mato Grosso PCI) through a multi-stakeholder process launched by Governor Pedro Taques in December 2015 during the Paris climate summit. The Mato Grosso PCI is one of the world's most ambitious programs for reconciling the growth of agricultural production with a decline in state-wide deforestation and an end to illegal deforestation. The PCI's combined goals of lowering deforestation and increasing forest restoration and recovery mean that if the PCI succeeds, Mato Grosso will achieve state-wide zero net deforestation in the next few years and zero net forest carbon emissions by 2030. The strategy would keep four billion tons of forest carbon (CO_2eq) out of the atmosphere. (See the Brazilian Beef report for a more detailed description of the PCI.)

In 2017, the Governments of Germany and the United Kingdom finalized a partnership with Mato Grosso in recognition of the PCI Strategy and REDD law and the State's progress in slowing deforestation. In Phase 1, Germany will provide up to 17 million Euros and the UK will provide 30 million British Pounds Sterling if Mato Grosso is able to maintain or further diminish its deforestation. (Leal et al. 2017)

4. The Brazilian Soy Moratorium

4.1 Introduction

The BSM virtually ended the deforestation caused by the conversion of forestland directly to soybean cultivation. But what was its contribution to the larger decline in deforestation that took place across the Brazilian Amazon? Was the BSM the main reason that deforestation declined, helped along by the government interventions as some have argued? Or was the role of the BSM to reinforce a message to farmers that the government programs had already made clear, specifically that farmers engaged in deforestation were at risk?

The report begins its assessment of the contribution of the BSM to Brazil's historic achievement in slowing Amazon deforestation by asking the question: why did regional deforestation decline?

4.2 Why has deforestation in the Amazon region of Brazil slowed down?

Dozens of interventions were made to slow deforestation and many claims have been made about the relative importance of those interventions. Rigorous quantitative analyses have been conducted of only a few individual interventions. (Assunção et al. 2012, 2014) The sheer complexity of the many public policy innovations, law enforcement initiatives, and voluntary agreements that have been brought to bear on Amazon deforestation means that it is virtually impossible to rigorously quantify the contribution of each to the decline with an acceptable degree of uncertainty, (reviewed in Nepstad et al. 2014)

Nonetheless, this review identified several reasons deforestation declined and allows for the *qualitatively* assessment of the contribution of each intervention. The main factors that influenced deforestation include farmer fear, expansion of the protected area network, a decline in demand for new deforestation, and collective action at the county level to slow deforestation.

4.2.1: Farmer fear

The government and value chain interventions that took place in the Brazilian Amazon beginning in 2004 provided a strong signal to Amazon farmers that clearing forest land is risky and can lead to punishment for illegal activity, exclusion from markets, or suspension of access to cheap public farm finance. Prior to these interventions, these signals were not there. In the case of legal compliance, most farmers found it virtually impossible to comply with the Forest Code and treated it with

impunity, or they felt that it was risky to comply with the Forest Code because of retribution from law enforcement agents (Text Box 1).

Farmer fear of association with deforestation came about through several interventions.

4.2.1.1. Fear of imprisonment or fines for illegal activities

Brazil's strategy to enforce the BFC and other laws and regulations that place restrictions on forest clearing and logging was orchestrated through the PPCDAm. Sting operations to capture and prosecute those involved with illegal land-grabbing and timber harvest led to the imprisonment of hundreds of people including some government officials. More than 700 people went to jail through these operations. Illegal deforestation could be rapidly detected through the DETER program, which allowed law enforcement agents to visit the location of the forest felling while it was still underway.

4.2.1.2. Fear of losing access to public farm credit

One of the most creative and effective interventions of the PPCDAm was the *Municípios Críticos* program of 2008. Through a strategy orchestrated between the Ministry of Environment with the *Banco Central*, public farm credit was suspended for farmers in black-listed *municípios*, the equivalent of a county in the Brazilian legal system. The black list was comprised of the 36 *municipios* that had annual deforestation of 40 km^2 or more.

The response was rapid in many *municipios. Prefeituras* (*municipio* governments) and farm associations/unions collaborated to slow deforestation, which was an important lesson in how to creative incentives for collective action to solve deforestation. Peer pressure was applied to farmers who continued to clear their forests. By 2014, six of the black-listed *municipios* had come off the list. (Nepstad et al. 2014)

The *Municipios Criticos* plan also inspired innovation. In the State of Pará, the success of Paragominas, a major logging and cattle center in the eastern Amazon, in reducing deforestation and re-establishing farmer access to public credit programs led to a state-wide *Programa Municipios Verdes* (Green Counties Program). *Programa Municipios Verdes* now supports 121 of the state's 144 *municípios* as they strive to reduce deforestation below 40 km^2 per year and reach targets for farm registration under the *Cadastro Rural Ambiental* (Rural Environmental Registry). In Mato Grosso, too, the *Programa Municipios Verdes* and MC programs inspired a *Programa Municipios Sustentaveis* (Sustainable Counties Program), which has supported 35 *municípios* to develop action plans for slowing deforestation and increasing the efficiency and productivity of agricultural and livestock production.

4.2.1.3. Fear of losing access to markets

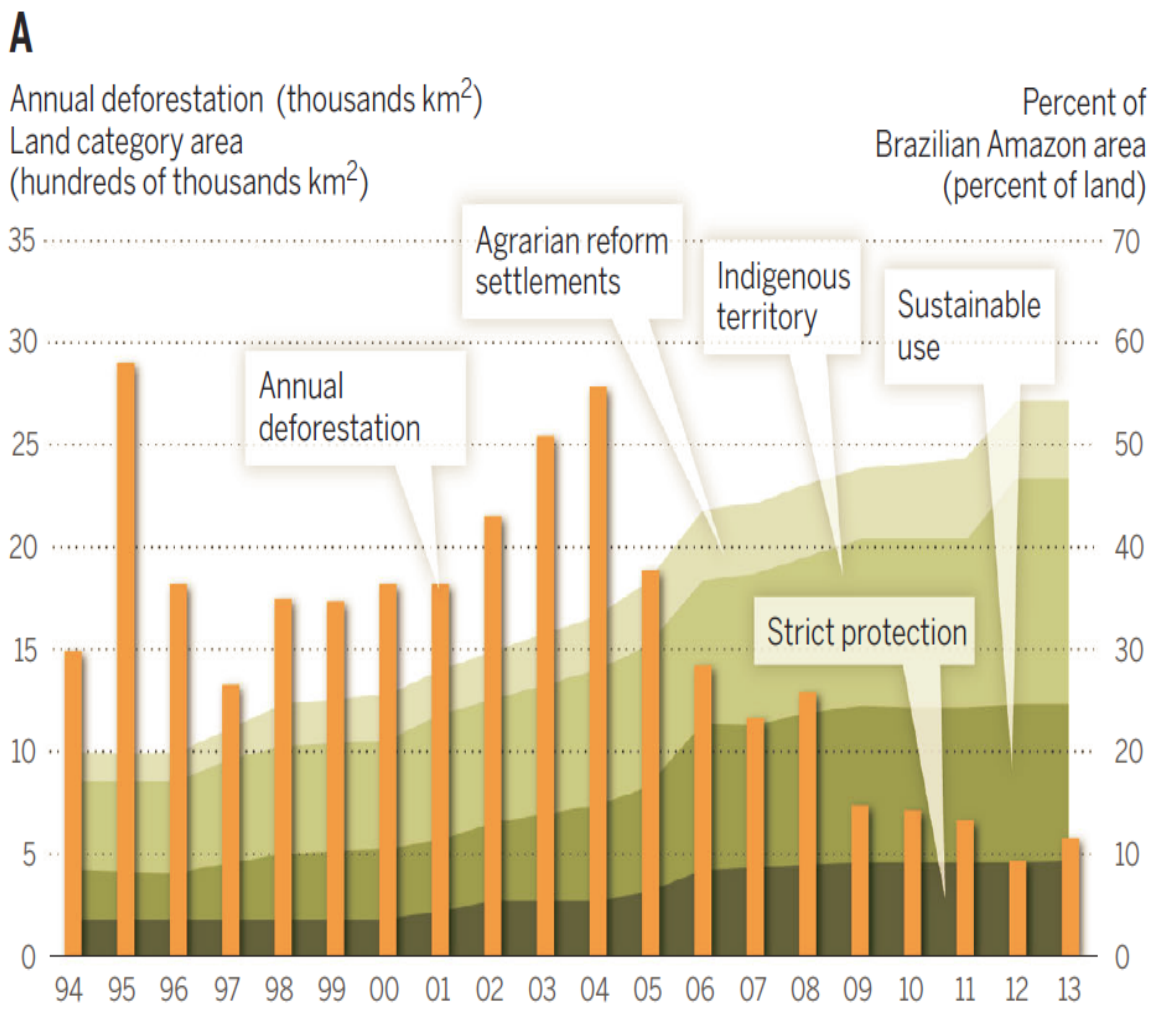
The Brazilian Soy Moratorium created a third type of farmer fear: of losing access to markets. With most of the companies that buy the soybeans produced by Amazon soy farmers participating in the BSM, this message was clear and emphatic. It was reinforced in 2010 when the Consumer Goods Forum announced the pledge of its 300 members to achieve zero net deforestation supplies of palm oil, soybeans, beef, timber, and pulp by 2020; it was further reinforced in 2014 with the New York Declaration on Forests pledge to achieve zero deforestation supply chains by 2030.

The BSM is fundamentally different from the other fear-provoking interventions in one important dimension. It does not distinguish between legal and illegal deforestation. And because of this difference it was opposed by Aprosoja, as explained above.

4.2.2. New protected areas

From 2004 to 2012, the area of the Brazilian Amazon under strict protection or designated as a sustainable development reserve increased 68%. (Figure 7) The Brazilian Government's formal commitment to expansion of the protected area network through the Amazon Region Protected Area program, coupled with regional plans emerging from multi-stakeholder dialogues associated with new highways (BR163, Interoceanic), provided the legal and planning framework for announcing and demarcating reserves, national forests, and indigenous territories. (Nepstad et al 2002; Campos and Nepstad 2006; Schwartzman et al. 2006)

Figure 7: Expansion of the Area of Brazilian Amazon Forest Lands Under Formal Protection



Significantly, many of the new designations were for forestlands in and around the expanding agricultural frontier region, which increased their importance as inhibitors of deforestation. (Soares-Filho et al. 2010) The complex of protected areas created in the Xingu River corridor and the *Terra do Meio,* south of the Transamazon Highway in Pará state, illustrates the impact of formal designation. With the prospect of paving of the BR-163 highway and the Transamazon (BR-364) highway in Pará in 2000, a frenzy of land claims were made in the region and some long-held claims (e.g. C.R. de Almeida) were resuscitated driven by the prospect of escalating land values that would accompany the paving. The Brazilian Government created a forest district along the BR-163 highway to end this frenzy as it formally designated several new protected areas and sustainable development reserves

within the *Terra do Meio*, which were supported by grass-roots movements. (Nepstad et al. 2002; Campos and Nepstad 2006; Schwartzman et al. 2006)

The formal designation of land as a national park, extractive reserve, national forest, indigenous territory, or other category inhibits deforestation in two ways. (Nepstad et al. 2006b; Soares-Filho et al. 2010) First, it suppresses deforestation carried out to claim land by lowering the likelihood that a claim results in a land title. Second, a formal designation makes it riskier to clear forest. Unlike *terra devoluta*, forest lands that are without a formal designation, land clearing in a designated protected area is more easily identified as an illegal act.

4.2.3 Lower demand for deforestation

4.2.3.1 Beef intensification

Higher yields of dominant production systems can also facilitate reductions in deforestation rates, and this appears to be one of the reasons that deforestation of the Brazilian Amazon has slowed down. The Brazilian cattle industry is inefficient and extensive. Its herd of 216 million heads is 2.4 times larger than the US herd of 89 million head, but produces 28% less beef at 8.4 million tons vs. 11.7 million tons. (Merry and Soares-Filho 2017) This comparison demonstrates the potential for producing more beef in Brazil with a stable or diminishing area of pasture. This potential is particularly high where cattle production is occurring side-by-side, or on the same farms, as agro-industrial production systems, which provide local supplies of silage and animal ration to accelerate weight gain and reduce the time required to slaughter. (Strassburg et al. 2014)

The intensification of cattle production is allowing the Amazon industry to produce more beef per area of pasture through several different modalities. In some operations, cattle are fattened and finished during the dry season, which is usually a time of weight loss in grass-fed systems, through confinement and diet supplements of minerals, ration, and silage. Others plant forage grasses following a crop of soy and corn or soy and cotton, which takes advantage of the residual fertilizer levels, and graze cattle in what is called an integrated agriculture-livestock system.

4.2.3.2 The contraction of soy and beef

In 2005, the Brazilian soy boom ended and an outbreak of foot-and-mouth disease closed Mato Grosso and other Brazilian cattle sectors to global markets. With this retraction of both sectors, the demand for new deforestation also declined. (Nepstad et al. 2014)

4.2.3.3 Abundant cleared land for soybean expansion

During the Brazilian soy boom of 2002 to 2004, large areas of land were cleared in anticipation of agricultural and livestock expansion. This study estimates that 35,000 km^2 were cleared in excess of the area planted to cattle pasture or soybean cultivation during this three-year period. (Nepstad et al 2014) This excess land is equivalent to the total area deforested from 2006 to 2008. It meant that the recovery of the soy and livestock sectors could take place without a significant upward trend in regional deforestation.

4.2.4 Positive incentives for foregoing deforestation

Some of the innovations implemented by the Brazilian government to promote a decline in Amazon deforestation involved positive incentives. The Low Carbon Agriculture (ABC) program provides loans to farmers interested in making the transition to more sustainable production systems. There was

initially little uptake of ABC finance in the Amazon region because of the complexity of the application process and the availability of other finance with similar terms and interest rates, but participation in the program is now growing in the Amazon region. (Stabile et al. 2012)

The German REDD-for-early-movers (REM) contract with the Government of Acre contributed to the state's low-emission rural development strategy. Similar contracts have now been established between Mato Grosso, Germany and the UK, and a Phase 2 contract has been established between Acre, Germany, and the UK. This could become an important driver of a further decline in deforestation.

Launched in 2008, the Amazon Fund is also a pay-for-performance mechanism. Norway's billion-dollar pledge to the Fund, which grew to $1.6 billion in 2015, is being dispersed as Brazil has demonstrated continued success in maintaining low deforestation rates. The Amazon Fund investment has supported state-level strategies, programs to encourage farmer participation in the CAR, and projects led by NGOs. The projects that have been most relevant to farmers are focused on small-scale producers. Medium- and large-scale farmers, who are responsible for most of the region's deforestation, have been largely omitted from its portfolio. Smallholder farmers received support from the Amazon Fund to shift to low-deforestation production systems, especially along the Transamazon Highway of Pará State.

Other programs, such as the &green Fund, financed by Norway, are just beginning to make investments in low-deforestation farm systems

4.2.5 Farm sectors push back

One of the most serious developments in Brazil and some other tropical countries is a growing farm sector backlash against tropical deforestation strategies and environmental laws and regulations more generally. This trend is manifested in the positions taken by the Brazilian *bancada ruralista* (*Frente Parlamentar da Agropecuaria*), now the biggest political block in the Brazilian Congress. It has supported reductions in the area of protected areas, changes to environmental licensing, and an easier pathway to legal land titles. It is reflected in the recent election of the Mato Grosso Aprosoja's leadership on a platform that has communicated little concern for the sustainability agenda.

This backlash merits a thorough investigation that is beyond the scope of this study. Conversations with farmers, farm leaders, and governments point to some possible causes of this apparent radicalization of the farm sector in Brazil. These include:

- an assumption that there is an international plot to prevent Brazil's growth as the new agricultural superpower, an assumption that has been featured in the Green Mafia literature and was reinforced by the US report entitled *Farms Here, Forests There*; (Friedman 2010)
- frustration at the lack of positive incentives for farmers to comply with the Forest Code and to invest in sustainable production systems (Text Box 1) including the lack of price premiums for certified production and the lack of REDD+ finance flowing to farmers;
- frustration that markets and NGOs are focused on tropical forest regions even when temperate region agriculture has important environmental challenges; and
- frustration that compliance with the Forest Code is not seen by markets and NGOs as a sufficient contribution to environmental conservation.

4.3 Did the Brazilian Soy Moratorium cause the slowing of Amazon deforestation?

The BSM made a significant, but modest contribution to the regional slowdown of Amazon deforestation in Brazil. It occurred when the sector was shrinking and when there was a large supply of cleared land and degraded cattle pasture available for conversion to soybean cultivation when the sector started to grow again. The BSM was restricted to the Amazon forest biome where only 10% of national production takes place. Its impact was limited because the soy sector did not really need new deforestation to expand cultivation. That condition persists today.

The powerful soybean farmer organization Aprosoja opposed the BSM but decided not to fight it actively. This is because few soybean farmers had forest on their land that they could legally clear and those who did were still able to convert that forest to cattle pasture. (Stickler et al. 2013; Alix-Garcia and Gibbs 2017) In other words, by requiring 80% of farms to be maintained as natural forest cover, the Forest Code reduced the opportunity cost to the sector of the zero deforestation cut-off date of the BSM. Although they did not actively fight it, soybean farmers see the BSM as a violation of their rights to legally clear a percentage of the forests on their farm as defined by the Forest Code, which it is.

The BSM had little impact on the indirect effect of soybean cultivation on deforestation. Arima et al. (2011) concluded that the BSM did not inhibit indirect land-use change through forest conversion to cattle pasture. The entrance of soybean cultivation into the Amazon region also appreciated land values for properties with cattle pastures on flat, well-drained soils. This land appreciation and the resulting capitalization of those who sold their cattle ranches likely increased deforestation indirectly as well. (Nepstad et al. 2006a)

The BSM reinforced the risks to farmers engaged in illegal deforestation that had already been established through the Brazilian strategy to enforce the Forest Code and the DETER system of early deforestation detection. It complemented the *Municípios Críticos* program that suspended access to public farm credit programs for farmers in high deforestation counties.

The BSM was not fully aligned with these governmental measures, however. By not making an exemption to the BSM for law-abiding farmers who retained forest on their land in excess of the Forest Code requirement, the BSM missed an important opportunity to avoid a farmer backlash and gained very little. Had farmers who retained the legal right to clear forest on their land been recognized, praised, and exempted from the zero deforestation cut-off date until a mechanism for compensating them for the opportunity costs was in place, the BSM would have won far deeper support from the soybean sector.

Gibbs et al. (2014) have demonstrated that soybean farms subjected to the BSM were less likely to clear forests than non-soybean farms registered in the CAR. This finding demonstrates the success of the BSM in moving the Brazilian Amazon soybean sector towards zero deforestation production. This finding does not demonstrate that the BSM was a major contributor to the regional deforestation slowdown, nor does it demonstrate that voluntary supply chain interventions are more effective than public policy in slowing deforestation. The CAR is just one element of a much broader array of public policy interventions to slow deforestation that are summarized above.

The BSM has probably induced little if any market leakage within the soybean sector. Market leakage takes place when a measure inhibits expansion in production of a commodity in one region, driving up prices, which then stimulate expansion in other regions. Macedo et al. (2012) found no evidence that soybean cultivation was expanding more in the Cerrado because of the BSM. As long as the BSM does not inhibit expansion of soybean production onto cattle ranches in the Amazon forest biome, major leakage between biomes will be unlikely.

4.4 Lessons learned from the BSM

The BSM is perhaps the world's foremost example of an effective agricultural commodity value chain intervention to slow tropical deforestation. One measure of its success is the establishment of a virtually deforestation-free soybean sector in a major tropical forest region—the Brazilian Amazon.

There are many ingredients to this success that can be summarized as (a) the high motivation for market players to participate because of the risk established by the Greenpeace campaign, (b) agreement on a simple, operational metric for defining success--the deforestation cut-off date, (c) clear rules for farmers who did not comply--exclusion from most of the market, and (d) reliable monitoring of compliance.

On another level, the BSM was clearly not a success. It was designed in a public policy vacuum and missed critical opportunities to become aligned with the legal framework that Brazilian farmers operate within. By not making an explicit recognition of farmers, who against all odds (See Text Box 1) had kept more forest on their land than required by the Forest Code, the BSM missed an opportunity to gain the support of the powerful soybean farmer association, Aprosoja.

The BSM raises a fundamental question about voluntary value chain interventions: will they work when their implementation means significant constraints on farm sectors? And if the answer is no, does this mean that they are, by definition, only partial solutions at best? A recent review found that the answer to this question is yes. (Lambin et al. 2018) The BSM's success was possible because the soy sector did not really need new deforestation when the BSM was launched. The expansion of soybean cultivation continues today onto cattle pastures. And therein lies an important form of BSM leakage. The BSM capitalizes the owners of cattle ranches who sell their farms to soy farmers, and it may have increased deforestation driven by cattle ranching in other ways as well.

As reviews of value chain interventions have concluded, these strategies work best when they are complemented by public policies and government programs that can translate the engagement of the private sector in deforestation solutions into support for regional programs and public policies. (Nepstad et al. 2014a,b; Lambin et al. 2018)

There is a growing body of evidence that jurisdictional approaches can foster synergies between commodity value chain strategies and government policies and programs to more effectively address tropical deforestation regionally. (Nepstad et al. 2013, 2014; 2017; Fischbein and Lee, 2015) The potential is to bring together value chain strategies and the powerful, agile companies that are driving them together with public policies and programs.

5. Harmonizing value chains and public approaches: Mato Grosso's jurisdictional strategy

The jurisdictional approach to tropical deforestation and other dimensions of sustainable development has emerged as a way of drawing on the strengths, while also addressing the limitations of value chain strategies on the one hand and public policies and programs on the other. Agricultural commodity value chains can harness the power of the market around simple performance metrics to drive rapid change. However, their impact is felt mostly within the value chain of a single commodity, and they are dependent upon a rather unusual set of enabling conditions to be effective.

Public policies and programs potentially affect all forms of land-use and entire political geographies from states to counties through to nations. Governments have their hands on far more levers for effecting "wall-to-wall" change. Land-use regulations including ecological-economic zoning plans, fiscal policies, agricultural credit programs, law enforcement, and transportation and energy policies are all within government capacity. However, the public sector is also notoriously inefficient. And the progress made with one administration can be weakened or reversed following a change in leadership through an election.

The jurisdictional approach seeks to realize the potential complementarities of value chain and public policy approaches. It differs from value chain strategies in that the unit of performance is an entire political geography—the jurisdiction—instead of the farm, processor, or value chain. It differs from typical public policy processes in that it features a multi-stakeholder process for determining shared definitions of success for a jurisdiction including the targets and milestones for agricultural and livestock output, environmental conservation, and the rights and livelihoods of indigenous peoples, smallholders and traditional communications. Ideally, jurisdictional strategies incorporate the strengths of private and public actors while plugging the gaps in each actor's competencies.

The jurisdictional approach is still in its infancy as none of the experiments have become fully operational. Two examples of jurisdictional strategies in the making are described in this LEAVES special report: jurisdictional certification of palm oil in Central Kalimantan and the Mato Grosso Produce, Conserve, Include Strategy. These examples are described in the beef report and further developed in this soy report. The focus we take here is to describe how jurisdictional sourcing agreements that are being negotiated between the Mato Grosso soy sector, the European Union (FEFAC and FEDIOL), and China are advancing.

5.1 The Produce, Conserve, Include Strategy (PCI) as a basis for sustainable sourcing agreements

An important proof-of-concept of jurisdictional sustainability is the establishment of an operational jurisdictional sourcing system with clear annual performance targets, rules for determining compliance with the agreements, and incentive systems that favor performance at the highest level. The Mato Grosso PCI is an excellent laboratory for developing such as system.

Several components of such a system are necessary for it to become fully operational and for it to deliver the necessary incentives to participants while driving large-scale positive impacts on the ground. These components include a shared set of principles, mandatory annual performance targets, an operational set of rules for determining compliance, an integrated system of incentives for driving progress towards compliance, and a system for monitoring, reporting, verifying, and visualizing compliance. This report calls this a jurisdictional performance system. (Nepstad et al. 2014) This jurisdictional performance system has both principles and rules.

An important goal of the principles is to register the key ambitions and concerns of the major stakeholders in the system. Farmers may want to include a principle that high-performing producers will gain access to positive incentives. Companies that buy from a jurisdiction may want assurances that the performance measured by the monitoring system is real and verified. Non-governmental stakeholders may wish to see that the strategy is moving the region towards sustainability beyond the baseline rate of change.

There are two main components of the sourcing agreement rules. First, operational goals and indicators must be established, probably at annual time steps, that are the core measures of success. Second, rules must designed to clearly favor performance at the highest level across the entire state. This means that farmers and communities should receive the most benefits when the entire state is achieving its performance targets. With this basic condition established, an incentive for collective action will be created drawing on the lessons of the *Municípios Críticos* program.

5.2 Sustainable soy sourcing agreements: EU (FEFAC) and China

As described in the beef report of this LEAVES publication, the core goals of the Mato Grosso Produce, Conserve, Include Strategy (PCI) was developed in 45 days through a series of multi-stakeholder dialogues and discussions. This process was first discussed with Governor Pedro Taques in June of 2015. He decided to move the idea forward the following August, and the strategy was formally launched on December 7th in Paris. Even though it was not part of the Paris Agreement, the

PCI was one of the top ten announcements made in Paris in terms of the magnitude of avoided emissions at roughly six billion tons CO_2eq by 2030. (PCI 2018)

The PCI is noteworthy in that it included strong participation of the farm sectors, especially soy and beef. These sectors contributed to the definition of state-wide production targets and both formally endorsed targets for reducing deforestation and clearing Cerrado savanna woodland. These targets included an extremely important threshold for the minimum area of Amazon and Cerrado native vegetation at 60% of the original extent. This lower threshold meant that if implemented, Mato Grosso will be a zero net deforestation jurisdiction. Amazon forest cover is currently at 61%, and in Cerrado is slightly lower than 60%.

As far as this report can tell, this is the first time the soybean sector of Brazil formally endorsed a deforestation target beyond legal compliance with the BFC. One reason such an endorsement was tenable was that it was for the entire state, not for individual farmers. The PCI leaves open the question of how the goals will be reached while leaving flexibility for innovation.

The real test of the PCI will be transforming the state-wide goals into performance on the ground and recognition of that performance through benefits and positive incentives. For soybeans, one way of putting the PCI into practice is through sustainable sourcing agreements that are based at least in part upon the goals of the PCI. Two sustainable soy negotiations that could incorporate the PCI goals are underway. The first is an agreement between the Brazilian soybean sector represented by Aprosoja and ABIOVE and the EU animal ration industry federation, FEFAC. FEFAC has been joined by FEDIOL, the EU federation of vegetable oils.[6] These two federations represent more than half of the soybean and derivatives imported by the EU. The second is a sustainable soy agreement under development between Brazil and China. The combined imports of FEFAC, FEDIOL, and China are more than two-thirds of global soybean trade.

If a harmonized framework for sustainable soy sourcing is achieved between Brazil and these two major markets, an important first step towards market transformation would be achieved. It would represent a major advance in achieving a unified definition of success in addressing tropical deforestation across vast regions.

5.1.2 EU animal rations federation, FEFAC

In recognition of the Brazilian soy sector's decision to leave the RTRS in 2009, an initial decision in the sustainable soy sourcing agreement dialogue between Aprosoja/Abiove and FEFAC was that a new set of guidelines would be developed through direct negotiation between the two parties. The resulting guidelines would then be opened up to review from other parties. The Brazilian soy sector proposed SojaPlus as the basis of the sourcing guidelines. SojaPlus has a strong emphasis on legal compliance with the BFC and on good practices in farm management. The FEFAC Soy Sourcing Guidelines were developed based in large part on SojaPlus. (FEFAC 2016) An agreement on these guidelines with Aprosoja and ABIOVE was nearly reached in January 2017. The system of incentives for complying with the guidelines is the missing piece for bringing this agreement to fruition.

One of the potential incentives under discussion through this process is carbon neutral soy. There is growing interest among FEFAC customers in low- or zero-carbon animal ration. This could potentially provide a price premium that could be returned to soybean farmers who meet pre-determined criteria as a bonus for their efforts. A working group has been established to determine the feasibility of delivering carbon-neutral soy to the EU beginning with Mato Grosso where the REDD+ Law provides a legal framework for allocating a portion of the emissions reductions achieved through state-wide declines in deforestation to offset the emissions embedded in the soybean value chain. The Brazilian National REDD Strategy is now nearly final with a UNFCCC-approved Forest Reference

[6] The negotiations have been supported by IDH, Agroicone, and, more recently, the Earth Innovation Institute.

Level baseline for Amazon-wide emissions from deforestation, a national emission reduction REDD+ registry called the InfoHub, and an agreement for allocating part of the emissions reductions to Amazon states. (Leal et al. 2017)

5.1.3 China Soy Industries Association

A similar set of dialogues has been underway between Aprosoja/ABIOVE and the China Soy Industries Association (CSIA) since 2015.[7] Individual Chinese soy importing companies have also been part of these dialogues. A Memorandum of Understanding (MOU) was signed between Aprosoja, ABIOVE, and CSIA in 2016, which committed the parties to collaboratively develop a sustainable soy sourcing agreement that was satisfactory to all parties. The MOU refers specifically to the SojaPlus program and the Mato Grosso PCI as important components of such an agreement. All parties in these dialogues have made it clear that they would like to see a financial benefit embedded in the eventual agreement. The Brazilian soy producing sector is seeking a financial incentive to enter into an agreement, especially if that agreement would require that soy farmers go beyond legal compliance with the Forest Code. The Chinese soy importing sector would like the agreement to lower costs and lower the level of residues in soy imports.

One of the possible ways forward for these negotiations is to build a mutually-beneficial incentive system around the large carbon mitigation potential of the agreement. Brazil is one of the world's leaders in lowering its national greenhouse gas emissions, almost entirely because of the slowing of deforestation in the Amazon region. An agreement with China as the destination for 80% of Brazil's soy exports to allocate some of the emissions reductions being achieved by Brazil in exchange for Chinese investments could provide the framework of an incentive system. As China gradually implements its national cap-and-trade system, whose design draws significantly on California's cap-and-trade program, mechanisms for incentivizing the emissions reductions achieved through a sustainable soy agreement could be developed.

The political context in China is favorable for building strong, collaborative agreements with emerging economies that are important sources of commodities. With the 19th Party Congress of October, 2017, China launched a long-term commitment to growth with quality and the development of an ecological civilization in China and around the world that harmonizes environmental quality with economic development, cultural heritage, and beauty. These strategies are hallmarks of President Xi Jiping, whose power and longevity is now secured for the indefinite future.

The one-trillion-dollar *One Belt, One Road* global infrastructure strategy is also potentially relevant to the China-Brazil agreement, even if the immediate target of this strategy is in Eurasia. China is developing infrastructure projects in regions that are critical suppliers of key commodities. In Brazil, it is developing investment in a rail transportation system called FerroGrão that would transport soybeans from Mato Grosso to the Tapajós River port of Miritituba, Pará with a large savings in freight costs.

What form might this incentive system take? There are many options. In one scenario, an infrastructure-for-performance system could be designed through which FerroGrão is financed by China within a government-to-government agreement to transfer the freight cost savings to farmers in municipios that are meeting pre-determined annual targets for lowering deforestation, expanding SojaPlus, and eliminating illegal deforestation. In a second scenario, China could become an investor in the Brazilian Amazon Fund and acquire non-transactionable emissions reductions that, like Norway, it would retire and not claim under the Paris Agreement.

[7]This process began with a Moore Foundation project led by The Paulson Institute, Solidaridad, WWF, and TNC. Earth Innovation Institute was invited to support the negotiations in 2016

6. Conclusion

The Brazilian Soy Moratorium rapidly led to the first global zero deforestation sector in one of the Earth's most iconic ecosystems, the Amazon. It galvanized international attention because of the speed with which it was developed, the simplicity of its rule such as the July 2006 deforestation cut-off date, and because it was embedded in the world's first major regional decline in tropical deforestation. This 70% slowing of deforestation in the Brazilian Amazon beginning in 2005 remains the world's main success story in the battle against tropical deforestation.

The BSM's success is indisputable at one level. Around 99% of the Brazilian Amazon's soy production takes place on land cleared after the revised cut-off date of July 2008. This is an impressive achievement. The BSM's contribution to the regional decline in deforestation is far more modest, however. It is best viewed not as the primary driver of this decline, but as an initiative that complemented the massive *Programa de Prevencao e Controle de Desmatamento na Amazonia* (PPCDAm) that was launched by President Lula and his Minister of Environment, Marina Silva. The BSM could have been better harmonized with the PPCDAm if it had made specific linkages to the Forest Code. At one level, we must ask if the large private sector and NGO investment in the BSM was the best use of resources.

And even this remarkable success story is beginning to erode. Since 2012, deforestation has started to climb again in the Brazilian Amazon as the command-and-control measures used to slow deforestation have begun to weaken. This is perhaps the main questions faced by value chain strategies for addressing tropical deforestation. Specifically, if we achieve zero deforestation supply chains even as regional deforestation rises, have we won the battle, but lost of the war?

One of the conclusions that arises from this case study is that the effectiveness of value chain interventions would be greater if they were designed to reinforce land-use regulations and the public strategies and frameworks that are being implemented to address deforestation across large-scale territories. Private sector actors can magnify their positive contribution to regional solutions to tropical deforestation by becoming collaborators in these regional strategies and by moving from a corporate risk management paradigm to become active contributors to regional transitions to sustainable development.

The emergence of jurisdictional approaches to sustainable development, and to the issue of tropical deforestation in particular, could allow the proliferation of large-scale success stories to both slow deforestation and drive reforestation through a deliberate strategic framework as illustrated by the Mato Grosso PCI Strategy. A shared definition of success, a system of integrated positive and negative incentives for driving progress, a system for monitoring, report, verifying, and visualizing success, and a multi-stakeholder governance structure for implementing that plan are core ingredients to successful jurisdictional strategies. They hold the potential to blend value chain strategies with public policies and programs to optimize successful transitions to greater food production with more forests.

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