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LIST OF ABBREVIATIONS
- ABC  Low Carbon Agriculture
- ABRAS  Brazilian Association of Supermarkets
- ADM  Archer Daniels Midland
- BNDES  Brazilian National Development Bank
- CAR  Rural Environmental Land Registry
- EID  Electronic Identification System
- EMBRAPA  Brazilian Agricultural Research Corporation
- FIESP  Federation of Industries in the State of São Paulo
- GTA  Animal Transport Guide
- GTPS  Working Group for Sustainable Beef
- IBAMA  Brazilian Institute of Environment and Renewable Natural Resources
- IFC  International Finance Corporation
- ILUC  Indirect Land Use Change
- INCRA  National Institute for Colonization and Agrarian Reform
- INPE  National Space Research Institute
- IRR  Rural Income Tax Credit
- ITR  Tax on Rural Properties
- LAR  Environmental Rural License
- LAU  Environmental License
- MV  Green Municipalities
- NGO  Non-Governmental Organization
- PES  Payment for Ecosystem Services
- PRONAF  Program for Strengthening Family Agriculture
- REDD+  Reducing Emissions from Deforestation and Forest Degradation
- ROSP  Roundtable on Sustainable Palm Oil
- RTRS  Roundtable for Responsible Soy
- SEMA  State Secretary of the Environment
- TAC  Terms of Adjusted Conduct

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EXECUTIVE SUMMARY

After decades of aggressive deforestation in the Brazilian Amazon, efforts to prevent deforestation are yielding positive results. From 2005 to 2013, the rate of deforestation dropped considerably, falling nearly 80% (INPE, 2014). At the same time, the beef industry—responsible for nearly 75% of previous deforestation—continued to rapidly expand production, proving it possible to produce more beef without more land (Boucher, 2011a).

Despite these impressive gains won by years of effort by government, NGOs, and the beef industry itself, the deforestation problem is far from solved. Sharp increases in demand from non-Western countries potentially undermines recent tactics most effective in reducing deforestation—pressure from Western companies that demand deforestation-free supply chains. Russia’s recent embargo of Western beef has increased demand for Brazilian beef by over 10% creating alternatives that do not require deforestation-free operations (Ward, 2014). The industry continues to face challenges as it adjusts to its new operating environment, leaving ample opportunity to backslide on recent progress. This report focuses on ranchers—the entities capable of preventing deforestation—and processors, the entities with the most direct leverage over ranchers.

Consolidation of beef processing firms has intensified a power dynamic in which ranchers have dwindling bargaining power and ever fewer options for selling their cattle. The market share of the three largest processors, JBS, Marfrig and Minerva, grew from 24% in 2011, to 37% in 2013 (BeefPoint, 2013). Several ranchers and midsize processors expressed concern, fearing that the three top firms could be an oligopoly in the making. Many small and midsize processors feel that unlike large processors, they have restricted access to finance, reducing their ability to monitor for deforestation.

Several regulatory inefficiencies increase costs for ranchers who comply, even while allowing impunity for violators. Since 2009, the evolving mix of deforestation laws has created a number of bureaucratic hurdles. Ranchers must acquire an array of federal and state licenses to operate. Although some requirements are straightforward and used in all states, others can be confusing, overlapping, or unevenly enforced from region to region. Agencies are notorious for bottlenecking paperwork, or worse, losing entire applications. And illicit cattle operations still have ample opportunity to enter legitimate supply chains. It is not difficult, for instance, to circumvent the GTA system to track cattle from the ranch to the slaughterhouse. Falsified GTA lists with the origin and destination of cattle are easily obtained, costing as little as R$ 200.

Choosing pasture management over clearing new land represents daunting costs for ranchers. A crucial element is land tenure, and the institution of land tenure in Brazil is deeply flawed. Several ranchers interviewed for this study have been waiting for years—sometimes more than 20—to receive a title to their land. Without a title, banks will not approve ranchers for the credit they need to make the costly transition to a deforestation-free operation. Depending on the terrain, the estimated cost to deforest 145 hectares of new land—the cost the rancher is accustomed to—is between R$ 65,250 and R$217,500 (Desmatamento, 2006; EMBRAPA, 2003). These gross costs do not account for earnings from the sale of timber, which may actually yield a net profit for clearing forest. By contrast, pasture management for 145 hectares will cost roughly R$ 412,000, a significant premium (Costa & Factori, 2011).
Many ranchers interviewed for this study complained that they receive no price premium for adopting a
deforestation-free operation. Worse, given the high costs to comply with regulations and the ease with which
unlicensed ranchers can sell cattle, ranchers have perverse incentives to revert to deforestation. For those
committed to maintaining legitimate operations, many are reducing their beef focus, shifting some of their land
to more profitable—and possibly less closely regulated—activities.

In sum, beef-focused efforts to combat deforestation to date are creating unintentional impacts on ranchers’ land
use decisions, raising the possibility that future deforestation threats will merely shift out of the beef industry and
into other sectors. Unfortunately, several dynamics external to the beef industry are already lining up to accelerate
this shift. Among them are land speculation, the growth of other commodities, and the rapidly emerging role of
palm oil.

Deforestation fueled by land speculators is increasing rapidly in Brazil. As the country’s agricultural
export market grows, and government and industry build new infrastructure for commodities exports,
speculators anticipate future demand in the North, including demand from displaced ranchers currently
operating in the South and Center-West regions. In the state of Pará from August 2012 to January 2013,
an estimated 80% of deforestation was speculative in nature, occurring around infrastructure projects
such as Transamazônica and highway BR-163. Only about 20% of deforestation comprised expansion of
existing agricultural operations (Brandao Jr., 2013; Mansur, 2013). The recent capture of a highly
organized deforestation gang reinforces the notion speculative deforestation has surpassed traditional
drivers. Responsible for an estimated 10% of recent deforestation in Pará, the gang systematically burned
public land, divided it into parcels, and sold it to farmers and ranchers (BBC, 2014).

Production of Brazilian agricultural commodities is expected to increase substantially during the next ten years,
creating additional drivers for deforestation. According to the Federation of Industries in the State of São Paulo
(FIESP), just four crops—soy, corn, sugarcane, and palm oil—will require more than 10.5 million additional
hectares of land by 2023 (FIESP, 2013).

Palm oil, relatively new in Brazil, is positioned to grow faster than any other commodity. The government of Pará
estimates that by 2022, oil palm plantations for biofuel will cover 700,000 hectares, which would place Brazil
third in global palm oil production, behind Indonesia and Malaysia (Frayssinet, 2013). To ensure that palm oil is
an environmental win for the Amazon and an economic one for ranchers and farmers, it is necessary to see that
only already-degraded land is used. The net effect of palm oil could turn out positive or negative for forests,
depending in large part on whether it creates economic opportunity for small producers; if they do not have
economically viable alternatives, they will only end up illegally clearing new land.

As more ranchers turn to producing oil palm or other crops, it will become increasingly difficult to attribute
deforestation to a specific commodity, making commodity-by-commodity enforcement methods less effective. An
alternative that merits further study is to complement future efforts to build deforestation-free supply chains with
enforcement and certification mechanisms focused not by commodity, but by jurisdiction.
Where is Beef-Driven Deforestation Heading?

Brazil’s Amazon region is the largest continuous area of tropical rainforest in the world, comprising roughly 40% of global tropical rainforests (Kirby et al., 2006; Ometto, 2011). While the forest extends over nine countries, 70% of the Amazon lies within Brazil’s borders. The Brazilian Amazon originally occupied over four million km²—an area roughly equivalent to half of continental Europe (Assunção, 2013). However, in the past 40 years the region has suffered severe deforestation.

Until 1970, expansion into the Brazilian Amazon was relatively slow, claiming an average of 10,000 km² of forest per year (Hargrave & Kis-Katos, 2013). Beginning in the 1980s, as deforestation became closely associated with agricultural markets, the annual rate of deforestation increased rapidly. During this time, drivers of deforestation grew increasingly complex and interrelated. Unresolved land tenure issues, poverty, expanding infrastructure, and demand for agricultural commodities acted together to fuel deforestation in Brazil, eventually peaking in 2004 at a rate of over 27,000 km² per year (Hargrave & Kis-Katos, 2013; INPE, 2013). During that time, Brazil lost approximately 18% of its original forest cover (Assunção, 2013).

PROGRESS SINCE 2004

After decades of aggressive deforestation in Brazilian Amazon, efforts to prevent deforestation are yielding positive results (see Figure 1). From 2005 to 2013, the rate of deforestation dropped considerably, falling nearly 80% (INPE, 2013). At the same time, the beef industry—responsible for nearly 75% of previous deforestation—continued to rapidly expand production, proving it possible to produce more beef without more land (Boucher, 2011a).

**FIGURE 1.**
Brazilian Amazon deforestation, 2004-2013

*SOURCE: INPE 2014*
Initiatives by Government, NGOs, and Industry

Several factors contributed to the decline in deforestation. Starting in 2004, the Brazilian government implemented several forest conservation policies, collaborating with state and municipal entities to restrict deforestation. Shortly after, the Brazilian National Institute of Space Research (INPE) implemented new satellite technologies to monitor the rate and location of land clearing, which made it much easier to enforce the new regulations. A case in point is the federally-mandated Rural Environmental Land Registry (CAR). The CAR uses a property’s GPS coordinates to monitor deforestation via satellite imagery. If the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) detects deforestation on a rancher’s property, it fines the rancher and revokes the license (IBAMA, 2014). By some estimates, conservation polices and improved monitoring are responsible for up to half the reduction in deforestation (CPI, 2012; UCS, 2011).

Beef industry initiatives also contributed significantly to the recent fall in deforestation. For decades prior, the industry largely ignored calls to clean up its supply chain. However, after a 2009 Greenpeace report identified several multinational brands and retail chains linked to beef-related deforestation, the government and major retailers pressured the industry to make changes (Greenpeace, 2009). Brazilian federal prosecutors threatened major processors with billions in fines if it did not take immediate action (Brasil, 2013). Large retailers such as Walmart, Carrefour, and Tesco banned Brazilian beef from suppliers identified in the report. The World Bank revoked US$ 90 million in loans from Bertin, the then-largest processor (Adam, 2009).

The beef industry responded, with the three largest processors—JBS, Marfrig, and Minerva— signing a moratorium on any products coming from newly deforested lands (Walker et al., 2013). To date, 140 beef processors in four Amazonian states—Pará (120), Mato Grosso (17), Rondônia (2), and Amazonas (1)—have signed the Terms of Adjusted Conduct (TAC), a federal agreement that provides credit, promotion, and technical assistance in exchange for a commitment to deforestation-free operations (Brasil, 2013). Additionally, JBS, Marfrig, and Minerva initiated regular third-party audits of their suppliers.

In the nearly five years since the Greenpeace report, the industry has taken significant steps to monitor its supply chain against deforestation—yet pressure on the industry continues. In March of 2013, the 2,800-member Brazilian Association of Supermarkets (ABRAS) declared it would no longer source beef raised in the rainforest (BBC, 2013). In April of 2013, federal prosecutors fined 26 producers in Mato Grosso and Rondônia US$ 236 million for purchasing beef from areas linked to deforestation and slave labor (Murphy, 2013).

The industry has responded by fortifying systems to monitor their supply chain. In December of 2013, JBS, Marfrig, and Minverva agreed to standardize their audits, making it easier for suppliers and retailers to ensure a deforestation-free product. Results from the new audits came out in April of 2014, and demonstrated the firms continue to make significant progress (Greenpeace, 2014). While not as extensive, almost every other small and midsize processor—such as Mafrinorte and Mafripar in Pará, and Superfrigo and Redentor in Mato Grosso—has implemented systems to audit their suppliers.
A shifting clandestine market

Accompanying these industry changes is a decline in clandestine beef—a market that, existing outside the official, registered market, is less likely to respond to regulatory or public pressure to prevent deforestation. Figure 2 shows how the clandestine market, at one time responsible for almost half of Brazilian beef production, has contracted in recent years, declining from 27% in 2007 to just 13% in 2013 (IBGE, 2013). To estimate the clandestine market’s size, researchers compare heads of cattle slaughtered to number of leather hides reported (Walker et al., 2013). In theory, the two numbers should match, yet because leather is not as closely regulated, more leather hides are reported than heads of cattle. The difference, therefore, is recognized as a proxy for the size of the clandestine market for beef.

While a clandestine market of 13% is relatively low—compared to a high of 44% in 2002—the actual size may be even smaller. In many cases, fully licensed ranchers may not report a portion of their beef, making it only appear to be part of the clandestine market.

On average, processors reject about 15% of cattle due to quality issues such as gender, low weight, and hide quality (Industry interviews). With few legitimate buyers available, licensed ranchers face limited options for selling these rejected cattle (see Figure 3). Most ranchers say they have the cows processed at the municipal slaughterhouse and then sell the beef to local stores. Several ranchers and processors interviewed said municipal slaughterhouses frequently underreport the number of cattle—sometimes by as much as 80%—to help ranchers avoid taxes. Many legitimate cattle thus go undocumented.

Other ranchers say they may sell their rejected cows to local butchers, who sell the meat in their shops. As a third option, some ranchers slaughter the cows on site, sell the meat to a local butcher, or give the meat away to family, friends or employees. In each of these cases, cattle from fully licensed ranchers can mistakenly be attributed to the clandestine market. This suggests that the clandestine market, often thought to reflect non-compliant beef, may be somewhat overstated.
FIGURE 3.
Up to 15% of beef from licensed ranchers may appear as part of the clandestine market

SOURCE: Industry interviews

MUNICIPAL SLAUGHTERHOUSES
Municipal slaughterhouses often give tax breaks to ranchers in exchange for cash. A common practice is to document only a portion (e.g., one of every five cows), saving the ranchers a percent of their tax liability.

LOCAL BUTCHERS
Rancher sells rejected cattle to local butcher who slaughters the cattle and sells the meat.

ON-SITE SLAUGHTER
Rancher processes beef on site and either sells it to local stores or gives it away to employees.

Paths via which registered beef can be undocumented and mistakenly attributed to the clandestine market

DEFORESTATION AND THE BRAZILIAN BEEF VALUE CHAIN

Sharp increases in demand from non-Western countries potentially undermines recent tactics most effective in reducing deforestation—pressure from Western companies that demand deforestation-free supply chains. Russia’s recent embargo of Western beef has increased demand for Brazilian beef by over 10% creating alternatives that do not require deforestation-free operations (Ward, 2014).

Deforestation Threats within the Beef Value Chain

To understand the dynamics of a given industry, it is useful first to map out the value chain. This can lend insights into how the target good is produced and why certain methods are used. Several factors, such as government regulations, production costs, and private sector quality standards, influence industry practices. Relationships between lead firms and their suppliers help explain which segments control and influence others, shedding light on how industry practices are likely to evolve over time.

The Brazilian beef value chain is depicted in Figure 4. Moving from left to right, the chain begins with firms that provide inputs such as fertilizers, machinery and vaccinations. Ranchers, simply put, raise cattle. Some ranchers specialize in a single aspect of ranching, for example, calving—providing calves to other ranchers—or “finishing,” providing the last stage before cattle go to slaughter. Cattle move to subsequent stages via traders, auctions, finishing lots, and processors. Ranchers who specialize in finishing cattle may never need some inputs, such as genetics.

Processing consists of primary and secondary processing. Primary processing occurs in the slaughterhouse, producing fresh and frozen meat and all other meat byproducts. Secondary processing transforms the products of primary processing into food for human or animal...
consumption, or nonedible goods such as cosmetics and leather. Increasingly, midsize and larger slaughterhouses are vertically integrating their operations to accommodate secondary processing. Firms such as Marfrig, Marfripar, and Marfrinorte have expanded to produce processed frozen foods. JBS has acquired several tanneries to manufacture leather.

FIGURE 4.
Brazilian beef value chain

SOURCE: Adapted from (Neves et al., 2012) and industry interviews

The chain ends with sales, including restaurants and retail outlets such as grocery and big-box stores. On the periphery of the value chain are entities that have a direct influence on the industry. These include supporting institutions such as banks and industry associations, the public sector, and non-governmental organizations (NGOs).

This report focuses on ranchers—the entities capable of preventing deforestation—and processors, the entities with the most direct leverage over ranchers.

Power dynamics between Processors and Ranchers
Starting in 2005, Brazilian beef processors have grown and consolidated rapidly, leaving ranchers with fewer options for selling their cattle. Figure 5 shows the rapid growth in market share for the three largest processors—JBS, Marfrig, and Minerva—up from 24% in 2011 to 37% in 2013 (BeefPoint, 2013). In some states such as Mato Grosso, Mato Grosso do Sul, and Goais, their market share is as high as 68%.
Sharp increases in demand from non-Western countries potentially undermines recent tactics most effective in reducing deforestation—pressure from Western companies that demand deforestation-free supply chains. Russia’s recent embargo of Western beef has increased demand for Brazilian beef by over 10% creating alternatives that do not require deforestation-free operations (Ward, 2014).

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Several ranchers and midsize processors expressed concern about this trend toward consolidation, many referring to the three top firms (JBS, Marfrig and Minerva) as an oligopoly in the making. Ranchers feel the consolidation distorts prices and has turned them into price takers (BeefPoint, 2013). In a 2011 survey, 43% of ranchers in Mato Grosso cited “consolidation of processors” as one of the main problems hindering their productivity (BeefPoint, 2012). Ranchers still have a degree of bargaining power during the dry season, when fewer cattle are available. However, several processors have plans to invest in finishing lots that will stabilize supply, effectively eliminating ranchers’ only bargaining edge.

Many ranchers in Pará fear that the “big three” will soon move into their geography. To prepare, they have begun to bypass processors and instead sell to live cattle exporters. This, in turn, has alarmed Pará’s small and midsize processors. Already having to compete with the big three, they will now also find a shrinking supply of cattle destined for slaughter, since many will be diverted instead to live cattle exporters.

FIGURE 5.
Market share of top three processing firms

SOURCES: (BeefPoint, 2013; JBS, 2014; Marfrig, 2012; Minerva, 2012)
Small and midsize processors also complain that, while small and midsize processors have difficulty accessing affordable credit, development banks continue to invest heavily in JBS, Marfrig, and Minerva. Between 2008 and 2010 the Brazilian National Development Bank (BNDES) invested US$ 4.7 billion in JBS (Forero, 2013). In 2013, the International Finance Corporation (IFC), a World Bank affiliate, acquired a 3% share of Minerva for US$ 19.65 million and approved financing for an additional US$ 60 million (Jelmayer, 2013). This inequitable access to finance makes it difficult for small and midsize processing firms to compete. It also restricts their ability to afford implementing systems to monitor for deforestation.

Public sector regulations and inefficiencies
Several weaknesses in regulatory rules and enforcement increase costs for ranchers and allow impunity for violators. Since 2009, the evolving mix of laws regulating deforestation has created a number of bureaucratic hurdles for ranchers and processors. Ranchers must acquire an array of federal and state licenses to operate, including the environmental license (LAU) in Mato Grosso, environmental rural license (LAR) in Pará, and the Animal Transport Guide (GTA). Although some of these are straightforward and used in all states—for instance, the GTA, which documents the movement of cattle throughout the country—others can be confusing, overlapping, or unevenly enforced from region to region. Table 1 lists ranching licenses required in Mato Grosso and Pará since 2009, along with fees and wait times, which vary according to ranch size and individual experience. At a minimum, the initial expense of regulatory compliance costs a rancher R$ 16,500 and can reach as high as R$ 28,000.

TABLE 1.
Ranchers’ costs to comply with regulations
SOURCE: Industry interviews

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<td>R$ 300 – R$ 3,000</td>
<td>3 months – 1 year</td>
<td>• Rancher hires service to expedite process</td>
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<td>SEMA (Mato Grosso)</td>
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<td>R$ 10,000 – R$ 15,000</td>
<td>1 – 2 years</td>
<td></td>
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<tr>
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<td>INCRA</td>
<td>Variable</td>
<td>1 – 20+ years</td>
<td>• Rancher cannot access credit</td>
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Many industry representatives reported that only the smallest ranching operations remain unlicensed. One possible discouragement for small ranchers to seek licenses may be the fact that many licensing fees are fixed on a per-producer basis, resulting in disproportionately high per-hectare costs for smaller operations. As shown in Figure 6, a 500-hectare ranch pays R$ 12.6 per hectare, a cost that goes down for much larger operations (Imazon, 2014).

**FIGURE 6.**
Per-hectare cost to obtain ranching licenses in Pará, according to ranch size

*Figures do not include geo-referencing costs to map property*

Source: (Imazon White Paper, forthcoming)

Ranchers say that although licensing fees are significant, they do not compare with the time and opportunity costs that result from government inefficiencies. Processors require most of these licenses, so ranchers cannot sell their cattle without them. The longer a government agency takes to issue a license, the longer the rancher must wait to generate revenue.

Agencies are notorious for bottlenecks in paperwork, or worse, losing entire applications. To avoid this, some ranchers drive weekly to the state capital to push the paperwork along. More often, ranchers hire services, such as Seta Ambiental, to shepherd applications for a fee. In extreme cases, ranchers resort to paying bribes to acquire the documents they need. Many licenses require ranchers to renew each year, starting the process over again.

The institution of land tenure in Brazil is also deeply inadequate. Several ranchers interviewed for this study have been waiting for years—sometimes more than 20—to receive a title to their land. Without a land title, banks will not approve ranchers for the credit they need to make the costly transition to a deforestation-free operation.

Many industry leaders expressed that they would have more patience with these inefficiencies if the system worked. Unfortunately, it does not. While most operations are licensed, a persistent minority of illicit cattle operations still have ample opportunity to enter legitimate supply chains. Figure 7...

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1 Figures do not include geo-referencing costs to map property
describes a phenomenon known as “leakage,” also referred to by several ranchers and processors simply as jeitinho brasileiro, or “the Brazilian way.” Leakage occurs when a licensed rancher offers to sell cattle from an unlicensed ranch, causing processors to believe the cattle is licensed. The ease with which one can circumvent the GTA system to track cattle from the ranch to the slaughterhouse facilitates leakage. Each carrier must present an official list with information regarding the origin and destination of cattle, gender, and reason for transport—yet falsified GTA lists are easily obtained, costing as little as R$ 200 (Industry interviews).

Not only is leakage easy to achieve, it also goes largely without punishment. The fine-collecting record of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) is dismal. In 2010, the agency issued more than R$ 1 billion in fines in the state of Pará, citing violations for deforestation, illegal fires, and illegal wood sales. Of all fines issued, the agency collected just 0.2% (Moukaddem, 2011). Industry representatives say that even violators who do eventually pay are rewarded for late payment; the longer they wait, the likelier they can negotiate a smaller fee.

High costs of adopting a deforestation-free operation

When beef processors signed the TAC in 2009, the costs of preventing deforestation, and the responsibility of enforcement, shifted from government to the beef industry. Processors assumed the role of enforcer, increasing their administrative costs to monitor suppliers. Most new costs were incurred by those who had to comply with the new regulations—ranchers. Because processors had consolidated into ever-fewer available buyers, ranchers of any significant size had little choice but to quickly meet processor requirements. Virtually overnight, ranchers needed to stop clearing land, adopt an entirely new method of raising cattle, and register their land with the licenses and certifications their buyers required. All of these involved unprecedented costs.
To make the transition to a deforestation-free operation, ranchers must adopt a pasture management system that will produce enough grass to fatten cattle. This requires a notably higher investment than the cost to deforest new land. Figure 8 illustrates two scenarios for a given rancher. Depending on the area and terrain, the estimated cost to deforest 145 hectares of new land—the cost the rancher is accustomed to—is between R$ 65,250 and R$ 217,500 (Desmatamento, 2006; EMBRAPA, 2003). These are gross costs and do not account for earnings from the sale of timber, which may actually yield a net profit for clearing forest. By contrast, pasture management for 145 hectares will cost roughly R$ 412,000, a significant premium over the gross cost to deforest the same acreage (Costa & Factori, 2011). Of the initial investment in pasture management, more than
After their initial investment in pasture intensification, ranchers must maintain the land, which requires the additional annual cost of fertilizers (see Figure 9). Deforestation, on the other hand, can support cattle for at least five years without further investment (Hecht, 1985). At an annual expense of R$ 50,544, fertilizing the pasture over five years costs R$ 252,720, considerably more than even the highest one-time cost to deforest 145 new hectares of land (Costa & Factori, 2011).

Ranchers’ declining profitability

Figure 10 sums up the effect these dynamics have had on ranchers’ profitability. The cost of raising cattle in Amazon states has increased substantially in recent years, in many cases surpassing the market price for beef (Del Isola, 2014). In the three Amazon states with the highest number of cattle, the cost of producing one arroba (unit of measure equal to 15 kg) doubled from 2007 to 2013 (Del Isola, 2014). Ranching in Rondônia has not been profitable for over three years, and it appears Mato Grosso and Pará may be heading in the same direction.

“Inputs have become increasingly expensive recently, especially costs to improve productivity. Ranching is not a good business nowadays. So some smaller ranchers still consider deforestation the best way to expand production without having to invest in the land.” – Rancher, Pará
FIGURE 10.
Profitability of ranching in Mato Grosso, Pará and Rondônia, R$ per arroba, 2007-2013

1 arroba = 15 kg of beef

SOURCE: (Del Isola, 2014)
No price premium for compliance

Ranchers we interviewed most commonly complained that they receive no price premium for adopting a deforestation-free operation. Anti-deforestation efforts to date have dealt ranchers only negative incentives. Table 2 lists the suite of laws and initiatives to persuade ranchers to adopt deforestation-free operations (Nepstad et al., 2013). Six of the seven initiatives increase costs, restrict entry into markets, or diminish access to credit. Only two provide positive incentives—Low Carbon Credit (ABC) program, and REDD—but neither has yet performed as intended. ABC, which offers 5.5% financing, has had little uptake, possibly because it requires ranchers to have a land title. REDD+ would provide compensation to ranchers who protect the forest, but it has not yet been implemented at sufficient scale to have significant impact.

Ranchers we interviewed feel the situation is not sustainable. Given the high costs to comply with regulations and the ease with which unlicensed ranchers can sell their cattle, ranchers have perverse incentives to abandon the rules and revert to deforestation. For those who are committed to maintaining legitimate operations, little choice remains but to reduce their beef focus and instead dedicate some or all of their land to more profitable—and possibly less closely regulated—activities. In sum, beef-focused efforts to combat deforestation to date are creating unintentional impacts on ranchers’ land use decisions, raising the possibility that future deforestation threats will merely shift out of the beef industry and into other sectors. Unfortunately, several dynamics external to the beef industry are already lining up to accelerate this shift.

### TABLE 2.
Laws and initiatives to promote deforestation-free ranching are all stick and no carrot

SOURCE: Adapted from (Nepstad et al., 2013)

<table>
<thead>
<tr>
<th>LAW/INITIATIVE</th>
<th>FOREST METRIC</th>
<th>NEGATIVE INCENTIVE</th>
<th>POSITIVE INCENTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Code</td>
<td>80% of property with forest cover</td>
<td>Fines. No access to credit</td>
<td>None</td>
</tr>
<tr>
<td>Critical Municipalities</td>
<td>Municipality-wide deforestation</td>
<td>No access to credit and markets</td>
<td>None</td>
</tr>
<tr>
<td>Beef Moratorium (voluntary)</td>
<td>Cut-off date for forest clearing</td>
<td>No access to beef buyers</td>
<td>None</td>
</tr>
<tr>
<td>REDD+</td>
<td>State-wide, historical deforestation</td>
<td>None</td>
<td>Not yet implemented for ranchers at scale</td>
</tr>
<tr>
<td>Consumer Goods Forum commitment (CGF)</td>
<td>Zero net deforestation by 2020</td>
<td>Exclusion from CGF buyers</td>
<td>None designed</td>
</tr>
<tr>
<td>Rural Land Environmental License (CAR)</td>
<td>Legal compliance (in Pará)</td>
<td>Cost of application</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time cost to comply</td>
<td>None</td>
</tr>
<tr>
<td>Low-Carbon Credit (ABC) Program</td>
<td>Legal compliance</td>
<td>No access to low-interest credit</td>
<td>Low interest (5.5%) credit; uptake has been low, possibly because a land title is required</td>
</tr>
</tbody>
</table>
Deforestation Threats Emerging Outside the Beef Value Chain

As Brazil’s agricultural export-driven economy continues to grow, new deforestation threats are emerging from outside the beef industry. At least three dynamics are expected to intensify the pressure on forests in northern Amazon states: land speculation, growth in demand for other agricultural commodities, and the rapidly expanding role of palm oil.

Land Speculation
Deforestation fueled by land speculators is increasing rapidly in Brazil. As the country’s agricultural export market grows, and government and industry build new infrastructure for commodities exports, speculators anticipate future demand for land in the North, including demand from displaced ranchers currently operating in the South and Center-West regions.

Figure 11 maps the deforestation in Pará from August 2012 to January 2013, illustrating the severity of land-speculation-driven deforestation. About 80% of deforestation was speculative in nature, occurring around infrastructure projects such as Transamazônica and highway BR-163. Only about 20% of deforestation comprised expansion of existing agricultural operations (Brandão Jr., 2013; Mansur, 2013). The recent capture of a highly organized deforestation gang reinforces the notion speculative deforestation has surpassed traditional drivers. Responsible for an estimated 10% of recent deforestation in Pará, the gang systematically burned public land, divided it into parcels, and sold it to farmers and ranchers (BBC, 2014).

Because speculators most often use cattle to show that land is productive, government agencies, NGOs and the international community often attribute land-speculation-driven deforestation to the beef industry, further tarnishing its reputation even as it works to clean up its supply chain (Barreto & Silva, 2013).

“As agriculture advances over degraded pasture, ranchers sell their land to farmers and relocate into new land.” - Rancher, Mato Grosso

“This is the problem, people can clear land for R$ 400 a hectare, then two years later sell it for R$ 3,000 a hectare.” - Rancher, Pará
A combination of public policies and market dynamics fuel speculative deforestation. Table 3 outlines the three contributing areas of public policy: land tenure, the rural income tax, and the tax on rural properties. As mentioned earlier, the institution of land tenure in Brazil—especially in Pará, where most speculative deforestation takes place—is deeply flawed. Almost 40% of territory in Pará has unresolved issues with tenure and titles, and over 70% of all deforestation takes place on this land (Brito et al., 2013). Land speculators know that years will pass before the government sorts out a title for the land, and by then it will not be possible to prove who is responsible for any deforestation on it.

“For cattle ranching to be viable, land needs to be a cheap asset and that is exactly what ranchers find as they move toward the north.”

– Rancher, Mato Grosso
Under the rural income tax (IRR), any business on rural land pays 1/5 the normal tax rate. The government designed the IRR to assist rural entrepreneurs, but the law has become an ideal way to launder money or evade taxes. Brazilians with excess income can purchase a rural property, put a few cows on it, report millions in revenue to the government, and pay a fraction of the taxes (Barreto & Silva, 2013). This only increases demand for land, further fueling speculation.

By design, the tax on rural properties (ITR) is an effective tool to discourage speculation by incentivizing land intensification and productivity. The ITR assigns higher taxes to landowners with less productive land, reaching a tax rate of 20% for land deemed unproductive (Barreto & Silva, 2013). Many owners of unproductive land are those using it to launder money or evade the non-rural tax rate. Unfortunately, the Brazilian federal tax authority does not strictly enforce tax collection, collecting less than 10% of potential ITR revenues (Barreto & Silva, 2013). This is an important missed opportunity to discourage people from clearing land to evade or minimize their income taxes.

TABLE 3.
Policies that facilitate speculative deforestation

SOURCE: (Barreto & Silva, 2013); (Brito et al., 2013)
The market dynamics that fuel speculation-driven deforestation begin with the historical relationship between farmland and ranchland. For most of the twentieth century, ranching in Brazil took place in the southern savannahs. Motivated by government policies that encouraged expansion into the Amazon, ranchers slowly moved north in the 1970s. Expansion accelerated quickly in the 1990s when agricultural exports started to take off, displacing ranchers into the forests of Mato Grosso (Boucher, 2011b). Today, demand for agricultural land continues to push ranching north. By 2023, an estimated 3.8 million additional hectares of ranchland are expected to be displaced out of the Center-west and Northeast regions (FIESP, 2013).

Demand for those 3.8 million additional hectares of ranchland will increase already-skyrocketing land values. As Figure 12 shows, the average value of farmland and ranchland has increased considerably in Mato Grosso and Pará, in some cases more than doubling between 2006 and 2010 (FGV, 2013). Several ranchers interviewed in Mato Grosso noted how quickly their land’s value had increased in recent years, expressing interest in selling it and moving their operations north. As the value of ranchland in Mato Grosso continues to rise, and as ranchers struggle with increased costs, ranching may similarly migrate northward, following cheaper land.

“\textit{For me, the future of ranching isn’t in cattle, but in the appreciation of the land value. I bought this 515-hectare ranch in 2001 for 45,000 reais, and today I can sell it easily for 2.5 million reais}”

–Rancher, Mato Grosso
Figure 13 illustrates the process by which speculators in the North deforest land in anticipation of ranchers displaced from ranchland in the South and Center-West regions. Global demand for grains increases demand for farmland in the southern half of the country. Public and private sector regulations prohibit deforestation, which limits the quantity of available farmland and rapidly increases its value. Facing increased costs from pasture management and burdensome regulations, ranchers sell their land for a large profit and buy less expensive land in the North. Speculators observe these trends, grab land in the north and deforest it in anticipation of future demand. This phenomenon is known as indirect land use change (ILUC). Several researchers have hypothesized that the expansion of industrial agriculture in Brazil is encroaching upon existing ranchland, displacing cattle ranchers into newly deforested areas (Andrade et al., 2010; Barona et al., 2010; Lapola et al., 2010). Although these findings of ILUC in Brazil remain controversial, more recent studies provide supportive empirical evidence (Andrade et al., 2013; Arima et al., 2011). One such study found that every 10% increase in soy production encroaching on ranchland results in up to 40% increase in deforestation on the forest frontier (Arima et al., 2011). It is possible that attempting to prevent deforestation by targeting a sole commodity may actually shift deforestation to another. More research is needed to fully understand this dynamic.
Growth in demand for other commodities

Production of Brazilian agricultural commodities will increase substantially during the next ten years, creating additional drivers for deforestation. According to the Federation of Industries in the State of Sao Paulo (FIESP), just four crops shown in Table 4—soy, corn, sugarcane, and palm oil—will require more than 10.5 million additional hectares of land by 2023 (FIESP, 2013). Accommodating this 17% increase in farmland in less than ten years while also preventing further deforestation presents considerable challenges for government and industry.

In the coming decade, Brazil is expected to increase production of corn by 14%, and soy by 47% (FIEPA, 2013; FIESP, 2013). Large new infrastructure projects will make exports more competitive and ensure long-term growth. A new federal highway (BR-163) will soon connect farms in Mato Grosso to a new US$ 2.5 billion port on the Amazon River, establishing a Pacific route to Asia via the Panama Canal. Together, the projects will increase shipping capacity by 72% and shave two days off the current south Atlantic route to Asia (FIEPA, 2013; Freitas & Wilson, 2014).

FIGURE 14. Increased acreage from projected expansion of corn, soy, sugarcane and palm oil, percent increase over 2012-2013

SOURCE: (FIESP, 2013)

<table>
<thead>
<tr>
<th>LAND REQUIRED IN 2023 (Ha)</th>
<th>PERCENT INCREASE</th>
<th>REAL INCREASE (Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17,700,000</td>
<td>11%</td>
<td>1,782,734</td>
</tr>
<tr>
<td>SOY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34,300,000</td>
<td>24%</td>
<td>6,571,625</td>
</tr>
<tr>
<td>SUGARCANE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10,500,000</td>
<td>20%</td>
<td>1,720,736</td>
</tr>
<tr>
<td>PALM OIL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>140,000</td>
<td>328%</td>
<td>459,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>62,640,000</td>
<td>17%</td>
<td>10,534,094</td>
</tr>
</tbody>
</table>
Increased production will expand acreage for corn and soy by 11% and 24%, respectively, requiring an additional 8.5 million hectares of land for these two commodities alone. As shown in Figure 15, much of the additional acreage will be located in Amazon states, particularly Mato Grosso and Pará. States in the northern Amazon—notably Pará—will experience the largest percent growth in corn production (36%), while the Center-West region—notably Mato Grosso—will see the largest total growth in corn production. The Center-West region will also see the largest total growth in soy production (FIESP, 2013).

Sugarcane and oil palm production are projected to grow as well, driven by expanding demand for ethanol and biodiesel. Brazil is the largest supplier of sugar in the global market, accounting for half of all exports (FIESP, 2013). About half of Brazil’s sugarcane production is manufactured into over 20 billion liters of ethanol, most of which is consumed domestically. Since 2009, Brazil has exported between 1.9 and 4.7 billion liters of ethanol to the United States, responding to demand from the revised U.S. renewable fuel policy (FIESP, 2013). Continued exports, combined with rapidly growing automobile sales in Brazil, will double annual ethanol production to about 40 billion liters by 2023 (FIESP, 2013).

To accommodate this growth in production will require an additional 2 million hectares of land. In 2023, nearly a quarter of production (23.1%) will be in Amazon states. Over the next ten years, productivity will grow 59.9% in the Center-west region and 71.2% in the North.

“Continued exports, combined with rapidly growing automobile sales in Brazil, will double annual ethanol production to about 40 billion liters by 2023” (FIESP, 2013).
Rapidly expanding role of palm oil

Palm oil, a relatively new addition to Brazil’s agricultural portfolio, is nonetheless positioned to grow faster than any other commodity, stimulated largely by federal policies promoting the use of biodiesel. In 2005, Brazil mandated that all diesel in the country contain a mix of five percent biodiesel (Brazilian National Congress, 2005). Recent proposals may increase the blend rate to as much as 10 percent by 2020, providing stronger incentives for companies to expand palm oil production to meet future demand (Nielsen & Lima, 2013).

Ideal climatic conditions for palm oil occur 10 degrees above and below the equator, which includes the entire Amazon region. However, as of 2012, 82% of Brazilian national palm oil production was concentrated in roughly 120,000 hectares in the single state of Pará.
The Brazilian government, prioritizing development on degraded lands, focuses most of its efforts in northeastern Pará, where the Zoneamento Agroecologico do Dende recommended 37 municipalities with large tracts of deforested land (CMEsar et al., 2013; Glass, 2013a; Yui & Yeh, 2013).

Several private and public sector initiatives aim to prevent deforestation in the leading palm oil firms’ supply chains. To date, these efforts seem promising. Agropalma, the longest-established palm oil producer in Brazil, has set deforestation standards exceeding those of the Roundtable for Sustainable Palm Oil (RSPO). The firm is also a founding member of the new Palm Oil Innovation Group (POIG), a small set of progressive palm oil companies dedicated to increasing the global demand and supply of sustainable palm oil (Greenpeace, 2014). The public sector’s own efforts to steer palm oil planting to already-degraded lands have also been effective, discouraging the expansion of new production into forested land.

Still, the aggressive domestic growth in demand for palm oil raises concerns that further forest land could be cleared. The state of Pará expects to more than double planting area to 329,000 hectares and increase the biofuels share from 33% in 2012 to 47% by 2015 (Frayssinet, 2013; Glass, 2013a). The state government estimates that by 2022, oil palm plantations for biofuel will cover 700,000 hectares, placing Brazil third in global palm oil production (Frayssinet, 2013). Given the devastating record of deforestation in Indonesia and Malaysia, the world’s two top palm-oil producing countries, it is worth closely monitoring the development of this industry in the Amazon.

To understand the emerging role of Brazilian palm oil, it is useful to lay out the full set of economic actors and how they are linked to one another. The value chain, depicted in Figure 17, begins with firms that provide inputs such as fertilizers, pesticides, and seeds. Most seeds are imported from Colombia, Costa Rica, or Ecuador, but some may be purchased from the Brazilian Agricultural Research Corporation (EMBRAPA). In many cases, nurseries grow seedlings and sell them to producers (oil palm farmers). Producers purchase inputs, grow the oil palms, and after three years, when the trees begin to produce fruit, sell fresh fruit bunches (FFB) to primary processors. Previously, production in Brazil consisted chiefly of large industrial farms. More recently, as processors increasingly decide to contract production to outside parties, small family farms have begun to play a larger role. According to confidential industry documents, up to 25% of processors’ FFBs come from operations under 100 hectares. One large firm hopes to increase the number of family farms from which it sources FFBs to 2,000 families by 2015.
Nine primary processors are already expanding palm oil production in Pará (see Figure 18). The four largest of these each plan to expand by 50,000 hectares or more. They are Agropalma, ADM, Petrobras, and Biopalma. Agropalma, Brazil’s dominant processor to date, now plans to add 50,000 hectares, more than doubling its 45,000-hectare production by 2020. ADM will also add 50,000 hectares, vastly increasing the size of its own 3,000-hectare operation. Petrobras and Biopalma will undergo the largest growth, expanding by 75,000 hectares and 70,000 hectares, respectively (Frayssinet, 2013; Glass, 2013a; Lane, 2012). Although the market currently offers higher prices for food end uses, these firms seem to be anticipating supplying the biofuel market in the future.

ADM, which already manufactures biodiesel from soy, plans to diversify its biodiesel feedstock with palm oil. The firm is building a processing facility in Sao Domingos do Capim, expected to be operational in 2016 (Crain’s, 2011). Petrobras recently signed a US$ 530 million agreement to produce palm oil in Brazil and ship it to Portugal, where it will be refined by Galp Energia, making 250,000 tons of biodiesel for distribution throughout Europe (Frayssinet, 2013). Biopalma also plans to expand biodiesel production, the result of a recent deal with mining giant Vale. As part of its strategy to produce biodiesel to fuel its mining equipment, Vale recently acquired 70% of Biopalma—which in turn plans to invest US$ 500 million in two extraction facilities in Pará. The first facility will open in 2015 with annual capacity of 120,000 tons per year. The second will open in 2018 with capacity of 450,000 tons per year (SABI, 2012).

With the Brazilian government ensuring a guaranteed market for its producers via its proposed increases in biofuel mandates, the country’s palm oil industry is poised to grow at unprecedented rates in the coming years. The resulting demand for farmland raises concerns about future deforestation. Will the palm oil expansion become a new deforestation threat, or an opportunity to continue the country’s recent progress? Much of the answer will lie in several dynamics not just within palm oil, but also within the beef industry.
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The Intersection of Beef and Palm Oil

To meet anticipated demand of 10.5 million additional hectares of farmland, the Brazilian government realizes it must encourage planting on already-degraded lands. Beef ranchers have millions of hectares of underutilized ranchland that could be devoted to palm oil and other high-demand commodities. Accordingly, several public and private sector programs now encourage ranchers to also plant crops—efforts that, if managed well, can help avoid further land clearing. Still, a positive outcome will not be automatic. To ensure that palm oil is an environmental win for the Amazon and an economic one for ranchers and farmers, it is necessary to ensure that only already-degraded land is used. It is also necessary to make certain that small producers capture economic value, to avoid the pitfalls of mono-cropping, and to step up the role of the public sector.

Planting on degraded ranch land

Although Brazil currently accounts for just 0.5% of global palm oil production, the government anticipates, and is actively encouraging, substantial growth (UNEP, 2011). In 2010, EMBRAPA identified 32 million hectares of land suitable for palm oil cultivation, 29 million of which are located in the Amazon biome (EMBRAPA, 2010). The Brazilian government considers palm oil a win–win opportunity, frequently citing the crop’s potential returns as green fuel, green jobs, and a carbon sink ideal for reforesting lost segments of the Amazon (Frayssinet, 2013; SAGRI, 2013; UNEP, 2011). Of course, the key to realizing these green benefits is preventing further clearing of forest land. Fortunately, several private and public sector incentive programs are in place, each prohibiting any expansion of new crops on forested land.

A description of programs that incentivize the integration of palm oil and other crops with ranchland is found in Table 5. One of the largest public initiatives is the Low Carbon Agriculture (ABC) program. ABC actively supports the integration of cattle and other agricultural activities, providing low-interest financing (EMBRAPA, 2011). The program aims to convert 15 million hectares of degraded ranchland to crops as a means to improve agricultural productivity without expanding into new areas (Marques, 2013).

To promote the expansion of palm oil, the government has implemented two complementary social inclusion programs: the Social Fuel Seal (SFS) and the Program for Strengthening Family Agriculture (Pronaf EcoDendê). The SFS is a certification private biofuel companies must earn in order to participate in the majority of biodiesel auctions, and it requires a certain minimum percentage of raw materials to be sourced from small producers (Cesar et al., 2013; Glass, 2013a; Secretaria da Agricultura Familiar, 2013). Pronaf EcoDendê—a subprogram recently developed under the broader Pronaf program—provides 2% financing to small family farmers to expand palm oil production (Glass, 2013b; MDA, 2012). Palm oil has become a priority for Pronaf. In the 2013/2014 budget, Pronaf allocated nearly R$ 125 million for palm oil projects in its EcoDendê
program, nearly 93% of all Pronaf spending in 2012 (Glass, 2013b). The government has linked these two programs, requiring that firms wishing to qualify for benefits in the Social Fuel Seal program collaborate with small family farmers in Pronaf EcoDende.

Private sector initiatives are equally ambitious. Firms that source products for Bunge and Cargill are already contracting directly with ranchers to grow soy and corn on their ranchland. The companies supply ranchers with inputs such as seeds and fertilizers in exchange for an agreed-upon bushel-per-hectare return at the end of the growing season. In interviews with Datu researchers, ranchers reported in 2013 paying the companies 21 bushels per hectare. In 2014, they will pay 22.8 bushels per hectare. In these agreements, ranchers keep any yield in excess of the agreed-upon share.

### TABLE 4.
Programs that promote the integration of commodity production into ranching

<table>
<thead>
<tr>
<th>ASSISTANCE PROGRAM</th>
<th>CORN</th>
<th>SOY</th>
<th>SUGARCANE</th>
<th>PALM OIL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PUBLIC SECTOR ASSISTANCE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Carbon Agriculture (ABC) program  — Provides financing up to $500,000, 5.5% interest, 5-15 year terms to help ranchers integrate agriculture into their operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pronaf EcoDendê  — Provides financing up to R$ 80,000 per family over 14 years to cultivate palm oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petrobras Biocombustivel  — Set a goal to contract 2,250 farmers to grow palm oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PRIVATE SECTOR ASSISTANCE</strong></td>
<td></td>
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<tr>
<td>Bunge, Cargill  — Provide ranchers inputs such as seed &amp; fertilizer in exchange for an agreed upon bushel/hectare return on the investment</td>
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<tr>
<td>ADM, Agropalma, Biopalma Vale  — Provide a mix of low interest loans and technical assistance to ranchers interested in growing palm oil</td>
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</table>

Similar to public sector initiatives, the largest private sector programs target palm oil. Backed by government incentives to work with family farmers, Agropalma, Archer Daniels Midland (ADM), Petrobras, and Biopalma each have initiated programs to engage small producers. In exchange for exclusive access to future harvest, each company offers producers a different mix of incentives, such as input materials at-cost, fees for rural licenses such as the CAR, transport of goods, technical assistance, and low-interest loans. These incentives are very effective. According to a private industry report, as a result of these programs, more than 80 percent of newly-initiated palm oil farmers now have access to credit for the first time.
Several ranchers interviewed for this study expressed interest in growing palm. Beef processors in Pará are aware of this interest and expressed concern that beef production could decline and restrict supply. A confidential large-processor report found that approximately one in three of its palm oil suppliers also raise cattle.

Because the expansion of palm oil is only beginning, it is difficult to predict which types of rancher will be more likely to convert to palm oil in the future. One may speculate—based on the licensing costs cited earlier for ranchers with fewer than 500 hectares—that smaller operators facing a disproportionately higher cost to operate may be some of the first to make the transition. Geography and infrastructure may also be a determining factor. Since FFBs must make it to processing within 24 hours, adoption will be limited to ranches located sufficiently close to transportation infrastructure.

Ensuring that small producers capture value
Brazil’s beef industry consists largely of small producers; an estimated 1,800,000 ranchers raise cattle, with an average of only 110 heads of cattle per farm (Ahola, 2014). Small ranchers lack the economies of scale enjoyed by larger producers. As the costs of fuel, equipment, labor, and regulatory compliance increase, small ranchers’ already-thin margins decline even further. It is no surprise that many small ranchers continue to find a way around current anti-deforestation measures, since the alternative—pasture management—requires up-front investment at a considerably higher price than clearing land. In short, if small producers simply cannot afford to avoid clearing land, that is what they will do, despite the rules. To avoid repeating this dynamic in palm oil, it is important not just to offer incentives to small producers to enter the palm oil value chain, but also to ensure that they fully capture the economic value they create.

Compared with beef ranching, palm oil offers greater potential revenues per hectare. On average, palm oil can yield R$ 6,028 per hectare per year, while beef yields only R$ 697 (IndexMundi, 2014a, 2014b). The important question is whether small producers will capture an adequate share of this value, or if it will be absorbed largely by the extraction plants and processors seeing the palm oil into its final stages.

To date, palm oil small producer projects undertaken by the biodiesel industry remain largely experimental. Initial programs have seen mixed success in their ability to generate income for rural families (Cesar et al., 2013; Glass, 2013a). Palm oil takes at least two years to become productive, reaching maximum productivity only in the eighth year of growth (ACET, 2013). Thus, while revenues are extremely attractive in the height of palm’s productivity—from its 8th–18th year—in its initial stages the cost of production (fertilizer, pesticides, some rental machinery, labor) can result in a net loss (ACET, 2013). Even small producers with mature trees achieve low net profits due to their financing obligations for fertilizer and start-up costs (Glass,
2013a). If small ranchers are to successfully include palm oil in their operations and not fall back on illegally clearing land for grazing, these economic hurdles will need to be addressed.

Avoiding pitfalls of monocropping
Reliance on a single crop presents several environmental risks, including vulnerability to pests and disease. Producers also face economic risk when they depend on a single crop in a highly fluctuating commodity market, with no guarantee that the prices they receive will cover their rising input costs. An additional risk is a decline in the local agrarian economy, as subsistence farmers move away from generating their own food in favor of a cash crop that may or may not produce sufficient returns.

The increasing shift of farmers to palm cultivation is already contributing to a regional economic effect underway in Pará. Sixty percent of food consumed in Pará is now grown out-of-state, and the price of many food items in the state is rising. According to Roberto de Sena Bentes, economist and technical advisor of the Pará regional office of the Departamento Intersindical de Estatistica e Estudios Socioeconomicos (DIEESE), the recent increase in food prices can be attributed to the turnover of agricultural land to palm oil (Glass, 2013a).

A large monoculture on a regional scale can also create power imbalances between the buyer and producer. The beef industry has already moved largely toward a consolidated, top-down power structure, a pattern that the palm oil industry is repeating. In the long-term contractual agreements between palm oil small producers and biodiesel companies, the buyer or company maintains a high degree of influence over the producer (Cesar et al., 2013). Contracts grant the company exclusive buying rights, largely unfettered access to the palm property, and the ability to define all management practices (Glass, 2013a). A lack of worker unions or cooperative support in the northern region for palm production accentuates the power disparity, inhibiting farmers’ self-reliance in producing and marketing palm (Cesar et al., 2013).

An “agro–pastoral” approach combining crops and livestock could help ranchers reduce their market risk and expand their choice of potential buyers. In a recent five-year study of the related concept of agro–forestry in Pará, palm oil yields in agro–forestry systems surpassed monocrop systems under similar conditions, at 7 tons per hectare per year for agro–forestry, versus 5 tons in a monocrop (EMBRAPA, 2013; Langford, 2014). While cattle were not included in this study, the economic benefits of a diversified operation are evident. EMBRAPA is currently pushing a variety of possible systems through their iLPF Strategy\(^1\), which encourages the integration of crops, livestock, and forest activities via rotation, intercropping, and succession (EMBRAPA, 2013). Recently, the Inter-American Development Bank (IDB) began funding a pilot project for integration of a native palm oil variety on ranchlands in the Cerrado region after a feasibility study determined the integrated system to be socially and economically sustainable (Averdunk et

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\(^1\) iLPF - Integração Lavoura-Pecuária-Floresta
al., 2012, 2014). Petrobras currently requires its palm oil producers to avoid intercropping, although the company, having commissioned a study with EMBRAPA to investigate its benefits, is considering changing the requirement (Glass, 2013a).

Stepping up the role of the public sector

Brazil’s burgeoning palm oil industry is already facing several consequences of government inefficiency. Poor road infrastructure results in higher prices and uncertainty in market access, leading processors to undertake maintenance of roads and bridges themselves in order to transport their goods (Averdunk et al., 2012). Rapid production expansion is inhibited by a backlog of land title paperwork. Procedures to obtain environmental licenses remain slow and complicated (Averdunk et al., 2012).

As demonstrated by Brazil’s experience with beef-related deforestation, vast improvement is needed in public sector monitoring and enforcement. In beef, negative publicity about deforestation led the large processors to take on a self-policing role, creating efficient systems to screen suppliers and commissioning independent audits of their supply chains. Much progress has been made thanks to these industry efforts, but they unfortunately have come at a cost that disproportionately affects small ranchers, diminishing their ability to compete.

Care must be taken to avoid recreating this dynamic all over again with palm oil. The palm oil industry uses the CAR to monitor suppliers against deforestation. As discussed earlier, the CAR is a federally-mandated license required of all agricultural producers that uses satellite imagery to monitor land for deforestation. When asked about potential leakage in the CAR system—similar to how illicit beef is sold through CAR-registered producers—industry representatives attributed the problem to insufficient regulation and enforcement, something they consider the responsibility of the government, not the private sector. So ultimately, industry self-policing for deforestation will be only as effective as the CAR system.

Recent land use data confirm that having ambitious regulations in place achieves little if the laws are not enforced. A 2013 University of California–Davis study projecting land conversion rates under three different Brazilian government enforcement scenarios (low, medium, and high) found that in a low anti-deforestation enforcement scenario, palm oil expansion in Pará would lead to 62% conversion of forested areas (Yui & Yeh, 2013). Effective monitoring and enforcement is crucial.

The New Deforestation Reality

Brazil’s challenge of preventing future deforestation is about to become much more complicated. Given the country’s anticipated rapid growth in palm oil and other commodities—and their
sudden intersection with the beef industry—it will be increasingly difficult to attribute land clearing to a single commodity. And, for the industries that must be held accountable, it will be increasingly hard to verify that their supply chains are deforestation-free.

Emerging complications for enforcement

The integration of ranching with crops for food and biofuel has extensive potential to prevent further deforestation, even as demand for agricultural land increases by 17%. However, as more ranchers also become farmers, complications arise. Under the current system, a rancher who chooses to grow soy and palm oil faces the daunting task of navigating requirements for the Terms of Adjusted Conduct (TAC), the Roundtable for Responsible Soy (RTRS), and the Roundtable on Sustainable Palm Oil (RSPO). Because each roundtable uses its own unique system to audit suppliers, this presents needless delays and compliance costs.

Fortunately, the states of Pará and Mato Grosso are moving to improve the existing fragmented licensing system by relying almost exclusively on the CAR to monitor against deforestation. By streamlining the process for ranchers and simplifying auditing for processors, the CAR markedly reduces licensing costs and allows operators to diversify and experiment with other crops without excessive bureaucratic hurdles. To promote rancher adoption of the CAR, in May 2011, Pará initiated an incentives program, Green Municipalities (MV), to provide CAR-registered property owners low-interest financing, and to grant ranches in federally-embargoed municipalities access to markets. As of April 2013, more than 70,000 rural properties had registered, more than any other state in Brazil (PMV, 2013).

Pará and Mato Grosso are demonstrating success in using the CAR system to address beef-related deforestation. However, an important regulatory challenge must be considered. As ranchers increasingly undertake production for more than one value chain, and as roundtable efforts, such as the RTRS, replace their unique systems to audit suppliers with the CAR system, opportunities for regulatory “leakage” will only multiply.

Consider the example from the beef value chain, discussed earlier, depicted again here in Figure 20. Within any single value chain, unlicensed producers can insert their non-compliant product into the legitimate supply chain via licensed producers. An unlicensed rancher, for instance, may have the opportunity to channel deforestation-linked beef through a licensed rancher who, facing ever-increasing production costs, will pass along illicit beef for a fee. This leakage is believed to at least partially explain why deforestation continues despite great strides in regulation and enforcement. It occurs only vertically between unlicensed and licensed producers of the same product—in this case, beef.
Figure 18 shows how, under a framework with all commodities regulated using the CAR system, leakage could occur horizontally, giving unlicensed producers many times more opportunities to channel their products into legitimate, regulated supply chains. Thus, while past unlicensed palm oil producers could only channel their product through willing licensed palm oil growers, they now can channel it through a willing CAR licensed rancher who also happens to grow palm oil. Since some of the largest processors do not collect FFBs directly from the farm, but rather at collection centers, the opportunity to channel illicit FFBs into the legitimate supply chain is even easier than it is for beef. Future frameworks will need to address these increased opportunities for leakage.

“Financing for palm oil is more widely available, the profitability is more predictable than beef, and the cattle industry is just too complex now with all the pressure on ranchers.” - Rancher, Pará
Increasing awareness by retail industry and consumers

The beef, soy, and palm oil industries have each worked hard in recent years to prevent deforestation in their respective value chains and show governments, buyers, and the international community that their operations are deforestation-free. As commodity operations merge, attributing deforestation to a specific commodity becomes more difficult. Said another way, it becomes easier to falsely blame one industry for deforestation committed by another. An example is shown in Figure 19. If a licensed palm oil operation, also raising cattle, deforests adjacent land to expand palm oil production, this deforestation could be attributed to beef. The same scenario could occur in the opposite direction, attributing beef-related deforestation to palm oil. Producers and buyers throughout each product’s value chain have reason to be concerned about this reputational risk.
Derivatives of beef, soy, and palm oil are used in millions of end products. Large retail firms that source these commodities—and consumers of final products—increasingly want to be sure they are not contributing to deforestation in the Amazon. Yet the links are not always obvious. To illustrate, a sample list of U.S. corporations that source beef products from Brazil is included in Appendix A. Consumers of products such as canned corned beef from Goya, or leather shoes from Birkenstock, can easily make the connection to ranching in Brazil. But other connections are not as widely recognized. For example, the public may not be aware that JP Morgan Chase trades in Brazilian leather, thus potentially linking it to Amazon deforestation. New Ford car owners may not consider the origins of their leather seats, and pet owners may assume Hartz dog treats come from a sustainable source. If future regulatory efforts continue to address deforestation commodity by commodity, the links to end products may become only more complex and difficult to isolate.

A Jurisdictional Approach

Commodity-by-commodity efforts such as the GTPS and RTRS have worked successfully with powerful firms to prevent deforestation in the beef and soy supply chains, thus helping to achieve impressive reductions in land clearing. However, future commodity-by-commodity efforts are not...
certain, as demonstrated by the recent decision to end the Brazilian Soy Moratorium in December, 2014 (Stewart, 2014). Roundtables also face challenges in globalized markets; for example, the RSPO, influential in western markets, has less impact in the highest palm-oil-consuming countries (China, India, and Indonesia), where environmental concerns are of lower priority. As observed with GTPS and Brazilian beef, regulations exclusive to a single commodity can drive up costs, distribute them unevenly across the chain, and create perverse incentives for producers. Future efforts will require moving beyond a single supply chain focus. Continued success will require complementing roundtable efforts with innovative measures that work across multiple commodities.

Zero net deforestation
Many organizations working to prevent deforestation are promoting the concept of “zero net deforestation.” Unlike zero deforestation, zero net deforestation allows land to be cleared in some areas, as long as other areas are sufficiently reforested to maintain net carbon density (WWF, 2014). A number of municipalities and states in Brazil are striving to achieve zero net deforestation by 2020 (PMV, 2013). This creates an unprecedented opportunity to simplify enforcement and traceability. By certifying a given jurisdiction, and all commodities produced in it, as “deforestation-free,” authorities would no longer have to track thousands of producers, instead focusing on a single geography.

New satellite technology and data management help make the jurisdictional approach possible by eliminating uncertainty about a geographic area’s deforestation record. Since 2002, the Brazilian National Space Research Institute (INPE) has made its satellite imagery available to the public (INPE, 2013). More recently, Google provided a public platform for new high-resolution maps, monitoring rates of deforestation at a spatial resolution of 30 meters (GFW, 2014; Science, 2013). Because this technology is available to governments, corporations, NGOs, and operators, it is more possible than ever to monitor performance at the state or province level, preparing the way for jurisdictional certifications.

Effects on producers, retail buyers, and consumers
For ranchers and farmers, meeting the requirements of a deforestation-free jurisdiction could potentially be less costly and time-consuming than obtaining commodity-specific certification. Costs associated with government bureaucracy and third-party requirements would likely decrease. In addition, the stage would be set for a United Nations Reducing Emissions from Deforestation and Forest Degradation (REDD+) program, giving producers economic incentives. A common complaint among ranchers is that they receive no price premium for their deforestation-free operations. A jurisdiction-based payment for ecosystem services (PES) program could provide ranchers an indirect premium for preserving the forest on their land. A PES system can also deliver additional benefits, such as capital, technical training, or inputs.
Beef, soy, and palm oil processors would save on the substantial administrative costs to monitor their supply chains. Processors staff entire departments to manage detailed files on each of their suppliers, ensuring that each one is up to date with the many required licenses. To publicly verify their deforestation status, processors such as JBS regularly hire firms to conduct independent audits of their supply chain. These practices are costly. A jurisdictional certification reduces these costs considerably, since the processor or retailer need only verify that the supplier operates in the designated jurisdiction.

Jurisdictional certifications also level the playing field across all products and producers. As discussed earlier, the smallest ranching operations face a per-hectare cost of compliance nearly ten times that of the largest operations. Similarly, third-party certifications are frequently too costly for small producers, putting them at a disadvantage. A jurisdictional approach helps address these challenges faced by small producers trying to compete with larger players.

A further advantage over the commodity focus is the elimination of most opportunities for vertical and horizontal leakage. If every producer within a given jurisdiction is licensed and certified, it removes the incentive for this type of leakage. Of course, if market demand increases for products in certified jurisdictions, leakage may well come from other, non-certified jurisdictions. The best way to prevent this is to improve the GTA system, the traceability mechanism for cattle. Incorporating the use of electronic identification (EID) systems—microchips that use radio frequencies to monitor the location and movement of cattle—would be much more effective than the current system. EIDs are currently used in Australia, Canada, and Denmark, where they reduce labor costs associated with cattle management (CowTime, 2003; Livestock Research, 2010).

From the perspective of conscientious retail buyers, jurisdictional certification would build far greater confidence that the suppliers they select do not contribute to deforestation. Several large companies in the Consumer Goods Forum, such as Kraft, Nestle, Proctor & Gamble, Unilever and Walmart, have committed to establishing zero net deforestation supply chains by 2020, raising the possibility that they could support efforts to identify and certify entire jurisdictions that have achieved this status (PRNewswire, 2010). Consumers, in turn, would benefit from increased transparency.

Challenges
Implementing a jurisdictional system with a PES component such as REDD+ is challenging. It requires well-established, reliable systems to monitor deforestation and realistic reference points upon which to base future progress. Extensive planning and negotiation are required to ensure an effective and equitable distribution of benefits. Also essential is coordination across multiple agencies at all levels of government, with effective and transparent institutions capable of enforcing the law (CIFOR, 2012).
With its sophisticated satellite technology to monitor deforestation, and its established reference points upon which it has already made considerable progress, Brazil has already overcome some of the initial challenges to implementing a deforestation prevention program based on jurisdictional certification. It has also put in place some of the world’s most comprehensive regulations—regulations that, unfortunately, it often fails to enforce. Institutional accountability and public sector enforcement need drastic improvement. Like any regulatory effort, a jurisdictional certification will only be truly effective if the public sector enforces the rules and collects fines from violators.

Perhaps equally daunting is the poor state of land tenure in Brazil. While not prohibitive to a jurisdictional certification, unresolved tenure can impede the implementation of a PES component. A successful PES program depends on clearly defined land tenure rights to ensure that regulatory enforcement and incentive-based components work effectively. If more than one occupant claims ownership of land, it is impossible to enforce regulations against environmental offenses, since each occupant can blame the other for the infraction.

To receive payment for ecosystem services for protecting the land, owners need to be able to prevent third parties from deforesting their land without consent (Duchelle et al., 2013). A possible opportunity to address unresolved land tenure may lie in cooperation between the government and processors. Because processors have established a system to verify that their suppliers have proper licenses—thus defining land/operator relationship over time—they may offer a start by providing reliable documentation.

A jurisdictional certification based on net zero deforestation would address many shortcomings of current commodity-based approaches. It has potential to trim administrative costs across the value chain, reduce leakage, and increase retailer and consumer confidence in the veracity of deforestation-free products. Realizing these benefits will require the public sector to make considerable improvements, particularly in enforcing regulations and resolving land tenure. Indeed, these public sector issues will need to be resolved before any approach, whether focused on commodities or on geographies, can reach its full potential.
CONCLUSION

This study has examined beef-related deforestation in the Brazilian Amazon. Responding to public pressure, the Brazilian beef industry has reduced deforestation considerably in a short time. By implementing systems to monitor their suppliers, processors have incentivized nearly all major ranchers to license and register their properties. For the first time ever, almost 90% of cattle come from legitimate, licensed operations.

Our research identified important areas of needed public sector improvement to reduce industry cheating and ensure that ranchers make long-term commitments to deforestation-free operations. Also needed are regulatory streamlining, reductions in the costs to comply, and resolution of land tenure issues to ease access to credit for improved pasture management.

While Brazil’s beef industry is now in large part deforestation-free, this transition has come at ranchers’ expense. Escalating requirements by processors and government have dramatically increased ranching costs without expanding revenues, calling into question ranchers’ ability to make further progress in avoiding deforestation. Just as when a balloon is squeezed, ranchers could respond by simply shifting to areas of less pressure, diversifying into other commodities that may not be as closely regulated.

Changes in ranchers’ land use decisions, along with other rapidly emerging dynamics in the beef industry, are pushing future land-clearing threats out of the beef value chain. An important focus for future anti-deforestation efforts is the intersection between beef and palm oil. The net effect of palm oil expansion could turn out positive or negative for forests, depending partly on how much economic opportunity it creates for small producers; if they do not have economically viable alternatives, they will only end up illegally clearing new land.

As more ranchers turn to producing oil palm or other crops, it will become increasingly difficult to attribute deforestation to a specific commodity, making commodity-by-commodity enforcement methods less effective. An alternative that merits further study is to complement future efforts to build deforestation-free supply chains with enforcement and certification mechanisms focused not by commodity, but by jurisdiction.
Appendix A. Corporations that source beef products from Brazil

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<th>FIRM NAME</th>
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<td>AUTOS</td>
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<td>Acura</td>
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<td>Audi</td>
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<td>BMW</td>
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<td>Buick</td>
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<td>Chevrolet</td>
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<td>Dodge</td>
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<tr>
<td>Ford</td>
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<tr>
<td>Honda</td>
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<tr>
<td>Hyundai</td>
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<tr>
<td>Jeep</td>
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<tr>
<td>Kia</td>
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<tr>
<td>Land Rover</td>
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<tr>
<td>Lexus</td>
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<td>Lincoln</td>
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<td>Mazda</td>
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<td>Mitsubishi</td>
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<tr>
<td>Volkswagon</td>
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<tr>
<td>Volvo</td>
<td>Leather upholstery for cars</td>
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<td>BANKS</td>
<td></td>
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<tr>
<td>JP Morgan Chase</td>
<td>Leather</td>
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<td>PNC Bank</td>
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<td>Standard Bank and Trust</td>
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## FIRM NAME

### FOOTWEAR

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<td>Footwear</td>
</tr>
<tr>
<td>Belvedere, Inc.</td>
<td>Footwear</td>
</tr>
<tr>
<td>Burten Distribution</td>
<td>Shoe parts, Footwear</td>
</tr>
<tr>
<td>DSW</td>
<td>Footwear</td>
</tr>
<tr>
<td>Genesco (Brands include: Journeys, Schuh)</td>
<td>Footwear</td>
</tr>
<tr>
<td>Happy Feet Inc (Birkenstock)</td>
<td>Footwear</td>
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<td>Kepner Scott Shoe Company (Children’s Shoe Brand’s: Amilio, Carpenter, Sandals by Carpenter and Self Starters)</td>
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<tr>
<td>L.L. Bean</td>
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<td>Loeffler Randall</td>
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</tr>
<tr>
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<tr>
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<td>Reef Sandals</td>
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<tr>
<td>San Marina Shoes</td>
<td>Footwear</td>
</tr>
<tr>
<td>Southern Leather, co; Sells to brands such as Birkenstock</td>
<td>Shoe repair products</td>
</tr>
<tr>
<td>The Jay Group (Retail in Adidas, Nike, JCPenny, Reebok, Payless, Steve Madden, Naturalizer, Stride Rite, Nine West, Timberland)</td>
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### FOOD

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<td>Bushy Creek shredded beef</td>
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<td>Bifi Snacks</td>
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<td>Jack Links Beef Jerky</td>
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<td>Peperami Snacks</td>
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### FURNITURE

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### FIRM NAME

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<td>LA-Z-BOY</td>
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<td>Stickley Fine Upholstery</td>
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### PET FOOD

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<td>The Natural Dog Company</td>
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Source: [ImportGenius, 2014](http://importgenius.com/).

References Cited


Stewart, Alastair. (2014). Brazil to End Amazon Soy Moratorium. The Progressive Farmer. Retrieved May 20, 2014 from http://www.dtnprogressivefarmer.com/dtnag/common/link.do;jsessionid=E0D65201842625E970FF7D06535E415B.agfreejavax2?symbolicName=agblogs/template1&blogHandle=southamerica&blogEntryId=8a82c0bc45a1ab8d01447409c86508td


