WORKING PAPER

The state of oil palm development in the Brazilian Amazon

Trends, value chain dynamics, and business models

Frederico Brandão

George Schoneveld

CIFOR

Working Paper 198

The state of oil palm development in the Brazilian Amazon

Trends, value chain dynamics, and business models

Frederico Brandão
Center for International Forestry Research (CIFOR)

George Schoneveld
Center for International Forestry Research (CIFOR)

Center for International Forestry Research (CIFOR)

Working Paper 198

DOI: 10.17528/cifor/005861

Brandão F and Schoneveld G. 2015. *The state of oil palm development in the Brazilian Amazon.* Working Paper 198. Bogor, Indonesia: CIFOR.

Photos by Miguel Pinheiro/CIFOR

CIFOR
Jl. CIFOR, Situ Gede
Bogor Barat 16115
Indonesia

T +62 (251) 8622-622
F +62 (251) 8622-100
E cifor@cgiar.org

cifor.org

We would like to thank all funding partners who supported this research through their contributions to the CGIAR Fund. For a full list of the 'CGIAR Fund' funding partners please see: http://www.cgiar.org/who-we-are/cgiar-fund/fund-donors-2/

Contents

List of figures, tables and boxes

Figures

Tables

Box

Abbreviations

ADM	Archer Daniel Midlands
ANP	National Agency of Petroleum, Natural Gas and Biofuels
APP	Area of Permanent Preservation
BBB	Belém Bioenergia Brasil
CAR	Rural Environmental Registry
CPO	crude palm oil
EMATER	Rural Extension and Technical Assistance Company
FDI	foreign direct investment
FFB	fresh fruit bunches
GHG	greenhouse gas
INCRA	Brazilian Agency for Agrarian Reform
ITERPA	State Land Agency of Pará
LAR	Rural Environmental License
MAPA	Ministry of Agriculture, Livestock and Food Supply
MDA	Ministry of Agrarian Development
PKO	palm kernel oil
PRONAF	Program to Support Family Farming
REASA	Reflorestamento Amazônia, SA
RSPO	Roundtable on Sustainable Palm Oil
SPOPP	Sustainable Palm Oil Production Program
SUDAM	Superintendence of Development in the Amazon
ZAE-Palma	Agro-Ecological Zoning of Oil Palm in Deforested Areas of the Amazon

Acknowledgements

We gratefully acknowledge Alfredo Homma, Adriano Venturieri and Kátia Monteiro from Embrapa Amazônia Oriental, Marcelo Thales from Museu Goeldi and René Poccard and Mark Piraux from CIRAD for valuable on-the-ground assistance, technical support, and reviewing this paper. This paper also greatly benefited from the critical insights and reviews from Marcello Brito and Túlio Dias from Agropalma, Diego Di Martino from ADM, and Pablo Pacheco from CIFOR. This work would not have been possible without the company, analytical insights, and data collection support of Jessica Banhos, Wando Matias, Cristina Silva and Fabricia Moura.

This research was conducted with the financial support of the UKAID-funded KnowFOR (Forestry Knowledge) program and the CGIAR research program on Forests, Trees and Agroforestry (FTA).

1 Introduction

Owing to its price competitiveness, palm oil is the most globally traded vegetable oil in the world. It is a highly fungible product used to produce biodiesel, food products, industrial chemicals, cosmetics and pharmaceuticals. Because of oil palm's productivity relative to substitute oilseed products, comparatively high supply stability and strong long-term market prospects, many governments, especially in Latin America and Africa, have begun to actively promote oil palm cultivation in their countries. In Brazil, for example, where the commercial oil palm sector has been incipient for decades, the government has begun to put in place mechanisms and incentives to promote investments in the sector. One of the underlying objectives is to diversify Brazil's biodiesel feedstock supply base in support of its 2005 Biodiesel Law, which aims to reduce Brazil's dependency on imported fossil fuels.

Upscaling palm oil production in Brazil could, besides enhancing national energy security, also generate a number of important co-benefits. For example, because of oil palm's high productivity, it places considerably less demand on land than soy, the most abundant oilseed crop in Brazil by planted acreage. This could contribute to more intensive land use in the Amazon and thereby reduce pressure on its rainforests. Moreover, since there is comparatively little mechanization potential in oil palm cultivation, it is considerably more labor intensive than other major land uses in the Amazon, such as cattle ranching and soy cultivation, which thereby also reduces incentives for rural-urban migration. Despite these potential benefits, a recent influx of large national and international investors in the oil palm sector has raised concerns among environmentalists and civil society groups about the potentially adverse social and environmental effects. These relate among others to water and soil contamination, land concentration, dispossession of marginalized communities, rising food insecurity and exploitative labor conditions.

In 2010, the Brazilian federal government sought to overcome some of these risks by launching the Sustainable Palm Oil Production Program (SPOPP) and developing the Agro-Ecological Zoning of Oil Palm in Deforested Areas of the Amazon (ZAE-Palma). These initiatives have produced guidelines for sector expansion by, for example, restricting oil palm cultivation to deforested areas and introducing credit incentives to promote the adoption of business models that are more inclusive of the rural poor and that generate greater shared-value. The latter builds on existing political commitments by the Brazilian government to support family farms by modernizing smallholder production systems and addressing rural market failures. Early evidence appears to suggest that these initiatives have contributed to ameliorating the negative social and environmental risks that have long characterized the crop's expansion in Southeast Asia. However, with many oil palm investors in Brazil failing to deliver on their expansion plans and reconsidering their investments in the sector, concerns are emerging that conditions in Brazil may not be sufficiently conducive to the development of a globally competitive oil palm sector.

This paper provides an analysis of the types of stakeholders participating in the Brazilian oil palm value chain, sector dynamics and the socioeconomic and environmental impacts associated with the sector's expansion in the Amazonian state of Pará, where most oil palm investments are currently concentrated. In doing so, this paper aims to generate new insights into the effectiveness of both public and private initiatives to promote sustainability in the sector and to identify unresolved economic, social and environmental challenges. Our findings will not only bring nuance to the sustainable palm oil debate in Brazil, but will also generate important lessons for other countries on opportunities and pathways for enhancing sector sustainability.

Section 2 provides background information on oil palm development in Brazil and on the state of Pará. This is followed by an overview of methods (section 3) and a review of the institutional, policy and regulatory framework that governs oil palm development (section 4). Section 5 analyzes the state of oil palm development and the value chain activities of the main oil palm investors in Pará. In section 6, we review the early socioeconomic and environmental impacts of sector expansion and, in section 7, the associated risks and opportunities. Section 8 offers some lessons and policy implications and section 9, our conclusions.

2 Background

2.1 Oil palm development in the Brazilian Amazon

Oil palm has emerged in recent years as a promising cash crop in the Brazilian Amazon. Although palm oil has been used in the Bahian tradition for centuries, having been brought to Brazil from Africa by slaves in the 16th century, it was not until 1974 when Dendê do Pará (Denpasa) was established close to Pará's state capital city Belém that oil palm began to be produced commercially. This was followed by a number of domestic investments in the 1980s and 1990s, primarily through fiscal incentives offered by the Superintendence of Development in the Amazon (SUDAM) to promote commercial investment in frontier areas. By 1995, the sector had 52,058 ha under cultivation in Pará (Venturieri 2011).

It was not until the second half of the 2000s, however, that the sector began to draw the interest of large national and international investors such as Archer Daniel Midlands (ADM), Petrobras and Vale. This was driven largely by economic prospects within the national and international biodiesel market as a result of high international petroleum prices and increased government commitment to incorporating biodiesel into the Brazilian energy mix following the enactment of the 2005 Biodiesel Law (see section 4.2 for more details). More generally, the long-term prospects for the crop also started improving, with crude palm oil (CPO) prices increasing from an average of USD 309 per tonne in 2000 to USD 1,256 per tonne in 2010 (Alves 2011). While new opportunities within energy markets partly contributed to this increase in global prices, increasing demand for vegetable oil from the emerging Chinese and Indian markets also played an important role during this time.

In 2010, attempts were made to further boost the fledgling oil palm sector in Brazil with the establishment of SPOPP, inaugurated by former president Lula da Silva in Tomé-Açu municipality, Pará state. SPOPP aimed to provide investment incentives to further diversify the biodiesel supply base, while providing mechanisms to ensure inclusive development in the sector and minimize the negative environmental impacts of sector expansion. SPOPP produced, among other official guidelines for oil palm expansion in Brazil, ZAE-Palma, which identified more than 29 million ha of land across 10 states of the Legal Amazon region that would be suitable and available for oil palm expansion without conflicting with forest and collectively titled lands. The program also introduced a new credit line specifically for oil palm smallholders, PRONAF-ECO, which, together with tax exemptions and the more favorable conditions in biodiesel auctions offered by the Social Fuel Stamp since 2004, incentivized many investors to integrate greater numbers of smallholders into their value chains.

Oil palm has unique agronomic advantages over other oilseeds, which partly underlies government commitment to the sector. A substantial body of literature in Brazil has, for example, highlighted the comparatively favorable oil yields per hectare, the high labor intensity and its fungibility (i.e. it can be used for numerous purposes, ranging from pharmaceuticals to cooking oils and biofuels) (Carvalho et al. 2001; Suframa 2003; Embrapa 2006; Furlan et al. 2006; Silva 2006; Castro et al. 2010). Oil palm can yield up to 7 t of CPO per hectare cultivated; considerably more than soy, Brazil's most important oilseed crop by area planted, which on average yields 0.5 t of soy oil per hectare (Pina 2010). Therefore, oil palm places considerably less demand on land resources than soy. Moreover, since mechanization is less viable in the oil palm sector than in soy, the sector has the potential to generate significantly more employment.

Considering its expansion potential, the Brazilian oil palm sector is negligible in terms of its scale and market share when compared to the world's largest producers Indonesia and Malaysia. This project estimates that 206,900–255,500 ha of oil palm is cultivated in Pará, with an additional 53,773 ha cultivated in Bahia (IBGE 2013). Nevertheless, the ambitious expansion plans by large private-sector investors have attracted much academic and public interest (Muller et al. 2006; Butler and Laurence 2009; Villela 2009; Becker 2010; Langevin 2011; Nahum and Malcher 2012; Rebello 2012; Rocha and Castro 2012; Glass 2013; Monteiro 2013; Homma et al. 2014). This can be ascribed to the social and

environmental sensitivity of the Amazon biome and negative experiences with oil palm expansion elsewhere. The development of oil palm plantations has been widely criticized for deforestation and biodiversity loss. In Malaysia and Indonesia, which in 2013 collectively accounted for 83% of the global area under oil palm production, 37% of expansion is estimated to have taken place in forestlands (Gunarso et al. 2013). Moreover, since the sector has historically been driven primarily by large-scale plantations, it has long been synonymous with displacement, dispossession and unequal distribution of costs and benefits.

Despite efforts by SPOPP to reduce these risks, critical reports have been published that highlight negative environmental and social impacts in Brazil. These relate to water and soil contamination, land concentration, dispossession of *quilombola* communities,[1] rising food insecurity and substandard labor conditions (Butler et al. 2009; Repórter Brasil 2010; Nahum and Malcher 2012; Backhouse 2013; Glass 2013; Repórter Brasil 2015). On the other hand, some studies have suggested positive impacts related to smallholder inclusion, employment generation, import substitution and carbon sequestration – especially when compared to many other cash crops suitable for cultivation in the Amazon biome (Becker 2010; Langevin 2011; Monteiro 2013; Homma et al. 2014; Villela 2009). The discussion is, however, highly normative, polarized and insufficiently evidence-based, reflecting the conflicting interests and ideological perspectives of the agribusiness lobby and the agrarian change and agro-ecology schools. The latter in Brazil is heavily focused on the need to preserve traditional production systems, reduce dependence on external inputs and conserve natural resources (Ramos et al. 2007).

Despite the initial optimism, since 2014 the sector appears to have been stagnating, with many of the large entrants failing to deliver on their expansion plans and reconsidering their future in the sector. As this paper will go on to show, this is attributable to range of factors, including unfavorable Brazilian economic conditions, low biodiesel prices and operational challenges arising from stringent environmental and labor laws and complexity of land tenure systems.

1 *Quilombolas* are descendants of Afro-Brazilian slaves who escaped from plantations or were liberated after the end of slavery. According to the Ministry of Culture, there are 3,524 communities throughout Brazil, 240 of them in Pará.

2.2 The Amazonian state of Pará

Pará is the largest economy in the Legal Amazon, an administrative area that also covers the states of Acre, Amapá, Amazonas, Mato Grosso, Rondônia, Roraima and Tocantins, and part of Maranhão (Figure 1). The Legal Amazon represents 61% of Brazilian territory and comprises the Brazilian part of the Amazon biome, which covers approximately 82% of the Legal Amazon. The remaining area is largely comprised of Brazil's tropical savannahs, known as *Cerrado*, in the states of Mato Grosso, Tocantins and Maranhão, and heath forests, known as *Campinarana*, in the states of Amazonas and Roraima.

Pará's commercial economy first developed in the 17th century around *drogas do sertão* ("spices of the forest" such as cocoa, vanilla, brazil nuts and cinnamon). It was, however, only in the mid-19th century, when the Industrial Revolution in Europe prompted a rubber boom in the Amazon, that Pará became an important region for commercial exploitation. With an abundance of wild rubber in the Amazonian rainforest, this boom attracted large numbers of migrants and led to the rise of major cities such as Belém in locations strategic for exportation. The first rubber boom ended in the 1920s, as the region was failing to compete with the highly productive plantations that were being established by the British and the Dutch in Southeast Asia (Weinstein 1993). A second, more brief, rubber boom (1942–1947) emerged during the Second World War when the US began to source rubber from Brazil when alternative supply lines were closed off during the Japanese occupation of Southeast Asia (Dean 1989).

Although a mining industry did develop in Pará in the 1950s, it was in particular the completion of the Belém–Brasília highway in 1960 and later the Trans-Amazonian Highway in 1972 that enabled Pará to more meaningfully integrate into the regional economy (Schmink and Wood 2012). During the 1960s, under Brazil's military government (1964–1985), the federal government also began to offer large federal grants and fiscal incentives to investors through SUDAM. One of the objectives of SUDAM was to integrate the underexploited Amazon region into the Brazilian economy, both for economic and national security reasons. Between 1966 and 1980, SUDAM provided more than USD 1 billion in finance to investors in the Amazon (Schmink and Wood 2012). In Pará, this led to an influx of

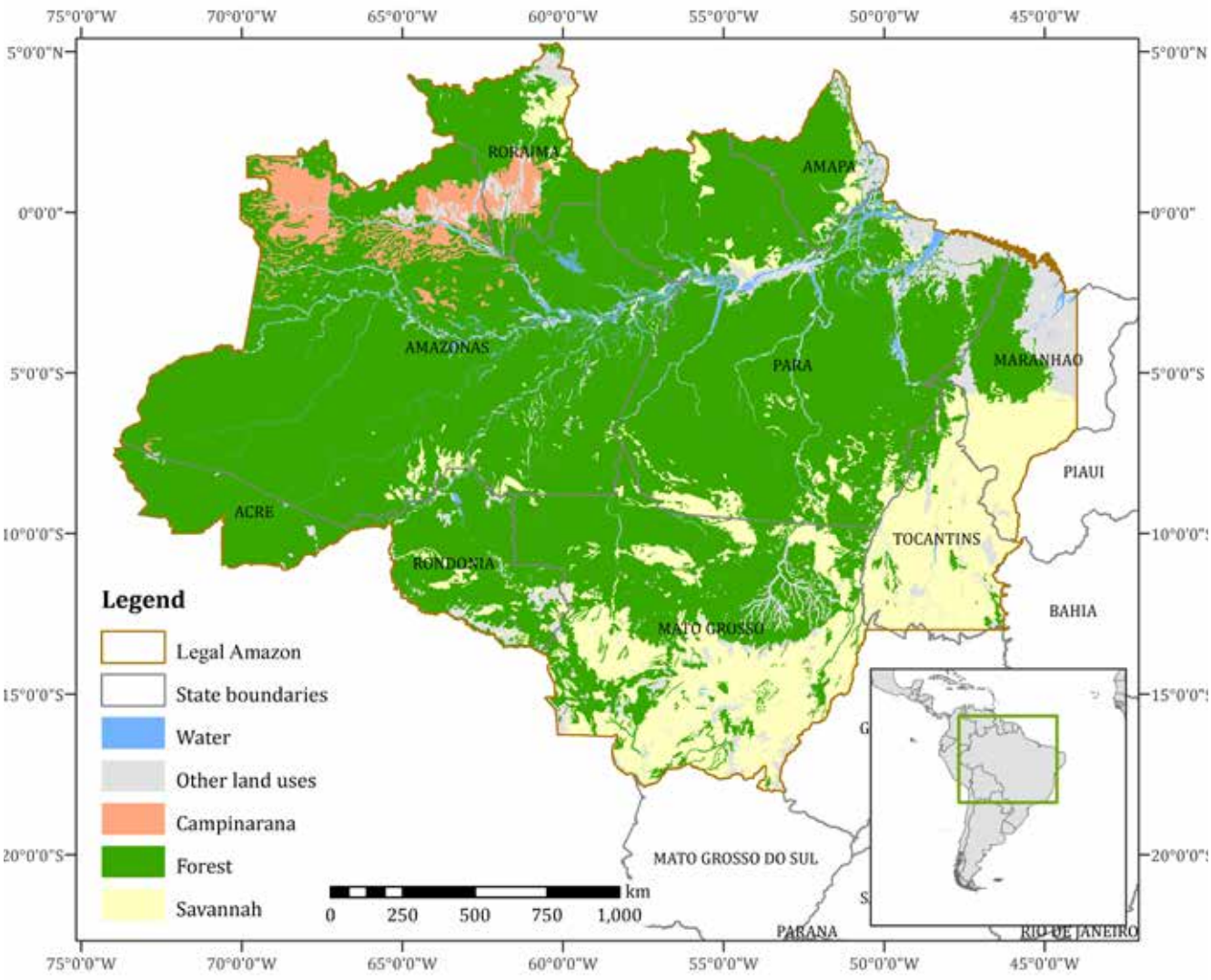

Figure 1. Major land uses in the Legal Amazon

Source: Own representation, with land use data obtained from INPE (2015)

migrants and medium to large-scale investments from southern Brazil, especially in the livestock and timber sector. Many of these investments were located along the Belém–Brasília and Trans-Amazonian highways. SUDAM incentives also led to the establishment of a number of oil palm plantations in northeast Pará. In the 1970s, a large-scale commercial mining sector also began to emerge with the development of the Carajás Iron Ore Project (owned by Brazilian mining giant Vale); today the largest iron ore mine in the world (Bunker 2003).

In northeast Pará, small-scale farming systems, in particular, developed during this period, with black pepper, introduced by Japanese settlers, becoming one of the most important cash crops in the area. Although black pepper accounted for approximately 35% of the value of Pará exports in the early 1970s, a disease began to spread among pepper plants during this time, which in the late 1970s led to the collapse of the sector (Homma 2009). This prompted the development of more diversified agroforestry systems in the area around cocoa, various types of fruit trees and perennials such as oil palm (Homma 2009). In the 1990s, large-scale commercial soy production began to extend into the agro-ecological transition zone between the *Cerrado* and the Amazon in the eastern municipalities of Santarém and Paragominas. This was driven largely by the development of new soy varieties that were better adapted to the Amazon's climate, comparatively cheap land prices in the area and improved transportation and storage facilities (Nepstad et al. 2006).

Despite increased diversification and commercialization of the Pará economy, it remains one of the country's least developed states, ranked 24 out of 27 on the Human Development Index (0.646) in 2010 (PNUD 2013). High poverty rates prevail especially among Pará's minority indigenous and black communities, which make up approximately 0.6% and 7.2% of the population, respectively (Verner 2004). These communities largely rely on subsistence production systems and tend to be poorly integrated into the state economy.

The emergence of predominantly land-extensive and extractive production systems in Pará has since the 1960s brought about large-scale conversion of forestland. According to INPE (2014), in 2012 forestland covered 70.5% of Pará's land area, with pasture being the most dominant anthropogenic land use, accounting for 12.1% of the land area, followed by secondary vegetation with 5.3% (including perennial crops such as oil palm). Annual agriculture, such as soy, corn and rice, accounts for only 0.3% of the Pará land area. Although adoption of advanced satellite technology to monitor deforestation, improved government enforcement of environmental laws and the self-imposition of sustainability standards by companies in the soy and cattle industry has led to a dramatic reduction in deforestation rates in Pará (Assunção et al. 2012), the state still experiences higher deforestation rates than other Amazonian states (Figure 2).

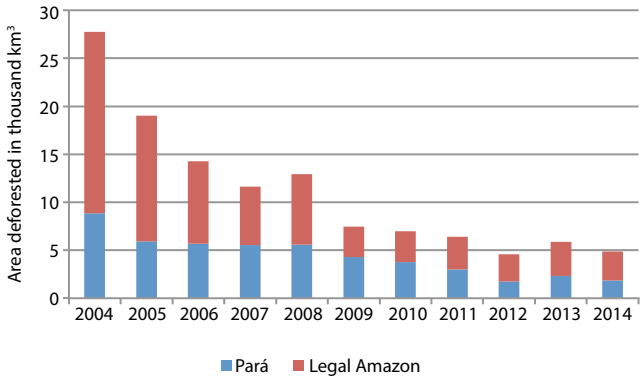

Figure 2. Deforestation rates 2000–2014 in the Legal Amazon and Pará

Source: INPE (2015)

According to a land use change analysis undertaken by Adami et al. (2015), approximately 66% of land deforested during 2008–2012 in Pará was initially converted to pasture and 34% to secondary vegetation. Approximately 0.7% of forestland that was converted to pasture during this period was later converted to annual agriculture, suggesting that the expansion of soy, for example, has not been a recent driver of direct deforestation. Since the secondary vegetation category is not disaggregated into more detailed land use categories, existing data does not provide insights into whether oil palm contributed to deforestation in the state during 2008–2012.

3 Methods

Research activities were undertaken between December 2013 and March 2015. These activities included (1) analysis of the institutional, policy and regulatory framework and (2) sector analysis. The impact assessment that falls under the sector analysis is ongoing, with this paper presenting preliminary findings and its more qualitative results.

3.1 Analysis of the institutional, policy and regulatory framework

The institutional, policy and regulatory framework that influences investor practices plays an important role in sector development and in shaping social, economic and environmental outcomes. In order to capture this, 47 semi-structured interviews were held with community leaders, civil society representatives and government officials at federal, state and municipality level (see Table A1 in the annex). This information was complemented with the collection of secondary data and a review of relevant policies and regulations.

3.2 Sector analysis

The sector analysis has the following three objectives: (1) to map the oil palm value chain in Pará, (2) to identify some of the key socioeconomic and environmental impacts associated with sector development and (3) to develop an informed understanding of future opportunities and risks that require attention by investors and policy-makers. Both quantitative and qualitative data was obtained for this analysis through a range of methods:

- Collection of secondary data from relevant government bodies and industry associations on investment trends and dynamics.
- Remote sensing analysis using Geographic Information System (GIS) software to map oil palm distribution and areas by municipality. This involved analysis of various 2014 Landsat 8 images, panchromatically sharpened to a 15 m resolution, using spectral signatures of oil palm plantations identified through on-the-ground sampling.
- Semi-structured interviews with 47 key informants from academia, civil society organizations, various state and municipal regulatory bodies, and labor and smallholder unions on, among others, value chain dynamics and regulatory challenges (see Table A1 in the annex for a list of key informants interviewed).
- Both open and structured interviews with eight oil palm companies to identify investor characteristics, practices and strategies (see Table A2 in the annex for a list of companies interviewed). Although the research sought to capture all of the nine major oil palm companies, one was unwilling to participate in the research. The interviews covered investor value chain activities, plantation management practices, employment generation and social and environmental practices.
- Key informant interviews and focus group discussions within four different oil palm producing communities, in order to reconstruct oil palm development trajectories and capture community social, environmental and economic conditions.
- 250 semi-structured interviews with outgrowers, employees, local leaders and households not involved in the oil palm sector (see tables A3 and A4 in the annex). These interviews covered household characteristics, livelihood activities, oil palm management practices and household welfare.

4 Institutional, policy and regulatory framework

This section summarizes key regulations, policies and institutional frameworks that are relevant to the oil palm sector, namely those related to land tenure, biofuels, family farming, environmental management and foreign direct investment (FDI).

4.1 Land tenure

Land tenure in Brazil, and the Amazon in particular, is considered to be an important barrier for the implementation of public policies. This has largely arisen from a long history of uncontrolled land occupation in the Amazon's frontier areas. Although such occupations date back to the colonial era, they have taken on unprecedented proportions since the 1960s. This was largely attributable to the rapid expansion of the economic frontier, driven in part by the federal grants and fiscal incentives offered to investors by the military regime through SUDAM.

At the same time, the military regime also invested heavily in infrastructure development to further promote economic integration of the Amazon. Through the Program of National Integration, road corridors such as the Santarém-Cuiabá and the Trans-Amazonian Highway were constructed in the 1970s and direct colonization programs were initiated at the road margins to absorb smallholders displaced by modernization programs in other regions. Increased accessibility, in combination with SUDAM incentives, however, attracted many medium- and large-scale cattle ranchers (Pacheco and Benatti 2015). In many areas, such as in southern Pará, this became a source of violence and social conflict, as many SUDAM-supported livestock projects contributed to the eviction of smallholders, thereby contributing to extensive land concentration in frontier areas (MacMillan 1995).

With the return of democratic rule in the 1980s, internal pressures to address societal inequalities prompted the government to undertake agrarian reforms, which involved land tenure regularization and redistribution of private lands. These reforms initially focused on transferring the administration of lands not registered as federal back to state administration and demarcating indigenous and *quilombola* lands (Pacheco and Benatti 2015)[2]. Redistribution took place largely through the expropriation of private lands that failed to fulfill social and economic functions – for example, from SUDAM-supported cattle ranchers that failed to productively use their land. Despite ambitious plans, it was not until the Fernando Henrique Cardoso administration (1995–2002) that the government began to make real advances in resettling landless and land poor peasants and titling their landholdings (Pacheco 2009); on federal lands this was realized through the Brazilian Agency for Agrarian Reform (INCRA) and on state lands through the State Land Agency of Pará (ITERPA). During this period, 319,514 families were resettled in the Legal Amazon, including 89,032 in Pará. These efforts were sustained under Lula da Silva's administration (2003–2011), where another 265,164 families were resettled in the Legal Amazon during 2003–2006, including 125,891 in Pará (Pacheco 2009).

Regularization of individual land rights outside indigenous territories and conservation units remains a difficult issue to resolve in the Amazon. In Pará, these areas comprise approximately 61.4 million ha, of which 27.3 million ha are classified as settlement areas or smallholdings (Pacheco and Benatti 2015). Considering the prevalence of fraud, illegal land occupation and conflicting claims, establishing legitimate ownership of land continues to frustrate land titling (Brito and Cardoso 2015). These challenges also inhibit the government's ability to ascribe responsibilities in the context of its anti-deforestation programs and provide targeted public services.

---

2 The territorial rights of indigenous and *quilombola* communities are offered special legal protection under Brazilian federal law, since the 1988 Brazilian Constitution formally recognized their collective land rights. In an effort to protect these minorities from marginalization and commercial exploitation, these collectively managed lands are to be utilized in a 'traditional' manner and are indivisible. Although the majority of indigenous territories have now been demarcated, the government has made slow progress in extending titles to *quilombola* communities. By 2012, only 192 out of 3,542 registered *quilombola* communities had received collective title deeds (Backhouse et al. 2013).

In order to address these issues, the Ministry of Agrarian Development (MDA) launched the Legal Land Program in 2009 to expedite the regularization process, especially for small and medium landholdings. State government established similar programs in 2009 for state land, modeled after the federal Legal Land Program, which in the case of Pará is led by ITERPA. Under these programs, properties to be regularized must have been occupied since at least 1 December 2004 and be less than 1,500 ha in size. With regularization involving a lengthy process of registration, geo-referencing, site inspection, and, ultimately, titling, progress of both the federal and state programs has been hampered by human and financial resource constraints (Brito and Cardoso 2015). Protracted disputes over the constitutionality of some of the regulations have also posed additional implementation challenges. According to Brito and Cardoso (2015), in Pará, ITERPA has on average only been able to issue 454 titles per year. Nevertheless, with land titling in Pará increasingly building on environmental enforcement programs, especially the Rural Environmental Registry (CAR) system (see section 4.4), operational and bureaucratic synergies are emerging.

Although foreign individuals and corporations have long been permitted to own land in Brazil, due to concerns over expatriate land concentration, and food security in particular, following the food price crisis of 2008/2009, laws were reinterpreted in 2010 to prohibit foreigners from owning more than 5,000 ha of land. This has led many foreign agribusinesses to engage in partnership arrangements with local farmers in order to access land, as is detailed in section 6.1. However, with the sugarcane sector in particular experiencing a loss of private sector investment and other sectors like the oil palm sector facing difficulties in attracting foreign investment, pressures are mounting to reverse the bill.

4.2 Biofuels

Brazil has a long tradition of state intervention to promote alternative energy systems as a means of reducing dependency on imported fossil fuels. This has long focused on the sugarcane-derived ethanol industry that since 1900 has been the primary focus of agro-industrial policies. The blending of ethanol with gasoline became mandatory in 1941 (Andrade and Miccolis 2011). In response to the oil crisis of the 1970s, the government sought to increase ethanol production by establishing the Pro-Alcohol program. Under this program, the federal government increased the blending mandate to 20%–25%, and introduced new incentives to ethanol-based industries and the manufacturers of ethanol-fueled vehicles. In the 1980s and 1990s, however, instability in the world sugar market, stabilization of oil prices and deregulation reforms reduced state intervention in the sector, in turn adversely affecting ethanol output. This changed in 2000, however, when the government established the National Agency of Petroleum, Natural Gas and Biofuels (ANP). The principal objective of ANP was to introduce new pricing mechanisms that would protect the ethanol sector from low international energy prices. To prevent output expansion from further exacerbating deforestation, the federal government developed agro-ecological zones for sugarcane, which banned the establishment of sugarcane plantations in the Amazon biome.

Seeking to replicate the success of the Pro-Alcohol initiative, the federal government established the Pro-Óleo and the Energy from Vegetable Oil (OVEG) programs in the early 1980s to stimulate the use of raw vegetable oils for biodiesel production. Under these programs, dozens of plant species were tested and new production technologies and engines were developed. However, as a result of comparatively high production costs, these programs did not receive the same level of government commitment as Pro-Alcohol, which led to their abandonment in the mid-1980s (Rico and Sauer 2015). Following the election of Lula da Silva, the government renewed their interest in reducing Brazil's dependency on imported diesel. This led, for example, to the establishment of the national Biodiesel Production and Use Program in 2004, which sought to improve the organization of the biodiesel value chain, introduce new funding mechanisms, support research and development, and establish regulatory provisions for blending (Andrade and Miccolis 2010).

In 2005, this resulted in the ratification of the Biodiesel Law, which specified national blending mandates for biodiesel (2% by 2008, 5% by 2013 and 7% in 2014), provided for fiscal incentives to producers and initiated the social certification scheme known as the Social Fuel Stamp (see section 4.3 for more details). In order to encourage the diversification of biodiesel feedstock and to include the more economically marginalized north in the renewable energy supply chain, the government launched SPOPP in 2010. This program provides tax incentives to companies, concessionary loans to small and medium-scale farmers, and cultivation guidelines (see section 4.3 about smallholder integration

mechanisms under the program and section 4.4 about environmental safeguards). Despite efforts to promote palm oil production for use as biodiesel, the sector continues to rely on soybean oil and tallow, which, respectively, accounted for 77.6% and 18.0% of total biodiesel output in April 2015 (ANP 2015). Palm oil accounted for only 0.1% of biodiesel production in that month (ANP 2015).

4.3 Family farming and smallholder integration

Democratization in the 1980s was instrumental to the emergence of smallholder social movements in Brazil. In a context of pervasive inequalities, violence and lack of state presence in rural areas, several politically powerful rural unions were formed such as the National Confederation of Agricultural Workers (CONTAG), the Movement of Rural Landless Workers (MST) and the National Council of Rubber Tappers (CNS). Their mobilizing power increased the pressure on the federal government to pursue more inclusive policies in order to guarantee the electoral support of rural trade union members. This culminated in 2006 in the passing of the Family Farming Law, which served to institutionalize policies targeting family farmers. It also created a clear working definition of what constitutes a family farmer, which is now used as eligibility criteria for most Brazilian smallholder support programs. Through this law, a family farmer is defined as a person who engages in rural activities, such as ranching and agriculture, possesses no more than four 'fiscal modes',[3] utilizes predominantly family labor and makes a living out of their own production. According to the 2006 National Census, family farming accounts for 84.4% of all rural properties.

Even before the passing of the Family Farming Law, the Brazilian government had established a number of specific programs to support family farming. One of the most important programs that served to entrench family farming discourse is the Program to Support Family Farming (PRONAF), established in 1995 as an initiative to improve farmer access to technical assistance and concessionary loans. Under the Lula da Silva administration, the program was expanded in an attempt to address some of the unresolved market access issues faced by smallholders. For example, in 2003, the Program for Food Procurement (PAA) was established, which sought to improve smallholder market access by purchasing products directly from family farmers and distributing these to food insecure households. In a similar vein, the National Program of School Nourishment (PNAE) was established in 2009, requiring all school canteens to source at least 30% of their produce from family farmers. Both PAA and PNAE continue to be important mechanisms to absorb smallholder output.

A number of specific measures to enhance smallholder integration are also being undertaken at a more sectoral level. For example, the Social Fuel Stamp established under the 2005 Biodiesel Law offers incentives to biodiesel producers when a minimum percentage of processed feedstock is sourced through smallholders. The minimum percentage depends on the region and since November 2014 varies from 40% in the South and 30% in the Southeast, Northeast and Semi-Arid regions, to 15% in the North and West-Central regions (Brazil 2014). Producers are also required to contract family farmers through farmers' associations or cooperatives and provide these with technical assistance and training. Biodiesel producers meeting these requirements are allocated a Social Fuel Stamp, which enables them to gain preferential access to the ANP biodiesel auction, which has set aside 80% of auction lots exclusively for producers with a stamp. Distributors and refiners can only buy from stamp-holders in these lots. Producers also benefit from lower income tax rates and more favorable financing conditions at the Brazilian National Development Bank.

Within the oil palm sector, the integration of smallholders and medium-scale farmers is promoted through three types of concessionary finance schemes introduced in 2010, PRONAF-ECO, PRODUSA and PROPFLORA. These credits are available through Banco da Amazonia and Banco do Brasil. PRONAF-ECO is a special PRONAF credit line, which enables family farmers to take out loans of up to USD 25,000 for a maximum of 10 ha, at an interest rate of 2% per annum.[4] Farmers have 6 years grace period to start repaying these debts

3 A fiscal mode represents a unit of economically viable farmland. This depends on the municipality in question, ranging in Pará from 5 ha in Belém to 80 ha in Parágominas; meaning that a family farmer can hold a maximum total land area of 320 ha in some municipalities. Not all smallholders have four fiscal modes, for instance in São Domingos do Capim the fiscal mode is 40 ha, while most smallholders have 25–35 ha.

4 Amounts have been converted from Brazilian real (BRL) at an exchange rate of BRL 3.2 per US dollar (1 June 2015).

and up to 14 years to finalize them. PRODUSA and PROPFLORA are part of the Ministry of Agriculture, Livestock and Food Supply (MAPA) sustainable agriculture program and provide credits to medium-scale producers and cooperatives. Under PRODUSA, farmers can apply for credits of up to USD 125,000 for plantation establishment on degraded lands at an interest rate of 5.75% per annum, repayable over a period of 12 years, including a 6-year grace period. An additional USD 93,750 can be obtained through PROPFLORA for plantation management, at an interest rate of 6.75% per annum, repayable over a period of 12 years, including a 6-year grace period.

Despite these advances, Brazilian agricultural policy continues to demonstrate contradictions between the demands of agribusiness and those of rural social movements. This is illustrated by the existence of two agricultural ministries, MAPA and the MDA, which have conflicting policy directions: MAPA is oriented toward agribusiness and large landholders and the MDA toward family farming, agrarian reform and land tenure issues. While MAPA and its predecessors date back to the beginning of the century, the MDA was created in 1999 as a result of increasing pressure from social movements and smallholders' organizations. Under the Lula da Silva administration, the MDA assumed greater political relevance since it represents the interests of the electoral support base of Lula's Workers Party. However, the 2012 revision of the Forest Code (see section 4.4), which softens the rules for agricultural investments and offers amnesty for environmental crimes committed before 2008, and the appointment of Kátia Abreu, an agribusiness leader, as Minister of Agriculture, illustrate that the agribusiness lobby continues to be highly influential in the Brazilian polity. This agribusiness lobby is organized through the *bancada ruralista*, a powerful congressional bloc representing the interests of large landowners, which in the present term includes more than half of all members of Congress.

4.4 Environmental management

The environmental legal framework in Brazil is considered to be one of the most progressive in the developing world. Environmental licensing requirements for polluting or environmentally damaging economic activities were created in 1981 through the National Environmental Policy, with environmental impact assessments becoming mandatory for many activities in 1986. Most forestry-related issues are governed through the Brazilian Forest Code, which was first enacted in 1934 by President Vargas. During the military regime in 1965, Brazil first amended the Forest Code and created two important long-lasting concepts, the Area of Permanent Preservation (APP) and the legal reserve. A legal reserve is a proportion of a rural property that should remain forested, while an APP is a sensitive area such as a riverside, hilltop or steep slope that should be protected from conversion. Initially, the Forest Code required that 50% of a rural property should be maintained as a legal reserve in the Legal Amazon; and 20% in the other regions. In 1996, at the time when deforestation rates peaked, the Cardoso administration increased the size of the legal reserve for the Legal Amazon to 80% and decreased this from 50% to 35% in the *Cerrado*. State governments may however reduce the size of the legal reserve from 80% to 50% by designating certain areas as agricultural production zones through Ecological-Economic Zoning (ZEE) plans. This is the case in northeast Pará for example, where oil palm production has expanded.

Despite the introduction of stringent new environmental regulations, law enforcement in the Amazon has traditionally been weak. Its large territory devoid of state presence long undermined compliance. It was only under the Lula da Silva administration that the federal government began to invest heavily in strengthening its law enforcement capacity and in improving coordination between the complex and fragmented network of ministries and agencies from the federal to the municipal level. This led the establishment of the Action Plan for Prevention and Control of the Legal Amazon Deforestation (PPCDAM) in 2004.[5] The PPCDAM led to the creation of a satellite-based monitoring system, the Real Time System for Detection of Deforestation (DETER), which has significantly increased the government's capacity to quickly respond to deforestation events.[6] In order to motivate individual municipalities to enforce environmental

5 In its first stage (2004–2008) it was responsible for, among others, the creation of 25 million ha of Conservation Units on federal land, plus another 25 million on state land. Ten million hectares of Indigenous Reserves were also created at that time. Many of these areas were created in active agricultural frontiers.

6 Developed by the National Institute for Space Research (INPE), DETER captures and processes images on forest cover every 15 days and has the capacity to identify deforestation and forest degradation for areas exceeding 6.25 ha. In parallel to this, the nongovernmental organization IMAZON launched its own Deforestation Alert System (SAD), which releases information monthly and provides deforestation alerts to local environmental agencies.

regulations, in 2008 the federal government began to place administrative restrictions on municipalities facing high deforestation rates and make rural credit access conditional on compliance with environmental and land laws. The reduction of annual deforestation rates from 27,772 km^2 in 2004 to 4,848 km^2 in 2014 is largely attributable to these efforts (Assunção et al. 2012). Voluntary private-sector commitments to remove deforestation from their supply chains, such as the 2006 Soy Moratorium and the 2009 Cattle Agreement, further contributed to this.

However, under the Dilma Roussef administration (2011 to present) extensive changes were introduced to the Forest Code, which many critics claim to be a reflection of the increasing political influence of agribusiness. One of the most controversial changes was the amnesty granted to perpetrators of environmental crimes committed before 2008 in order to incentivize offending landowners to regularize their activities. Other changes included the introduction of so-called Environmental Reserve Quotas, which allow landowners with 'environmental debts' (e.g. legal reserve areas deforested illegally) to buy forest titles elsewhere in the same biome to avoid the costs of reforestation. The new Forest Code also institutes the CAR system, in force since 2009 in Mato Grosso and Pará, which mandates the registration of all rural properties in order to facilitate social and economic planning and the monitoring of deforestation. Once registered under CAR, landowners involved in, for example, ranching, agriculture and forestry activities should obtain a Rural Environmental License (LAR), which regulates activities on the property and details requirements for complying with the Forest Code. With an LAR, a property owner is permitted to legally deforest within the legal reserve boundaries set by the Forest Code. Smallholders are excluded from having to restore legal reserves deforested before 2008 and are exempted from obtaining an LAR. For owners who have environmental debts, the Forest Code has also charged state governments with the responsibility to create a Program of Environmental Regularization to set rules for restoration. Although softened in comparison to the previous version, the new Forest Code is perceived by some as a positive revision since it is more incentive-oriented and creates viable pathways to enable full legal compliance (Nepstad et al. 2014).

With regards to oil palm, a number of specific zoning instruments are relevant to regulating the environmental impacts of sector expansion (see Villela et al. (2014) for more details):

- The Macro Ecological-Economic Zoning of the Legal Amazon (MZEE-AL) was approved in 2010 as an overarching strategy for the sustainable use of land. It also aims to contribute to the formulation of federal and state development policies.
- The Ecological-Economic Zoning of Eastern Pará was approved in 2010 as a state-level instrument building on MZEE-AL to establish the rules and guidelines for the use of land in Pará, specifically. It forbids the expansion of oil palm in environmental conservation areas, indigenous lands and other areas of high social or environmental significance.
- ZAE-Palma was published by Embrapa in 2010. It is the primary planning document for managing and monitoring oil palm expansion – establishing social, economic, agro-ecological and environmental criteria for identifying suitable land. It identified 29.7 million ha of land that could be available in the Amazon biome for sustainable oil palm development, including 12.8 million in Pará. Most significantly, ZAE-Palma restricts the expansion of oil palm onto forested land. In order to gain access to low-interest credit, oil palm production should only take place on land deforested before 2008. This was incorporated into Brazilian law in the same year through Presidential Decree 7172.

4.5 Foreign direct investment

The political sentiment towards FDI in Brazil has become considerably more favorable since the return of democratic rule in the 1980s. Since the early 1950s, various Brazilian governments adopted import substitution industrialization policies in order to reduce dependency on external markets and develop domestic industrial capacity. This involved, among others, foreign exchange restrictions, a range of fiscal incentives for import substituting industries and direct state intervention through state-owned enterprises (Bonelli 1998). Although this provided impetus for the Brazilian economy, with many large state-led projects funded through external credit lines, in the early 1980s large public deficits led to economic stagnation, currency devaluation and unsustainable inflation. With the return of democratic rule, numerous structural reforms were introduced, which eventually led to the privatization of many state-owned enterprises and the introduction of extensive trade liberalization and fiscal and monetary reforms (Lima 2014). Additionally, the reforms abolished mechanisms discriminating against

foreign capital, allowing foreign companies to enjoy the same legal status as national companies. This implies that wholly foreign-owned enterprises are free to operate in most sectors. Foreign investments are, however, not permitted in some strategic sectors such as nuclear energy, postal services and healthcare. Some restrictions also apply to foreign enterprises operating in the financial services, aviation, shipping, communications and mining (PwC 2013).

Although the left-wing rhetoric of the Workers Party, which won the 2002 elections, generated fears among foreign investors that the government would introduce new restrictions, the party continued to embrace the so-called tripod of economic stability: a floated foreign exchange regime, fiscal surplus and a system of inflation targets, and refraining from introducing new FDI restrictions (Lima 2014).

With these reforms, FDI begun to play an increasingly important role in Brazil's economic development from the 1980s, with the value of net inflows increasing from less than 0.5% of gross domestic product in the 1980s to 3.6% in 2013 (World Bank 2015). Brazil is now the largest regional recipient of FDI, accounting for 45% of total FDI stock in Latin America (FAO 2013). Much of this FDI is concentrated in the industrial and services sectors, with the primary sectors (agriculture, livestock and minerals) typically accounting for less than 10% of total FDI flows (Figure 3). Within the primary sector, more than 95% of FDI flows target either the mining or oil and gas subsector (Banco Central do Brasil 2015).

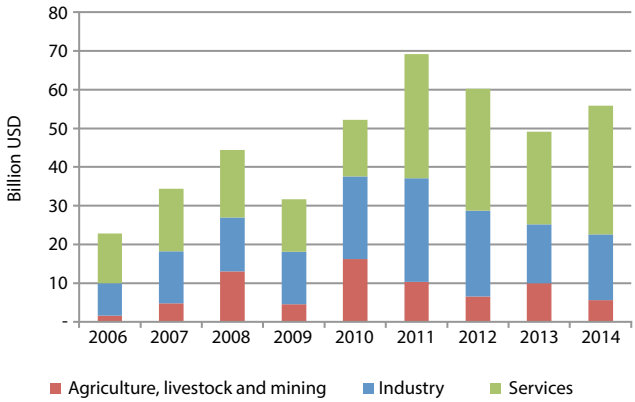

Figure 3. Foreign direct investment in Brazil by sector

Source: Banco Central do Brasil (2015)

5 The oil palm value chain in Pará

5.1 Trends and geographies

Pará has become the largest oil palm producing state in Brazil, with our estimates suggesting that at least 206,923 ha of oil palm was under cultivation in 2014 (Table 1).[7] Remote sensing analysis conducted in the context of this project identified at least 255,529.5 ha of land being cultivated with oil palm in Pará in 2014. These figures are significantly higher than official statistics, with the State Secretary of Agriculture (SAGRI 2013) estimating that only 140,000 ha was under production in 2012 and IBGE (2013) estimating 54,475 ha for the same year. This highlights the limited accuracy of official data sources, in particular IBGE, which works with limited human and financial capacity. The difference between remote sensing data and data obtained through the Brazilian Association of Palm Oil Producers (Abrapalma) and the oil palm companies could be explained by the existence of producers that operate independently who are not formally tied into company supply chains, and also by the inclusion in remote sensing data of abandoned and old plantations with no commercial value because they have been affected by the disease *amarelecimento fatal* (see section 5.3 for more information).

Table 1. Total area of oil palm planted per year

Year	Area (in ha)
1985	28,160
1989	43,997
1995	52,058
1999	63,174
2004	80,430
2008	95,293
2011	117,689
2014*	206,923.4–254,555.6*

Source: Venturieri (2011) and *LIFFE Data

7 Our estimates are based on data collected from the Brazilian Association of Palm Oil Producers (Abrapalma) and directly from all oil palm companies.

However, contrary to what was expected in 2010 – after ZAE-Palma identified 29.7 million ha of degraded lands suitable for oil palm plantations and companies began to announce ambitious expansion plans – absolute oil palm expansion rates have been significantly lower than was anticipated. Some of the expansion bottlenecks are explained in more detail in the following sections.

Oil palm expansion in Pará has taken place predominantly in northeastern Pará and the Metropolitan Region of Belém, across 35 municipalities (see Figure 4 and Table 2 for geographic distribution). Expansion in the 1970s primarily took place in the municipality of Santa Bárbara, close to Belém, through a 5,000 ha plantation established by Denpasa. Expansions in the 1980s and 1990s were located near to the Denpasa plantations and in municipalities south of Belém such as Moju, Tailândia, Acará and Tomé-Açu because of SUDAM fiscal incentives. The new incentives offered under the Biodiesel Law in 2005 – in particular those through the Social Fuel Stamp – initiated a third wave of oil palm investments in Pará, focused largely on the municipalities south of Belém like Tailândia, Moju, Tomé-Açu, Acará, Concórdia do Pará, and São Domingos do Capim. In contrast to earlier investments, this wave was led by large national and international corporations such as the Brazilian mining giant Vale (Biopalma), the US-based grain company ADM and a joint venture between Brazilian petroleum company Petrobras and Portuguese petroleum company Galp (Project Belém Bioenergia Brasil, BBB).

Historical expansion patterns reveal a high concentration of oil palm expansion around Pará's largest urban center, Belém, and major coastal ports. Since palm oil estates require a comparatively large labor force, especially in comparison to soy and ranching, proximity to large urban areas is critical. Additionally, the road system is more developed in the area, which improves the accessibility of the large labor force to company plantations and ensures timely delivery of fresh fruit bunches (FFB) to processing facilities. Most investors require delivery of FFB within 24 hours of harvesting to prevent FFB bruising, which increases free fatty acid (FFA) content; high FFA content lowers the quality of the extracted CPO. As a result, most investors concentrate their cultivation activities within 50 km of their mills.

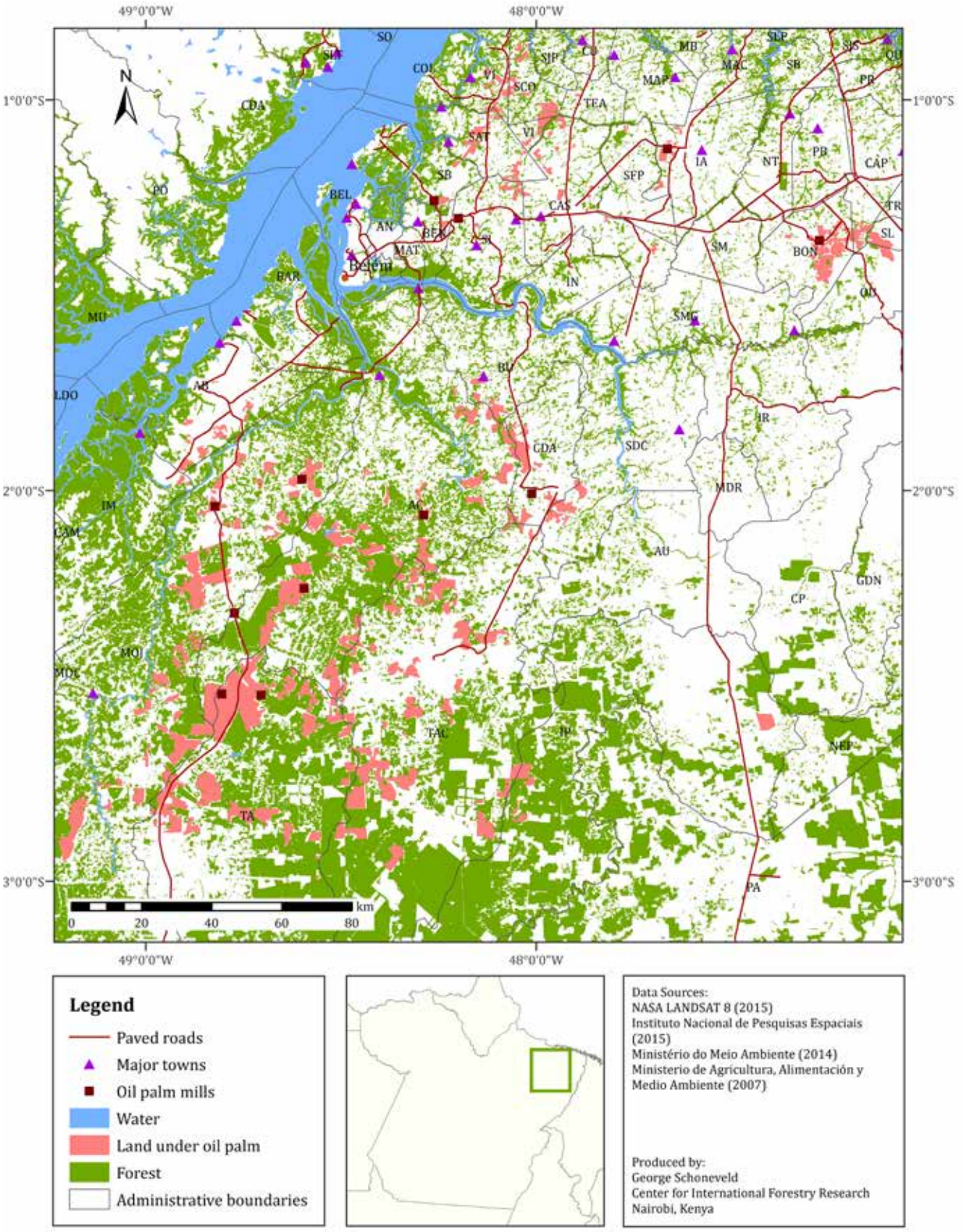

Figure 4. Distribution of oil palm plantations in Pará

Table 2. Estimated area planted with oil palm by major producing municipality (2014)

Municipality	Map code	Mapped area (in ha)	Unmapped smallholder area (in ha)	Major projects
Abaetetuba	AB	3,127.7	9.3	Biopalma
Acará	AC	38,473.1	725.4	Agropalma, Biopalma, Marborges
Aurora do Pará	AU	0	55.8	Biopalma
Baião		0	37.2	BBB
Benevides	BEN	298.5	0	Denpasa
Bonito	BON	9,746.0	0	Mejer-Yossan
Bujaru	BU	2,748.1	102.3	Biopalma
Cametá	CAM	0	102.3	BBB
Capanema	CAP	1,951.4	0	Mejer-Yossan
Capitão Poço	CP	0	25.0	ADM
Castanhal	CAS	3,668.2	9.3	Dentauá
Concórdia do Pará	CDA	6,007.8	362.7	Biopalma, Dentauá
Garrafão do Norte	GDP	1,253.0	409.2	Marborges
Igarapé-Açu	IA	2,007.4	37.2	Palmasa
Ipixuna do Pará	IP	5,281.0	0	Unclear
Irituia	IR	0	591.0	ADM
Mãe do Rio	MDR	0	25.0	ADM
Mocajuba	MOC	0	74.4	BBB
Moju	MOJ	49,838.6	3,375.9	Agropalma, BBB, Biopalma, Guanfeng, Marborges
Ourém	OU	1,141.6	0	Mejer-Yossan
Santa Bárbara do Pará	SBP	1,432.3	0	Denpasa
Santa Isabel do Pará	SIP	2,003.2	0	Denpasa, Dentauá
Santa Luzia do Pará	SLP	1,789.2	0	Mejer-Yossan
Santo António do Tauá	SAT	4,417.4	0	Dentauá
São Caetano de Odivelas	SCO	4,229.4	0	Dentauá
São Domingos do Capim	SDP	2,472.0	1,389.0	ADM
São Francisco do Pará	SFP	160.0	0	Unclear
Tailândia	TAI	54,751.1	1,292.7	Agropalma, BBB
Terra Alta	TEA	163.6	0	Dentauá
Tomé-Açu	TA	48,676.4	1,794.9	BBB, Biopalma
Vigia	VI	4,221.7	0	Dentauá
Total		**244,137.0**	**10,418.6**	

ADM = Archer Daniel Midlands; BBB = Belém Bioenergia Brasil.

Note: Smallholder areas planted with oil palm could not be mapped using remote sensing analysis since plots smaller than 10 ha do not exhibit the same spectral signatures as larger plantations. Data on smallholder areas by municipality were obtained from Banco da Amazônia (unpublished materials).

5.2 Investor background and strategies

Almost three-quarters of the area under oil palm in Pará can be attributed to Agropalma, Biopalma and BBB (Table 3). Agropalma is a wholly owned subsidiary of the Alfa Group, a conglomerate owned by Brazilian billionaire Aloysio de Andrade Faria with business interests also in the banking, construction, communications and hospitality sectors. Agropalma began its operations when it acquired oil palm company Companhia Real Agroindustrial in 1989 and now consists of 12 oil palm plantations and a separate refining division under the name Companhia Refinadora da Amazônia, which also includes a margarine and fats factory (see Figure 5 for an investment timeline).

In anticipation of a biodiesel boom, Biopalma was established in 2007 by three former Agropalma employees through the newly formed MSP Group led by Paulo Brito, with ambitious plans to develop the infrastructure for a large oil palm operation that it could sell onwards quickly. It managed to sell a 41% stake to Vale in 2009, who increased its stake to 70% in 2011. Vale largely intended to use the company as a supplier of biodiesel for the transportation operations of its mining companies. However, when petroleum prices plummeted in 2014 and Vale began experiencing a loss in profits as a result of low ore prices, it begun to explore opportunities to divest from Biopalma.

Table 3. Oil palm total planted area per company in 2014 (including associated outgrowers)

Company	Total planted area (in ha) (LIFFE data)	Total planted area (in ha) (SAGRI data)	Year of first planting
ADM	7,530	3,000	2012
Agropalma	50,356	45,000	1982
Biopalma	62,099	42,000	2007
Denpasa	2,250	6,000	1968
Dentauá	13,000	4,000	1980
Marborges	8,980	5,000	1981
Palmasa	6,530	3,000	1985
BBB	40,272	4,000	2010
Mejer-Yossan	15,000	16,000	1994
Guanfeng Group	906		2010
Other		12,000	
Total	**206,923**	**140,000**	

ADM = Archer Daniel Midlands; BBB = Belém Bioenergia Brasil.

Project BBB arose from bilateral negotiations between Brazil and Portugal in 2007 to secure biodiesel feedstocks for the Portuguese market within the context of a well-established partnership framework between Portugal's largest oil company Galp and the Brazilian state-owned Petrobras. Although the project also aggressively established a large oil palm operation, like Biopalma, the future of BBB appears insecure, with Petrobras currently embroiled in a high profile corruption scandal and experiencing heavy losses. Petrobras initially launched two projects: Project Pará to produce biodiesel for the northern Brazilian market, and BBB, in collaboration with Galp, to export palm oil to Portugal. The planned total investment for both projects was USD 276 million, which was to involve 2,250 smallholders, plant 74,000 ha and generate 7,000 direct jobs. Due to implementation difficulties and changes in the leadership of the company, in June 2011 Petrobras abandoned Project Pará and significantly changed their approach to BBB frustrating local stakeholders, investors and farmers who had been planning investments based on the expectations created by the project's arrival. Twenty-three farmers that had already planted for Project Pará in the municipalities of Cametá, Baião and Mocajuba were transferred to BBB. In 2014, the BBB project benefited from a SUDAM loan of USD 180 million.

The most recent entrant, ADM, also with ambitious expansion plans, has taken a more cautious approach. Although ADM has long been actively involved throughout the Brazilian soy value chain and operates a number of palm oil refineries in Europe, this is the company's first foray as a majority stakeholder into direct oil palm production. Having begun soy-based biodiesel production in Brazil in 2007, its initial intention by expanding into oil palm cultivation was to diversify and to secure a Social Fuel Stamp. However, operational and logistical difficulties associated with the construction of its mill in combination with Brazilian economic slowdown led ADM to cease expansion activities in late 2013 (see section 5.5 for more information).

The other five oil palm companies are smaller, typically private-owned, enterprises engaged in oil palm production since the 1980s and 1990s. Palmasa and Dentauá, though established as corporate entities, have strong cooperative characteristics. They were initially established by groups of former Japanese pepper farmers that transitioned out of pepper as a result of crop disease in the 1970s. Denpasa, the first oil palm company in Pará, arose out of a partnership between SUDAM and the

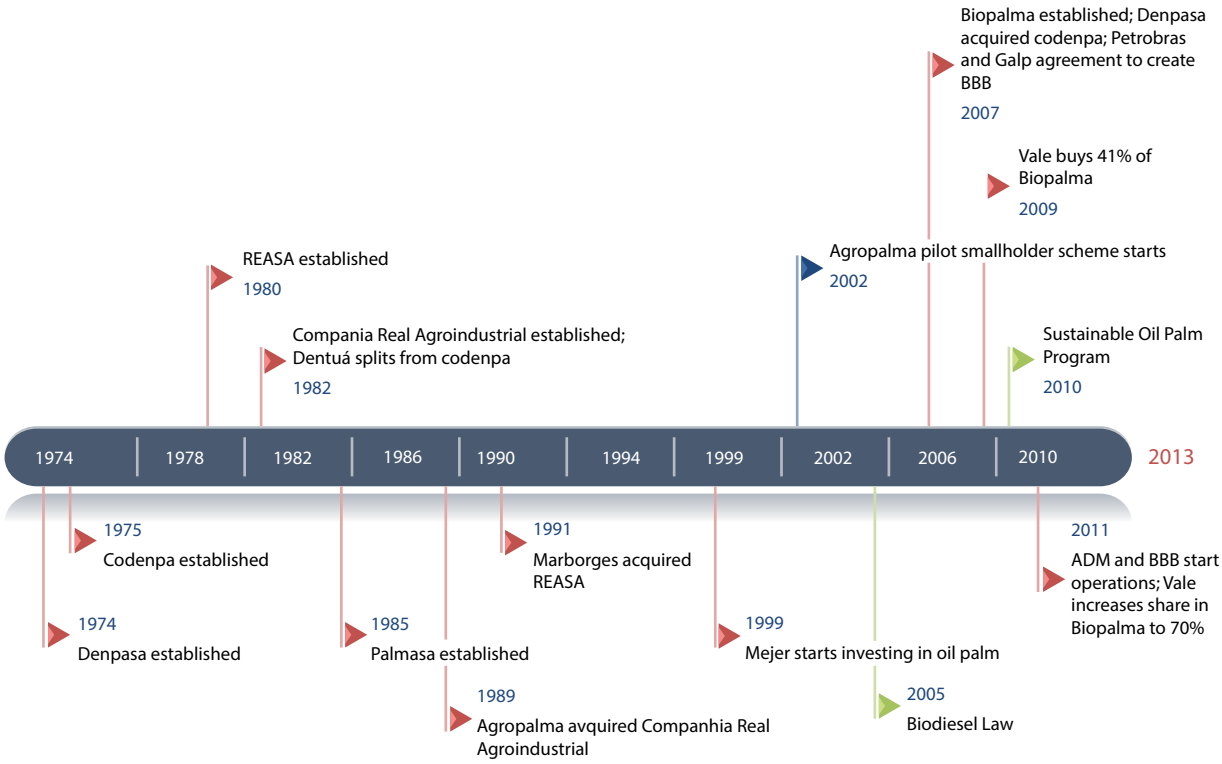

Figure 5. Oil palm investment timeline

ADM = Archer Daniel Midlands; BBB = Belém Bioenergia Brasil.

French–Brazilian Oil Crop Research Institute (IRHO) to explore the commercial potential of oil palm in the Amazon. In 1974, Denpasa was formally established when the ownership was transferred to a consortium of private investors. Although Denpasa is now controlled by the family-owned OMB Group, previous partners included the Dutch plantation company HVA International, the Dutch Development Bank (FMO) and the International Financial Corporation (IFC). In 2007, Denpasa merged with another Japanese cooperative Codenpa. Mejer-Yossan is part of the Kabacznik Group owned by two Polish rabbis who migrated to Brazil in the 1970s. Starting out as a soap-making operation, the diversification into oil palm production was largely to secure a sufficient supply of oils for their soap factory. Privately owned Marborges was established in 1991 through the acquisition of the bankrupted Reflorestamento Amazônia (REASA) who had been planting oil palm since the early 1980s, also benefiting from SUDAM fiscal incentives.

A number of private individuals also operate at a more industrial scale, though most are technically considered to be outgrowers, typically of Agropalma. One exception is the Guanfeng Group, a China-based seed development company, which independently cultivates 906 ha of oil palm. Another Asian company, Malaysian government-owned FELDA Global Ventures Holding, the world's third-largest oil palm company by planted acreage, explored options to invest in the Amazon but the investment was officially cancelled in 2010. Although a tripartite cooperation agreement was signed between FELDA, the Malaysian government and the state government of Pará in March 2014, Pará authorities were reluctant to divulge information about the content of the agreement and FELDA plans. The agreement relates to the release of hybrid oil palm seeds developed in Pará by Embrapa. Producers have, however, called on the state government to rescind any agreement involving seed transfer.

5.3 Oil palm cultivation

Most companies operate through nucleus–outgrower arrangements (Figure 6). This involves a combination of company-managed and owned plantations and third party sourcing through exclusive off-take contracts (see section 5.4 for more details). Only Palmasa relies exclusively on outgrowers. In total, third parties account for 38,161 ha (18.5%) of the

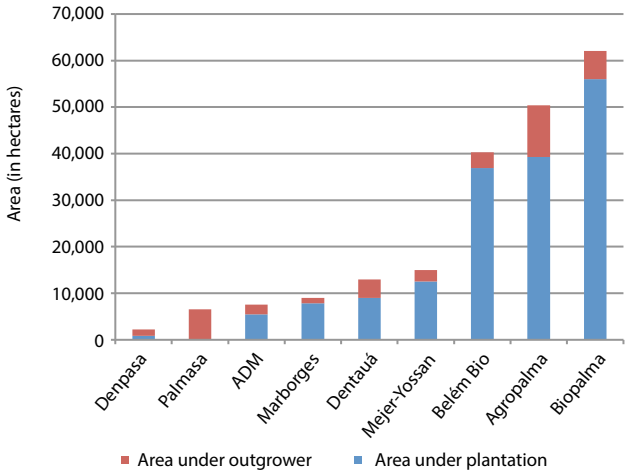

Figure 6. Area under production, by type of production arrangement

ADM = Archer Daniel Midlands.

area controlled by these nine companies. In the case of the three companies that operate through Japanese cooperatives (Denpasa, Dentauá and Palmasa), third parties account for the majority or a large proportion of total controlled acreage, while in the case of the four larger conglomerates this ranges from 8.4% in the case of BBB to 27.0% in the case of ADM.

The nine oil palm companies and their outgrowers all cultivate African oil palm (*Elaeis guineensis*) due to the comparatively low productivity of the indigenous caiaué (*Elaeis oleifera*) variety. African oil palm can potentially reach yields of up to 7 t of CPO per cultivated hectare, while caiaué on average yields 2 t per hectare. However, the African oil palm is more susceptible to the disease *amarelecimento fatal*, a rot that is characterized by leaf yellowing that in Brazil has been a major agronomic challenge (Boari 2010). *Amarelecimento fatal* was first detected in 1974 in the Denpasa plantations. Although the impact was then limited, from 1984 to 1987 the number of affected palm trees grew from 465 to 32,673 per year. This wiped out most of Denpasa's plantations and also nearby cooperative, Codenpa. It was not until 2010 that Embrapa formally launched an interspecific hybrid cultivar of African oil palm and caiaué, BRS Manicoré, that demonstrates higher resistance to *amarelecimento fatal*. It had been testing the hybrid since 1991 on Denpasa plantations and since 2001 on Codenpa plantations. Yields, however, failed to meet expectations until 2007, when Denpasa began trialing assisted pollination experiments on Codenpa plantations. While successfully improving yields, on average assisted pollination increases total production costs by approximately 15% compared to unimproved varieties, negatively affecting adoption rates. Biopalma has the largest area under cultivation with interspecific hybrids, having planted 15,972 ha of land with BRS Manicoré. Another interspecific hybrid cultivar was developed by Marborges, registered in 2014 as Marborges Inducoari. Marborges has currently planted approximately 770 ha of land with interspecific hybrids.

With many of the northern plantations affected by *amarelecimento fatal*, few companies have been obtaining economical yields. Agropalma, located in an area where *amarelecimento fatal* is less prevalent, is the most productive investor to date, obtaining yields of 4.39 t of CPO and palm kernel oil (PKO) per hectare (Figure 7). Since most companies in the sector have planted large areas over the last 5 years, the low yields by large investors such as ADM, BBB and Biopalma are largely attributable to immature plantations. Typically, oil palms only start producing harvestable FFB after 3 years, with maximum yields in Pará not expected until the trees are between 7 and 10 years of age. Therefore, recent market entrants are yet to realize maximum obtainable yields. Although ADM and BBB did not harvest FFB in 2014, harvesting did commence in some of their plantations in early 2015.

In 2014, Agropalma was responsible for 49.6% of total CPO and KPO produced in Pará (Figure 8). In total, an estimated 445,950.7 t of CPO and PKO were produced in Pará in 2014. This is equivalent to 95.4% of official reported Brazilian national CPO and PKO production in 2013 (FAO 2014). Once the immature plantations, particularly of Biopalma, BBB and ADM, start becoming productive and if they succeed in obtaining yields in line with those

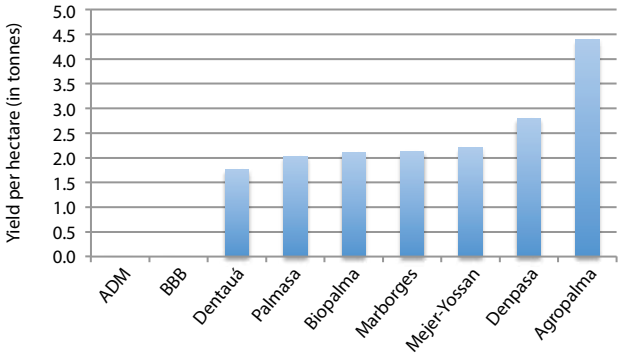

Figure 7. Average yield in 2014

ADM = Archer Daniel Midlands; BBB = Belém Bioenergia Brasil.

Note: Agropalma data is based on production between July 2013 and June 2014.

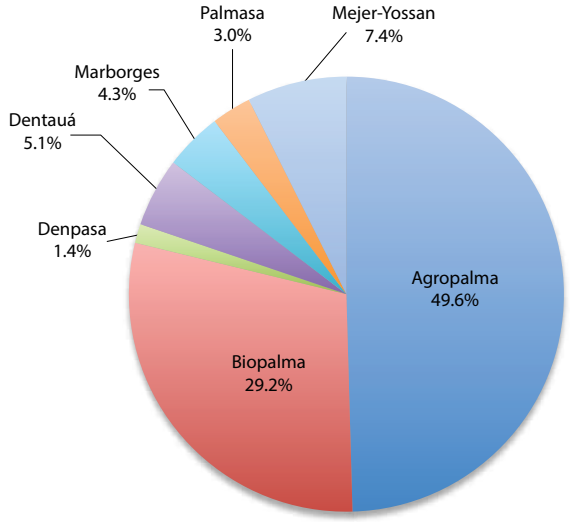

Figure 8. Output by company in 2014, as proportion of total

Note: Agropalma data is based on production between July 2013 and June 2014.

of Agropalma, based on current areas planted, it is estimated that by 2020, the state of Pará could produce almost 800,000 t of CPO and PKO per annum. Should the current annual domestic consumption growth rates remain constant, Brazil would then become a net exporter.

5.4 Model for smallholder integration

Formal attempts to promote smallholders in the palm oil sector date back to 2000 when oil palm investors signed a 'compromise agreement' with local smallholder unions. In 2002, the state government, the Municipality of Moju, Agropalma, ITERPA and Banco da Amazônia signed a Technical Cooperation Agreement to pilot a smallholder program in Moju municipality. In this pilot program, the following agreement was made:

- Agropalma would make a non-refundable contribution of 40% to smallholder land preparation, conduct topographical surveys, ensure property delimitation, provide seedlings and fertilizers, and purchase all FFB at a guaranteed minimum price.
- The state government would provide technical support and oversee smallholder environmental management.
- Banco da Amazônia would provide loans for other startup costs and make a payment of one minimum wage every 2 months over the first 3 years.
- ITERPA would donate and regularize land to the smallholders in projects I–III.

In 2002, 50 families were involved around the community of Arauaí, followed by 50 families in 2004 in Soledade, another 50 families in 2005 in Arauaí, and 35 families in 2006 in Calmaria II, an INCRA settlement. Another 13 families joined the scheme in 2012. In total, 192 families with 1,746 ha of land were involved in the pilot project. Projects I–III involved the establishment of contiguous plantations with families residing in other areas, while in project IV each producer was responsible for cultivating oil palm within their individual plots of land. Agropalma claims that productivity is higher in areas where families live nearby, as is the case in project IV.

As part of the Technical Cooperation Agreement, ITERPA donated three farm blocks of approximately 500 ha to each of the first three projects. In some cases, farmers living there for some time but owning no title (*posseiros*), were resettled to nearby plots in exchange for permanent titles and participation in the project. Since projects I–III were established before 2008 – in a period when environmental legislation was less strictly observed – the farm blocks allocated by ITERPA did comprise some degree of forestland.

The success of this pilot program caught the attention of the federal government and, following a visit by former President Lula da Silva in 2005, led to the creation in 2010 of SPOPP. This program is embedded within PRONAF and is intended to deepen and strengthen the Biodiesel Production and Use Program, notably the Social Fuel Stamp initiative. SPOPP differs from the Agropalma Smallholder Program in a number of critical ways, however. For example, while the early Agropalma Smallholder Program involved a large grant component from Agropalma, the newer schemes operate on a full cost recovery basis. This implies that all costs related to land preparation and inputs are borne by the smallholder. In the case of new schemes, smallholders receive a standard loan of USD 25,600 for a 10 ha plot, while Agropalma smallholders were only required to take out loans of between USD 4,800 and USD 7,040 for a similarly sized plot. These loans are paid back in yearly tranches after a 6-year grace period.

Additionally, the Agropalma Smallholder Program was developed under the assumption that the state government, through the Rural Extension and Technical Assistance Company (EMATER), would contribute with technical support. However, with the government failing to deliver in this respect,

Agropalma took over all technical responsibilities at their own expense. Therefore, within SPOPP, the government no longer plays any explicit role beyond its traditional mandates, with technical support now undertaken directly by the companies.

The Agropalma Smallholder Program also experienced some early challenges with the loan repayment structure. When the program was first conceived, smallholders were required to directly repay the bank, which, like many other PRONAF schemes, led to high default rates. Thus, the bank created a mechanism through which 25% of FFB payments would be transferred directly by Agropalma to the outgrower's own savings account, from which the bank would be repaid at the end of each year. Another 25% is deducted for the costs of inputs and transportation, with any difference between deducted and actual costs settled annually. Payment of loan tranches also became conditional on the adoption of good management practices, with the technical supervisor assigned to the outgrowers required to sign a loan payment release form certifying that the outgrower has satisfactorily managed their plantation. These practices have now been incorporated into the design of SPOPP.

In order to streamline communications between the company and its outgrowers, following the Agropalma business model, outgrowers are encouraged to form community-level growers associations and elect a representative that will act as a liaison. Under the Agropalma Smallholder Program (projects I, II and III), the land titles for the farm blocks allocated by ITERPA are in the name of the association. Although individual outgrowers are responsible for the management of their own plots, under this configuration they are technically not allowed to sell their plots. In the case of plantation mismanagement, Agropalma has the right, as a last resort, to terminate individual contracts and reallocate land through the associations to new outgrowers. It does not have this leverage over the smallholders of project IV, where individuals own planted lands.

This consolidation of smallholder plots under projects I-III has generated economies of scale for both Agropalma and its outgrowers by reducing transportation and transaction costs and enabling more efficient delivery of technical support. It has also facilitated the certification of smallholder production under the Roundtable on Sustainable Palm Oil (RSPO) by increasing the viability of initiatives to support smallholders in conforming to national laws and RSPO principles and criteria. This includes, for example, initiatives related to integrated pest management, worker health and safety (e.g. by constructing on-farm emergency showers and washing facilities), and formalization of employment. The latter has been a longstanding issue with smallholders, who are accustomed to hiring informally.

In 2014, Agropalma sought to overcome these informal hiring issues by supporting the formation of a smallholder consortium specifically tasked with formally hiring plantation workers for smallholder plots. This is a corporate entity managed by elected representatives of projects I, II and III. Through the consortium, individual outgrowers are able to hire workers contracted to the consortium for specific tasks. Since this arrangement requires close coordination and is only feasible within concentrated areas of oil palm, such initiatives were not introduced in project IV (e.g. due to the comparatively large distances between smallholder farms). Although the smallholder consortium plays a positive role in formalizing labor relations and responds to RSPO requirements, it may generate perverse incentives by further facilitating or formalizing absenteeism and, therefore, rural outmigration (that also existed before the establishment of the consortium), as has already been the case among some Agropalma smallholders. One the other hand, the need to create corporate smallholder entities with managerial capacity to adequately oversee smallholder operational issues could provide the basis for upscaling rural entrepreneurialism and enabling greater smallholder autonomy.

The recent schemes follow the structure of project IV, where oil palm is integrated within outgrowers' own properties. Although block farms reduce transaction costs and enable economies of scale, this model was not adopted by SPOPP. Within the context of current environmental legislation and with most degraded lands being privately owned, insufficient large contiguous areas of land are currently available to accommodate investors' smallholder expansion plans. Moreover, based on Agropalma experience, farmers tend to adopt better agronomic practices and achieve higher yields when they live in proximity to their plots.

Following the contracts used by Agropalma, outgrowers are contracted to a company for a period of 25 years – the productive age of oil palm – and

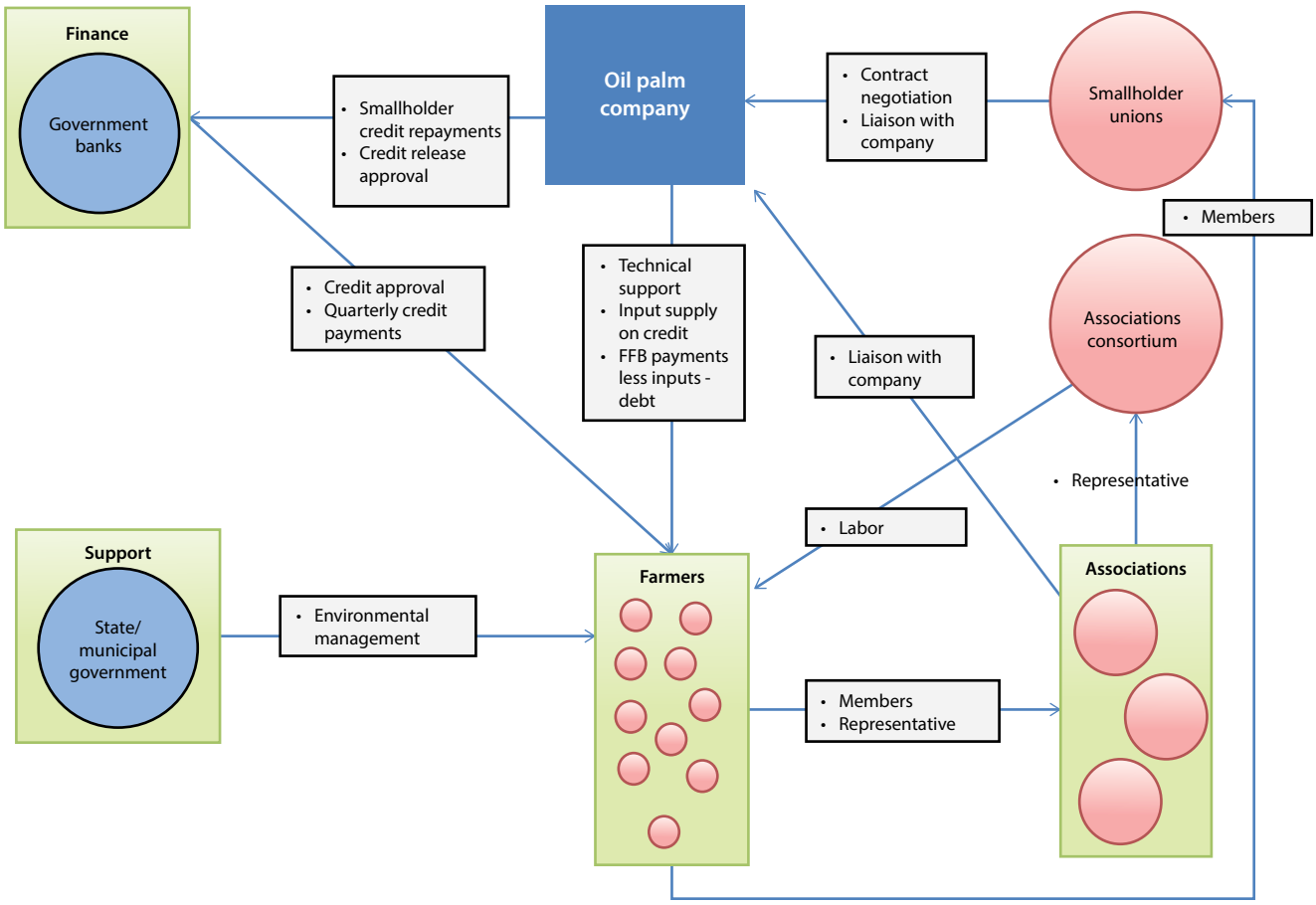

Figure 9. Oil palm outgrower schemes in Brazil

FFB = fresh fruit bunches.

are paid a minimum of 10% of the Rotterdam price of CPO for their FFB. Outgrowers in some cases are eligible for bonuses of up to 8%, determined on the basis of FFB quality and outgrower adherence to the agronomic practice guidelines and management schedules provided by the company. In practice, payments typically range from 10% to 16% of the Rotterdam CPO price. ADM pays its smallholders 10% of the Rotterdam CPO price for FFB collected from smallholder farms, while BBB pays 10%, Biopalma 14.25% and Palmasa 15% for FFB delivered to their respective mills. Over the course of 2014, Agropalma paid their smallholders 12.3%–15.34%, plus 10% of the RSPO premium received by Agropalma for the sale of its CPO.

Companies provide the outgrowers with a harvesting schedule and strategically place containers to enable efficient collection of FFB – in the case of Agropalma, collections take place every fortnight, with payments for the FFB collected made every month. Figure 9 depicts the typical smallholder outgrower scheme in Pará. There are some variations between companies; for example, only Agropalma has established an association consortium, while ADM, Biopalma and BBB are still at an early stage of establishing associations of smallholders. The transport and weighing systems also differ between companies, with ADM assuming the transport costs throughout the 25-year contract period, while most other companies only assume these within the first few years. Moreover, Biopalma has put in place a system of individual weighing, which provides the real weight at the time of collection, while other companies operate a system of counting the number of FFB and calculating total weight using an average value per bunch. This sometimes creates tensions among smallholders when the real weight is significantly different than their own estimates.

5.5 Processing

All companies except ADM and BBB have their own palm oil extraction facilities. By late 2014, the seven companies with operational extraction facilities

had a processing capacity ranging from 12 t of FFB per hour for Denpasa to 261 t of FFB per hour for Agropalma (Table 4). Biopalma is working to expand its current processing capacity of 120 t of FFB per hour by another 560 t of FFB per hour in the municipality of Acará. Their new extraction facility will be the largest of its kind in Brazil. Agropalma has started operations in its sixth extraction facility, with an installed capacity of 60 t of FFB per hour. BBB planned to construct three mills, which by 2025 were expected to have a total installed capacity of 405 t of FFB per hour; however, due to its operational problems and the abandonment of Project Pará their processing strategy is likely to change and there is only record of one extraction facility planned to start construction in Tailândia by late 2015.

Although ADM planned to have the construction of its own extraction facility finalized by 2016, the company faced difficulties in the municipality of São Domingos do Capim and decided to relocate its offices and extraction facilities to the neighboring municipality of Mãe do Rio. ADM continues to plan for the construction of a 40 t per hour mill, which is expected to be operational by 2017. There are no plans for a biodiesel plant but the economic returns of a refinery are being studied. Without their own processing facilities, ADM and BBB are selling their first harvests in 2015 to other companies. Consequently, due to high transportation costs and comparatively low margins on FFB sales, neither company is currently making a profit. By 2015, Pará's total FFB processing capacity was 532 t per hour, which is expected to increase to more than 1,500 t per hour should all facilities planned for construction become operational.

Four companies, Agropalma, Dentauá, Marborges and Mejer-Yossan, further process their CPO into refined products, with Agropalma having a refining capacity of 320 t of CPO per day. The refining process involves fractionation, degumming, bleaching and deodorizing in order to separate liquid and solid fractions and remove impurities. The liquid fractions (or *palm olein*) are typically used as cooking oils and the solid fraction (or palm stearin) for the production of candles, soaps and margarine. From its refining activities, Agropalma produces a range of specialty fats, including its own home cooking brand, Dentauá produces cooking oils and Mejer-Yossan makes soaps. Agropalma also produces a range of certified organic palm oil products, which originate from a dedicated 4,100 ha plantation and are processed exclusively by one of its six extraction facilities.

Only Agropalma has the capacity to esterify – a chemical process to produce biodiesel – which between 2005 and 2010 produced biodiesel from fatty acids (*ácidos graxos*), a by-product of the refining process. As a result of unfavorable market conditions within the biodiesel sector, since 2010 Agropalma has only been producing methyl esters for the chemical industry. Although BBB and Biopalma did pursue a collaboration agreement in 2014 to develop a biodiesel refinery in the state, with both of its parent companies currently reexamining their corporate

Table 4. Processing capacity by company

Company	Number of extraction plants (2014)	Extraction capacity (in tonnes of FFB per hour)(2014)	Number of refineries	Number of biodiesel plants
ADM	0 (1)	0 (40)	0	0
Agropalma	6	261	1 (1)	1
Biopalma	1 (1)	120 (560)	0 (1)	0 (1)
Denpasa	1	12	0	0
Dentauá	2	51	1	0
Marborges	1 (1)	20 (15)	1	0
Palmasa	1	32	0 (1)	0
BBB	0 (3)[a]	0 (405)	0	0 (?)
Mejer-Yossan	1	36	1	0
Total	**13(5)**	**532 (1,020)**		

ADM = Archer Daniel Midlands; BBB = Belém Bioenergia Brasil; FFB = fresh fruit bunches.

[a] After the closure of Project Pará the processing strategy of BBB may have changed.

Note: Facilities planned or under construction are denoted with brackets.

direction due to internal difficulties, negotiations stalled. Although incentives offered to the biodiesel sector and favorable market prospects in the late 2000s largely motivated the establishment of these new projects, with low international and national petro-diesel prices, in recent years the energy sector has become an insufficiently attractive end-market for oil palm (see also section 7.3). At present, oil palm cannot compete with soy due to soy's comparatively low cost of production and well-developed market and logistics networks (Padula et al. 2012).

Despite this, should the BBB production activities reach maturity, BBB still plans to export the vast majority of its output to Portugal for further processing into biodiesel at its partner Galp's Portuguese facilities. Since the BBB project principally serves to address Portuguese energy security and is a product of bilateral agreements, it does not operate under the same market principles as most of the other companies. This also applies to Vale, who intended to use palm oil for its mining operations; though with Vale currently looking to offload Biopalma to other investors, this will likely change.

5.6 Marketing

In 2014, Agropalma was the only company to serve the export market. According to Agropalma (2014), approximately 50% of total output is typically exported; 90% of which to the European Union, where, due to its certification under the RSPO scheme, it is typically able to obtain a premium of approximately USD 30 per tonne, though this may vary according to the product and the market. Internationally, Agropalma's largest customers are consumer goods manufacturers and refiners such as Wilmar and Ferrero and, domestically, cosmetics company Natura and consumer goods manufacturers Unilever and Yoki (owned by General Mills).

Companies such as Denpasa, Palmasa, and Dentauá used to exclusively sell to the Brazilian vegetable oil company Triângulo Alimentos in São Paulo. However, in 2013, with Triângulo Alimentos beginning to face financial difficulties and failing to fulfill payment obligations, companies had to start looking for new costumers. According to affected companies, this has had significant implications for the profitability of their operations. Dentauá, for example, now sells their vegetable oil to more than 400 different customers, significantly increasing transaction costs. With Dentauá and Palmasa claiming that local prices for CPO are insufficiently profitable, they are currently seeking to capture premiums through refining. Palmasa is now also in the process of constructing a new refining facility and Denpasa is exploring options for the same. These companies exclusively target the domestic market since they are unable to compete with Southeast Asia-based competitors due to comparatively high production and transportation costs. Many companies ascribe the comparatively high transportation costs to the lack of return loads on freight exchanges between Europe and the Pará ports. Only Agropalma, by virtue of their RSPO certification and high palm oil quality, is currently able to target overseas markets. Recognizing this, many of the smaller oil palm companies have begun to examine their options for RSPO certification.

With CPO prices over recent years exceeding the prices set through government-regulated biodiesel auctions (USDA 2015), none of the producers in Pará are servicing the energy end-market anymore (see also section 7.3).

6 Socioeconomic and environmental impacts

6.1 Local land rights

Companies access land for direct cultivation through a variety of mechanisms. Some own land through freehold titles, while others lease land directly from individuals or companies, either through fixed land rents or through partnership arrangements. Partnerships are a practice adopted by foreign companies due to legal restrictions in owning and leasing land. The differences between partnership and leasing are small and have to do mainly with management and income distribution. In partnerships, profits or losses are shared based on respective contributions, while in leasehold structures the landowner is paid a predetermined amount, periodically or at one time, independent of crop performance. ADM, as a foreign company, operates through a partnership model with 14 medium-holders, mostly cattle ranchers with secure land titles, covering an area of 5,500 ha. BBB, on the other hand, leases all its land in Tailândia and Tomé-Açu, while companies like Agropalma, Biopalma, Marborges, Denpasa and Mejer-Yossan directly own land. These companies accessed land at the time of SUDAM's fiscal incentives or purchased land directly; in some cases from other oil palm companies and more recently from medium to large cattle ranchers and through the consolidation of land from large numbers of smallholder farmers, as is the case for Biopalma.

Since most companies acquired land before the tightening of environmental regulations, and in some cases have not been able to obtain formal titles, none of the surveyed companies, with the exception of Agropalma, has been able to access the LAR, a mandatory license to operate in Pará, across their entire landholdings. Complications include not having adequate legal reserves of forests on certain properties and the existence of unresolved conflicts. These land conflicts tend to affect lands that were acquired during the 1970s and 1980s, when the SUDAM fiscal incentives available under the military dictatorship encouraged large-scale agricultural investment in Pará through deforestation. This often involved the forcible possession of land in the forested frontiers populated by *posseiros*.

The most notorious case in Pará's oil palm sector involved REASA (later acquired by Marborges), which violently occupied today's *quilombola* land, resulting in protracted retaliatory conflicts.[8] When Marborges acquired REASA, efforts were made to resolve the dispute, with the final 500 ha of disputed lands returned to the *quilombola* communities in 2014. Denpasa was also required to cede 7,000 ha of land to an occupation of landless workers that was organized by MST in 2003. This area is now the INCRA settlement of Abril Vermelho.

However, even more recently established companies face land conflicts arising from the ongoing practice of acquiring untitled lands. For example, Biopalma commissioned intermediaries to acquire and consolidate large- and smallholder lands in their four plantation areas in Moju, Acará, Concórdia do Pará and Tomé-Açu. Approximately 17,000 ha of its landholdings are undocumented or have illegitimately acquired land titles. This includes 8,000 ha of land subject to fraudulently obtained titles on the border between Acará and Tomé-Açu. When Biopalma began its cultivation activities there, a violent conflict arose with the local communities that had been using those lands for generations, but lacked legal titles. Pressured by the companies, in 2009 these communities created a *quilombola* association and the courts ruled in favor of the communities in the ensuing legal dispute. A similar conflict also occurred in *quilombola* communities in Concórdia do Pará and Bujaru do Norte, some of them demarcated as *quilombola* and others still in the process. In response to the conflict, these communities agreed to forbid any trade in land and participation in oil palm smallholder schemes within their territory. Under ZAE-Palma, there was no consideration for those areas that were in the process of being titled as *quilombola* lands, enabling some companies to obtain lands that were subject to conflicting claims.

8 In the 1980s, the land conflict between *posseiros* and REASA resulted in the death of several *posseiros* and a city counselor, and the invasion of the city of Moju (Sacramento 2012). The situation calmed down after Marborges purchased REASA's land areas. Due to the influence of the Catholic Church, through Comissão Pastoral da Terra, those areas were later recognized as *quilombola* land and the community decided collectively not to allow palm oil cultivation in their territory. Nevertheless, dozens of *quilombola* community members work in Marborges plantations.

In general, forcible possession of land in the oil palm sector was commonplace during early sector development, as in other sectors at the time of SUDAM fiscal incentives. However, with the government seeking to regularize and privatize land ownership, involuntary dispossession has become less endemic during more recent expansions, especially when access to land is governed by partnership and leasehold arrangements (e.g. ADM and BBB). Contemporary land conflicts arise only when companies purchase from opportunistic individuals that do not have legitimate claims to those lands, as illustrated by the Biopalma case.

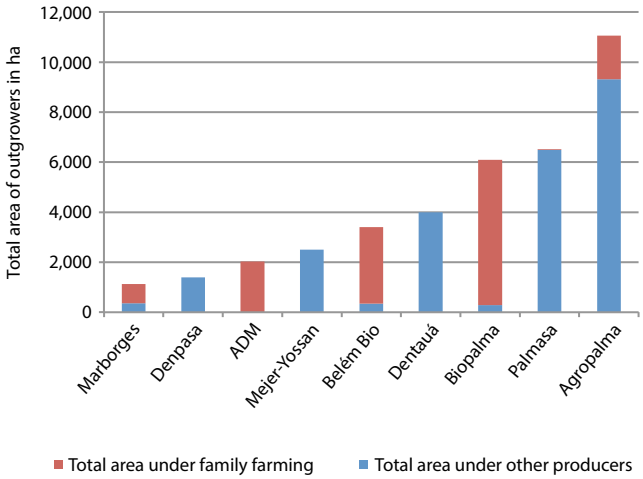

Figure 10. Type of outgrowers, by total area

ADM = Archer Daniel Midlands.

6.2 Productive integration of smallholders

While outgrower schemes are typically perceived to be smallholder-oriented, in the Pará oil palm sector not all outgrower arrangements exclusively involve smallholders or 'family farmers' (Figure 10), as is the case for Agropalma, Denpasa, Dentauá, Mejer-Yossan and Palmasa.[9] For example, data obtained from the companies show that outgrowers that can be formally classified as family farmers account for only 35.2% of the area cultivated by outgrowers. This ranges from as low as 0.5% in the case of Palmasa to as high as 95.0% in the case of Biopalma and 100% in the case of ADM. By the end of 2014, the sector engaged 1,442 family farmers, on average cultivating 9.3 ha per farmer, and 178 non-family farmers cultivating an average of 138.9 ha per farmer. The largest outgrowers are integrated into the Agropalma supply chain (49), with six outgrowers cultivating in excess of 500 ha, including one landowner with 2,039 ha. Some of these larger outgrowers are Japanese and have more entrepreneurial and commercial characteristics, and some of them even negotiate collective labor agreements with local worker's unions. In the case of Palmasa, Dentauá and Denpasa, their outgrowers are primarily former members of Japanese cooperatives, who have, historically, had a more commercial orientation. Although these three companies consider their external suppliers to be outgrowers, in practice few of their outgrowers work through off-take contracts; relying instead on the social capital arising from a shared cultural heritage.

The large new investments by ADM, BBB and Biopalma have had ambitious plans to integrate smallholders. By the end of 2014, they collectively contracted 1,169 smallholders, equivalent to 81.1% of all oil palm smallholders in Pará. Although all three companies expressed the desire to further expand the number of smallholders, the pace of integration has been slower than planned. Biopalma had the most ambitious plans, with plans to engage more than 2,000 smallholders. By late 2014, it had contracted 591 families. While ADM and BBB's initial plans were to contract 600 and 1,000 smallholders, respectively, at the end of 2015 BBB had only contracted 310 and ADM 267 smallholders.[10] In light of ADM, BBB and Biopalma's internal problems and/or operational difficulties, in the short-term no further expansion is anticipated from them. The three companies struggled to find sufficient numbers of suitable smallholders interested in and/or capable of planting oil palm. This can be attributed to inherent smallholder distrust of private enterprise and the perceived high risk of indebtedness and devoting a large proportion of their farmland to a perennial crop with which they have no agronomic experience. Foremost, as was also the case in Agropalma's first projects, many farmers fear that

9 Although in the case of Denpasa, Dentauá and Palmasa other outgrowers can be technically considered smallholders since many fulfill the criteria set out by the Family Farming Law of owning less than four fiscal modes, using predominantly family labor force and having most income generated through agricultural activities. However, since they did not benefit from smallholder credit schemes, we consider them to be other producers for this purpose.

10 In the case of ADM, after a socioeconomic assessment, it was understood that there were not enough suitable smallholders within a determined radius to have an economically viable operation.

Table 5. Outgrower scheme inclusion criteria

Typical company selection criteria[a]	PRONAF-ECO criteria
Able to plant 6–10 ha of oil palm	Certified 'family farmer' through a Declaration of Aptitude to PRONAF – Variable (DAP-V) certificate, with annual income of more than BRL 20,000
Sufficient non-forest land available within property in order to keep cultivating other crops	Property registered in the Rural Environmental Registry (CAR)
Located within certain distance by road to the company mill	Documentation proving property ownership
Land suitable for oil palm	Not blacklisted as a credit defaulter
Access to roads	Signed outgrower contract
Able to demonstrate financial and crop management capacity	Own at least 25 ha of land
Availability of sufficient capable household labor	Household head should be 18–60 years of age

PRONAF = Program to Support Family Farming

[a] These criteria are not established through PRONAF, but are adopted by companies at their own discretion to enhance economic viability and reduce default and performance risk.

companies will use the long-term supply agreements to seize smallholder farmland. In the case of BBB and Biopalma, where some of its contracted smallholders are located in close proximity to Agropalma's plantations and smallholders, the long presence of oil palm and mostly high regard for Agropalma as a company has served to alleviate these concerns. With more modest and pragmatic expansion plans, Marborges engaged 78 smallholders. Of these, 72 are located in Garrafão do Norte, a municipality where Marborges has its own plantations and plans to commission a new mill in 2017. The company selected this area due to the low prevalence of *amarelecimento fatal*.

While apprehension shapes participation in some areas, by and large non-participation in oil palm outgrower schemes is predominantly a product of ineligibility. In order to be eligible for participation, smallholders need to fulfill a number of inclusion criteria. Some of these are formal criteria related to loan access through PRONAF-ECO, while others are more company-specific (see Table 5). By and large, those smallholders that are ineligible in practice tend to be credit 'blacklisted' (e.g. due to failure to repay previous PRONAF credits), and/or have insufficient land available for planting oil palm. Smallholders are required to own at least 25 ha of land with sufficient non-forest land available to plant 6–10 ha of oil palm. These are formal requirements of SPOPP that companies have to enforce so as to ensure smallholders cultivate an economically viable area of oil palm while leaving sufficient land available to enable continued food crop cultivation. However, these criteria disqualify some smallholders since they either own too little land or are unable to plant 6–10 ha of oil palm without deforesting. Another important company criteria shaping actual participation is logistics, with dirt roads and poorly maintained bridges in some regions excluding smallholders from participation. Another important PRONAF-ECO qualification criteria is that applicant annual incomes must exceed a minimum threshold. The income threshold increased from BRL 6,000 in 2011 to BRL 20,000 in 2013 in order to reduce credit default risk. Income is seen by PRONAF as representative of agronomic and financial management capacity. However, many farmers have been able to circumvent this restriction and obtain the required DAP-V certificate[11] without being eligible. This can partly be attributed to pressure on local government agencies by companies who struggle to contract sufficient numbers of smallholders for their schemes and bureaucratic irregularities.

Prior default on credit appears to be primary reason for scheme exclusion. The scale of this problem is illustrated by the case of Concórdia do Pará. Of the 530 families interested in planting for Biopalma, only 34% were accepted. The major reason for exclusion (50%) was being credit blacklisted; two fifths of which was due to failure to repay small consumption credits and three fifths for previous

11 Declaration of Aptitude to PRONAF – Variable (DAP-V). DAP-V is for farmers with an income of BRL 20,000 or more per annum, while DAP-B is for farmers with a total annual income below BRL 20,000.

PRONAF projects, particularly cattle and pepper. In the case of Marborges, in the first year 326 farmers demonstrated an interest in their program in Garrafão do Norte. However, only 53 of these farmers were not credit blacklisted, with only 20 finally being approved by the bank. In the regions operated by ADM, default was not a major issue, while minor outstanding debts of up to USD 300 played the most important role in excluding farmers from the program.

While the reasons for high credit default rates under PRONAF are numerous, interviews with government officials and smallholders reveal some structural underlying problems with past credit schemes. Firstly, some of the input supply, technical assistance and extension support services that are part of most PRONAF packages were outsourced to private companies, due to lack of investment in the capacity of EMATER and other public enterprises. Lack of oversight and irregularities in how companies obtained lucrative contracts heavily undermined the quality and timeliness of input and service delivery. Secondly, PRONAF schemes focused primarily on modernizing and upscaling upstream production activities without adequately investing in market articulation. Consequently, with many crop-specific PRONAF packages, the market was unable to absorb the rapid rise in smallholder output, which often resulted in a collapse of local market prices. Thirdly, lack of oversight over PRONAF projects, lack of financial management capacity among farmers and lack of effort by banks to recover outstanding loans that were insured by the state often resulted in beneficiaries using loans for unintended purposes.

In sum, the inclusion criteria adopted tend to result in the exclusion of households that are land-poor, indebted, too old, too small, too poor, too far away or isolated and/or with high dependency ratios. This reveals some tensions between economic efficiency and poverty alleviation and integration of marginalized groups. Based on average cost, price and productivity data obtained from Agropalma smallholders, the average scheme participant with 10 ha of oil palm will on average generate a USD 9,377 per year profit over the economic life of oil palm. This is approximately 4.9 times higher than the average annual household income in the region and 4.5 times higher than the maximum achievable annual profits from the same area under cassava production (the most commonly planted crop in the region). Considering limited successes in upscaling the production of other high-value cash crops in the region, the large income disparity between scheme participants and non-participants might generate increasing inequalities within the region. However, though not yet fully apparent, some indirect positive spillovers may accrue with non-participants in the long-term, as participants generate more local employment, invest in and begin to rent out productive assets (e.g. tractors) and shift away from the production of staple crops such as cassava, thereby potentially improving long-term price and market prospects for the food crops produced by non-participants.

6.3 Employment generation

Oil palm investors directly employed 16,067 people in 2014; this excludes employment generated informally through outgrower schemes. Agropalma, BBB and Biopalma are collectively responsible for 72.4% of total employment, with Agropalma, the largest oil palm employer in Pará, employing 4,954 workers (Table 6). In the case of Agropalma, 93.2% of workers are employed on a fulltime basis and 85.0% are employed as manual laborers. It is estimated that on average company-managed plantations generate one fulltime employment position for every 13.9 ha of land planted (or 0.072 jobs per hectare). In the case of Agropalma, being an example in terms of good management practices, this figure was higher at one job for every 9.6 ha of land planted (or 0.106 jobs per hectare).

Relying largely on household labor, considerably fewer jobs are generated by smallholder outgrowers; for example, the consortium of the Agropalma Smallholder Scheme (projects I, II and III) hired only 32 full time employees for a planted area of 1,452 ha. This is equivalent to one fulltime employment position for every 45.4 ha of land planted (or 0.022 jobs per hectare). Nevertheless, oil palm generates considerably more jobs on a per hectare basis than other major agribusiness commodities in the Amazon; soy plantations, for example, generate on average only one fulltime employment position for every 200 ha of land planted (or 0.005 jobs per hectare).

In Pará, well-developed institutional structures are in place to promote constructive dialogue between trade unions and companies. For example, company-specific employment terms and conditions are negotiated annually through municipal or regional rural workers unions.

Table 6. Employment generated in 2014, by company

Company	Plantation jobs	Industrial	Administrative	Direct jobs (2014)
ADM	158	0	20	178
Agropalma	4,194	724	36	4,954
Biopalma	3,880	510	137	4,527
Denpasa	120	37	40	197
Dentauá	600	200	23	823
Marborges	875	170	75	1,120
Palmasa	0	120	6	126
BBB	2,200	0	150	2,350
Mejer-Yossan	700	1,000[a]	60	1,760
Agropalma smallholder consortium	32	0	0	32
Total	**12,759**	**2761**	**547**	**16,067**

ADM = Archer Daniel Midlands; BBB = Belém Bioenergia Brasil.

[a] Includes workers in the soap factory

Examples of positive collaboration between unions and companies include, for example, Agropalma, BBB, ADM, Biopalma, Marborges and Denpasa. Agropalma pioneered these practices, having signed the first collective agreement in 1998. These collective agreements specify salary structures and secondary benefits.

These constructive relations with unions are important steps toward formalizing employment in the Amazon, where employment was long largely informal and highly insecure. Abrapalma members, which include all the major companies except Mejer-Yossan, also endorsed a socio-labor agreement detailing industry commitments to adopting better labor practices.

Directly contracted manual laborers at most of the nine companies enjoy several benefits. They have a wage base that is slightly higher than the statutory minimum wage of USD 246 per month. This ranges from USD 250 per month for BBB to USD 253 for Agropalma and USD 259 for Palmasa. Aside from fixed monthly salaries, workers are typically eligible to receive productivity bonuses, which depending on individual productivity and the time of the year (e.g. at harvest time productivity can significantly increase) can more than double the base wage. As is required by Brazil's labor laws, most companies also provide transportation, food allowances and pensions (though the amounts vary between companies) and, in the case of the larger companies, discretionary benefits such as *hora intinere,* a 13th and 14th month, health insurance, housing and schooling for higher-level employees.[12] Due to competition for skilled labor between some of the larger companies, employment terms and conditions have become comparatively uniform. This has led to increased labor costs for the sector as a whole, with some of the smaller companies struggling to offer competitive employment packages and, by their account, experiencing difficulty in hiring experienced workers as a result. Stringent Brazilian labor laws and strong local trade unions have led most producers, except for Mejer-Yossan and most smallholder outgrowers, to only formally contract their workers. While the base salary does not differ materially between formal and informal workers, formal hires are legally entitled to the aforementioned secondary employment benefits and require the payment of social security tax on behalf of the employee. For most companies, this increases the actual costs of an employee to USD 625–687 per month; almost double the base salary and bonus. Alves (2011) estimates that labor costs comprise on average approximately 59% of the total CPO production costs in Pará. According to the RSPO, labor costs in Brazil are the highest of the 44 countries that produce oil palm; more than three times higher than the cost per employee in the world's largest oil palm producer, Indonesia.

12 *Hora intinere* was initiated in 2007 through negotiations between Tailândia's rural workers union and Agropalma. It is a form of compensation for time spent traveling between home and plantations. Other companies like Biopalma and BBB also offer this benefit.

Box 1. National Pact to Eradicate Slave Labor

The National Pact to Eradicate Slave Labor was signed in 2005 between the Brazilian government and 250 large companies, which in 2014 increased to over 400 corporate signatories. ADM, Agropalma, Biopalma (through Vale) and BBB (through Petrobras) are signatories. This pact is being overseen by a coordination and monitoring committee, which publishes an annual blacklist of producers engaged in slave labor practices. Signatories agreed not to source from producers that are blacklisted and federal financial institutions agreed to suspend any outstanding credit lines. The pact follows the Brazilian definition, which defines slave or forced labor as situations where workers face substandard working conditions, are submitted to exhausting work hours, are coerced to work through violence or intimidation or are working through debt bondage.

In July 2014, 609 producers were on the blacklist, with 27% of these producers originating from Pará. The livestock sector accounts for 40% of total cases, while the forestry and the agricultural sectors account for 25% and 16%, respectively. In 2013, the oil palm sector first appeared on the blacklist, when two Pará-based producers in Moju and Castanhal were implicated for engaging in slave labor. One of these cases involved the deputy mayor of Moju, an Agropalma outgrower, where in 2007 the authorities released 15 slave laborers, and in 2012 a further 10. When Agropalma signed onto the pact in 2013, it terminated the agreement with the deputy mayor.

The Brazilian Social Observatory Institute (Instituto Observatório Social 2013) estimates that 60% of the formal oil palm workforce in Pará originates from local communities, which suggests that the sector has generated more than 10,000 local jobs in Pará. With one fulltime manual laborer earning almost 2.4 times the regional average household income, these jobs have undoubtedly made important contributions to local economic development; enabling, for example, rural households not able or willing to participate in outgrower schemes to derive some benefits from sector development.

However, with 40% of the total oil palm labor force estimated to be comprised of migrants, typically from other regions in Pará and states such as Piauí and Maranhão, local communities have noted increasing incidences of prostitution, violent crime, illegal land occupation and drug and alcohol abuse as a result of in-migration. Migrant workers also increase pressure on the capacity of local healthcare and education services. These negative effects have also been acknowledged in Agropalma's environmental and social impact assessments submitted to the RSPO. Agropalma also suggested that their use of 600–700 temporary workers in the harvesting seasons resulted in economic disruptions and social problems once these workers became redundant. In response, Agropalma has begun to source temporary workers exclusively from nearby communities and to draw more on its permanent workers. This reduced the number of temporary harvesters to 70. The Brazilian Social Observatory Institute (Instituto Observatório Social 2013) also noted that approximately 2,200 BBB workers were contracted through third parties, which enables the company to avoid payment of company benefits and to circumvent union agreements. According to Brazilian law, companies are required to directly hire labor for core strategic activities within 2 years of starting operations. Agropalma and Biopalma have ended this practice in recent years. ADM also does not hire workers through third parties. BBB, however, continues to adopt this contentious and unresolved practice.[13]

Issues of slave labor that have long been prevalent in Brazilian frontier areas have also been raised as a concern by some within the oil palm sector, especially among less visible medium-scale producers. In 2013, for example, two private oil palm producers, one of which an Agropalma outgrower, were implicated in engaging in slave labor practices (Box 1). Although the problem of slave labor may be more prevalent than these two cases suggest, slave labor is not necessarily considered to be more prevalent in the oil palm sector than in, for example, the soy and livestock sectors, especially among the larger companies that are increasingly being held accountable for environmental and social issues within their supply chain.

6.4 Quality of environmental management

With investors now being required to adhere to the ZAE-Palma criteria and deforestation laws being strictly monitored and enforced, the recent expansion of company-owned oil palm plantations appears to have taken place exclusively on deforested

13 According to the Tailândia labor union (STTR Tailândia), BBB only hired 30 of its plantation workers directly while the remaining were hired through seven different outsourcing companies.

lands. Since smallholders are now required to have registered their properties in the CAR and companies are required to verify and monitor that outgrower planting activities take place within existing farming systems, the recent wave of smallholder expansion apparently has not driven forest conversion.

Earlier expansions in northern municipalities by Denpasa, Mejer-Yossan, Palmasa and Dentauá took place in comparatively high population density areas where forests had already long been converted. Nevertheless, a study by Venturieri (2012) showed that in 1980–2008 (before the establishment of SPOPP), approximately 20% of oil palm expansion occurred directly through deforestation, albeit with the majority of land conversions involving pasture. The most significant deforestation can be attributed to early expansion activities by Agropalma, which estimates that 45.3% of its plantations (17,939 ha) involved deforestation.

Prior to 2010, the sector lacked transparency and accountability, with public regulations and incentives having little bearing on environmental management practices. Nevertheless, Agropalma adopted a zero-deforestation policy in its own areas in 2001 and claims that the 7,403 ha of new land it has placed under production since then has exclusively involved conversion of degraded lands and pasture. Of the 107,560 ha owned by Agropalma, 63,224 ha (58.8% of their total land area) has been reserved for conservation purposes. This exceeds the legal minimum of 50% legal reserve applicable in northeast Pará (see section 4.4). In order to prevent logging and charcoal burning within its properties, Agropalma has hired guards to patrol its reserve areas. In 2002, Agropalma also successfully obtained certification through the International Standards Organization Quality Management System (ISO 9001), Environmental Management System (ISO 14001) and Occupational Health and Safety Assessment Services (ISO 18001). Agropalma continued to further cement itself as a sustainable palm oil producer when it became member of the RSPO in 2004. By 2014, all of its mills and their supply base became RSPO certified. In 2012, Greenpeace published a scorecard rating global palm oil producers on their sustainability efforts. Agropalma was ranked as the most sustainable palm oil company in the world. Agropalma claims that in order to become RSPO certified an initial capital outlay of USD 54 per hectare was required, with variable costs of maintaining RSPO certification averaging around USD 15 per tonne of CPO. With a USD 30 premium typically paid for RSPO-certified CPO in Europe, Agropalma maintains that there is a strong business case in Brazil for pursuing RSPO certification.

The other three large oil palm investments (ADM, BBB and Biopalma), though sufficiently capitalized to comply with various certification requirements, are yet to pursue certification. In the case of Biopalma, since the palm oil they produce was initially intended to serve their mining activities, there were few market incentives to warrant certification. In the case of BBB, most palm oil was planned to be exported to Portugal where it will be refined into biodiesel. In order to secure market access, the project has begun preparations for eventually applying for certification through sustainability schemes approved under the European Commission's Renewable Energy Directive. To this end, BBB will seek certification under the International Sustainability and Carbon Certification (ISCC) scheme, through which some operations of partner Galp are already certified. In the case of ADM, the company has completed all the required RSPO assessments and has received New Planting Procedure (NPP) approval after public consultation.

Some larger companies, with more capacity than smaller producers, have been investing in good environmental management practices; besides maintaining and protecting the legal reserves, this involves investment in waste and effluent management, in particular. Companies provide training and technical guidelines to their outgrowers and conduct inspections to ensure these adhere to environmental laws and company environmental policies. Agropalma is investing in a costly system of effluent treatment as a strategy to reduce greenhouse gas (GHG) emissions. There have though been some complaints of effluent contamination in small rivers near some company plantations. This apparently occurs when effluent overflows from tanks during heavy rains or as a result of fertilizer run-off.

Biopalma's sustainability department was particularly proactive and progressive in addressing a wide range of sustainability issues. For example, it formed working groups with local farmers to address a range of locally relevant issues. These working groups work on environmental issues related to use of fire and composting, to ensuring that best plantation management practices are employed, and alternative livelihood activities to prevent farmers from excessively relying on oil palm. In order to promote food security, Biopalma has also provided

training and guidelines on more sustainable and productive cassava production practices and has actively promoted and supported intercropping oil palm with for instance banana and cassava during the first 3 years (Agropalma and BBB do not allow intercropping). Unfortunately, with Vale divesting from Biopalma, in 2014 it ceased all non-strategic operations within their sustainability department, which terminated all working groups and the socioeconomic development support team. Similarly, while ADM initially planned to invest in socioeconomic development, to date sustainability activities focus exclusively on production-related activities, in turn frustrating local civil society organizations.

Although the major companies are becoming increasingly committed to reducing the environmental footprint of their operations, many communities remain concerned about pollution, especially water contamination. Some environmental groups, for example, claim that the use of non-organic fertilizer and pesticides has resulted in widespread contamination of rivers. Following claims by Glass (2013), a study by the Evandro Chagas Institute (Repórter Brasil 2015) involving the analysis of 18 different locations in the municipalities of São Domingos do Capim, Concórdia do Pará, Bujaru and Acará confirmed that at 14 different locations sediments were contaminated with endosulfan, a banned toxic substance typically used in pesticides, and dichlorodiphenyltrichloroethane (DDT), an insecticide used to combat malaria. Although this cannot conclusively be linked to oil palm cultivation, these findings are supporting an ongoing court case by the indigenous Tembé community in Tomé-Açu against Biopalma, who are seeking compensation for and appropriate mitigation measures to address water contamination that has allegedly adversely affected local crop production, livestock and health within their community. Abrapalma has denied that endosulfan has been used in the sector.

In contrast to the larger companies, the smaller oil palm companies typically lack capital and capacity to comply with new environmental standards. Companies like Denpasa and Mejer-Yossan whose plantations were established at a time when environmental controls were weaker are, for example, struggling to comply with the 50% legal reserve and APP requirements.

7 Future risks and opportunities

7.1 Socioeconomic development

While marked increases in the household income for Agropalma outgrowers generated high expectations among more recent participants of the long-term economic prospects of oil palm, the recent rapid expansion of smallholder oil palm through other companies should be approached with caution. For example, the credit component in the new schemes is considerably larger than in the Agropalma Smallholder Program. This will require the average participant to make repayments until year 18, as opposed to year 9 in the Agropalma case. Since the Agropalma Smallholder Program was meant to serve as an example of inclusive oil palm development, participants also benefited from repayment support and in the case of project I, loan forgiveness. Moreover, in the face of operational difficulties and uncertain macroeconomic prospects, the BBB, ADM and Biopalma outgrower schemes are reducing their socioeconomic orientation and face an insecure future. With companies having contractual commitments to 1,442 smallholder outgrowers, their collapse could have far-reaching socioeconomic implications, especially considering the comparatively high debt levels of their outgrowers. However, since the federal government and the Agricultural Workers Federation (FETAGRI) are politically vested in ensuring the Sustainable Oil Palm Program succeeds, and large companies such as ADM, Petrobras and Vale have significant corporate value tied into their brand and reputation, industry insiders are confident that these companies will not renege on their contractual commitments. As has already been apparent, they are more inclined to pay, but not collect, their FFB if necessary.

Regardless, Biopalma's approach to contracting outgrowers – in contrast to Agropalma and ADM – may prove unsustainable and uneconomical over time. Its outgrowers, for example, are spread across 52 communities, some of which are located more than 100 km by road from its mill. This increases transaction and transportation costs and reduces Biopalma's capacity to deliver targeted technical support, in turn undermining productivity and, consequently, profitability. Agropalma's outgrowers, on the other hand, are located within three adjacent communities. This has enabled Agropalma to allocate one fulltime technical support staff member to each outgrower cluster to conduct weekly farm visits and provide individualized support.

The risks facing the Biopalma smallholder scheme may in future be exacerbated by poor vetting of smallholders. There are numerous cases throughout the region where smallholders were included in the schemes without meeting important criteria; for example, by not having sufficient family labor, being too old, not demonstrating adequate agricultural capacity or not having the minimum annual income to qualify for the required DAP-V certificate. The inclusion of such smallholders occurred in a context where companies and their employees struggled to meet their smallholder incorporation targets. Marborges' more cautious smallholder integration strategy may in future prove to be more successful for both the company and its smallholders.

Although current schemes have benefited significantly from Agropalma's learning curve, as illustrated in section 5.4, investors should acknowledge that, in the absence of operational support by state agencies, successful upscaling requires a well-developed corporate support structure. However, the success of the model does reveal that public incentives (e.g. through PRONAF) in combination with productive integration into agribusiness supply chains helps to overcome structural problems associated with most state-sponsored smallholder modernization initiatives. In particular, past PRONAF projects suffered from problems both at the supply side (e.g. poor quality technical assistance, extension services and inputs) and the demand side (e.g. weak access to markets and lack of capacity to absorb surplus). With agribusiness having a direct interest in ensuring their smallholders produce high-quality FFB, there are greater incentives to invest in smallholder productivity and in supply chain efficiency. Since public and private stakeholders responsible solely for the delivery of goods and services on the supply side have no immediate stake in the outcomes, their interactions with smallholders become more susceptible to rent-seeking through the input dissemination and contracting process. Fully integrating smallholders into agribusiness supply chains, on the other hand, leads to improved alignment of supply- and demand-

side objectives. However, due to high vertical integration of the oil palm supply chain, smallholders in this type of system have few opportunities to expand independently since companies are vested in tightly controlling their supply base.

As is highlighted in section 6.2, the barriers to participation in outgrower schemes show that recent oil palm developments do not necessarily equate to broad-based growth. Although it is too early to speculate about the magnitude of positive and negative spillovers that could narrow or broaden the inequality gap, preliminary findings from the household surveys appear to suggest that both types of spillovers have been limited to date. As the more mature Agropalma Smallholder Program (projects I, II and III) illustrates, for example, a smallholder outgrower on average generates only 0.022 fulltime jobs per hectare. Although most productive oil palm households are reinvesting their incomes predominantly in asset accumulation and continue to produce food crops (though at a reduced scale), changing household strategies and portfolios have had limited direct impact on non-participant households. With secure individual property rights, in the major oil palm growing areas smallholder oil palm cultivation has not generated conflicts over land either. Although outgrowers cannot expand beyond the maximum area of 10 ha without losing access to concessionary credits and other family farming benefits, new accumulation strategies are emerging to overcome barriers to expanding both independently and as outgrowers. For example, some outgrowers have been able to accumulate up to four oil palm plots by purchasing properties and accessing credit through relatives. This has begun to drive an increasingly active rural land market and is encouraging land concentration, thereby potentially undermining the political family farming philosophy of promoting equitable land access among smallholders.

While the sector at present does not accommodate independent smallholders, in well-developed oil palm areas in Indonesia, for example, the desire by smallholders that have gained experience with oil palm cultivation to expand outside company structures has led to the establishment of independent mills and specialized input providers. This appears to be a natural evolution of the sector in many countries as smallholders over time become less dependent on company technical support, inputs and off take. In the case of Brazil, this would, on the one hand, facilitate further accumulation by outgrowers, but, on the other, exacerbate processes of land concentration and unequal benefit distribution. Although a debate around such issues is not immediately relevant in Brazil, these are important political issues that policy-makers need to be cognizant of as the sector evolves.

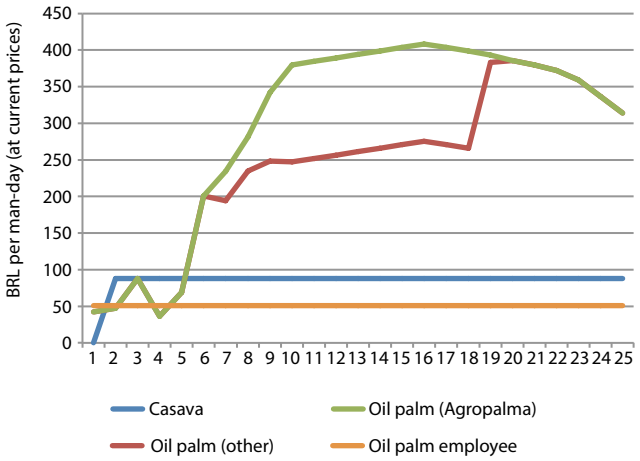

Figure 11. Returns to labor from alternative livelihood options

Note: The cassava scenario is based on the most productive systems in the region. These typically involve up to 2 ha of land under cassava production, which is harvested every 2 years. In order to restore soil fertility, farmers typically employ rotational fallowing on 5-year cycles, implying that at least 10 ha of land is required for every 2 ha of cassava planted. The oil palm scenarios are based on average smallholder yield data and a 5-year average fresh fruit bunch (FFB) price paid to smallholders of USD 80 per tonne. Differences between Agropalma outgrowers and other outgrowers are attributable to different loan sizes (see section 5.4).

The most tangible benefit accruing to non-participant households is employment on company plantations, which generate considerably more formal employment positions than smallholder plantations. With wages exceeding average regional household incomes (as discussed in section 6.3), these employment opportunities can make meaningful contributions to rural incomes and diversification of rural livelihood portfolios. However, as illustrated by Figure 11, the returns to labor from oil palm and cassava cultivation exceed that of plantation employment by a factor of 4.8 and 1.7, respectively. This suggests that investments in increasing the productivity of cassava and the adoption of oil palm may be preferred long-term livelihood options from a purely economic perspective. With many oil palm employees increasingly residing in urban centers, this would also likely align better with the political objectives of reducing urbanization.

7.2 Environment

The recent expansion of oil palm in Pará illustrates that the sector is not necessarily synonymous with deforestation. Although sector-specific guidelines and legislation limited the oil palm expansion of the 2010s to degraded and previously deforested lands (before 2008), political commitment to curbing illegal deforestation across sectors has also prevented oil palm-induced displacement of pastureland and farmland that could contribute to indirect land-use change. Even though smallholder expansion tends to be more difficult to regulate due to their geographic dispersion and comparatively small plot size, since companies require and typically support individual outgrowers to register their properties through the CAR system, this results in outgrower land rights becoming more formalized, and allows the government to hold smallholders accountable for deforestation within their plots. With the current smallholder production models, companies are also increasingly held accountable for the environmental management practices within their supply base. This is leading to a privatization of environmental monitoring and enforcement, partially relieving pressure on poorly funded state and municipal environmental bodies.

Despite not being a major driver of deforestation, the jury is still out about other environmental impacts. Some evidence, for example, appears to suggest that water and soil contamination could be occurring as a result widespread pesticide use. However, any causality with oil palm cultivation is yet to be established, so such claims should be treated with some degree of caution. Nevertheless, state environmental agencies should pay more heed to these more difficult to monitor environmental impacts.

From a land use efficiency perspective, oil palm clearly represents new opportunities. Returns to land, representing the implicit rental rate of land, are at least 2.6 to 3.2 times higher for oil palm than for cassava production, generating on average more than USD 938 per ha per year over the 25-year productive life of oil palm (Figure 12). Oil palm outgrower schemes also lead to an intensification of smallholder production systems through positive productivity spillovers, as some outgrowers were observed to be diverting some of their inputs and income to the production of other input-intensive crops. Moreover, since some outgrowers reduce the area under food crop production, some farmers are shifting away from more land inefficient rotational farming systems. These improved returns to land across smallholder farming activities will support the region in realizing rural development objectives without exacerbating pressure on forestland. Nevertheless, these approaches should be taken with caution as food security risks might occur in shifting from food to cash crops.

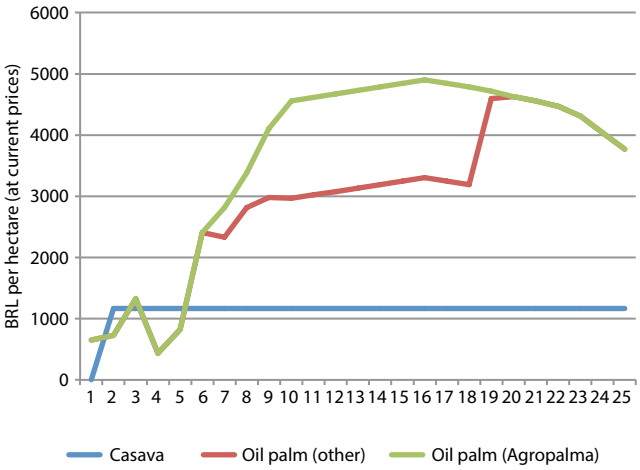

Figure 12. Returns to land for oil palm and cassava

The expansion of company-owned plantations has also promoted the rehabilitation of degraded lands. In particular, land extensive production systems such as cattle ranching are being put to more productive use. Not only are returns to land considerably higher for oil palm than for cattle ranching, cattle ranching is a net source of GHG emissions, while oil palm through sequestration is a net sink of GHG emissions when this involves conversion of pastureland. Mello et al. (2014), for example, estimate that the conversion of pasture releases up to 31.8 t of CO_2 per hectare. A study commissioned by Agropalma (2014) estimates that their oil palm plantations have a net positive carbon balance of 4.4 t of CO_2 equivalent per hectare per annum.[14] This suggests that within 7.2 years, oil palm plantations could recover the carbon debt arising out of pastureland conversion and become net carbon sinks. In the case of annual cropland conversion to oil palm – for example, in the case of smallholder outgrowers – there typically is no meaningful carbon debt; implying that a positive net carbon balance can be realized within the first year.

14 This includes emissions attributable to fertilizers, N_2O, fuel and processing, but excludes land conversion.

7.3 Sector development

Despite renewed interests in the oil palm sector in Pará over the past decade, the sector faces an uncertain future. With major companies such as Vale, ADM and Petrobras looking to scale back or divest from their operations, the further development of the sector will depend on their ability to find suitable buyers and/or garner internal commitment to deliver on their initial business plans. Considering low diesel prices and reduced political commitment to further incorporating biodiesel into the Brazilian energy mix, in the medium-term the sector is unlikely to be sufficiently attractive to companies targeting the energy end-market. Although the ANP sets a maximum reference price for its biodiesel auction, between June 2013 (the 31st auction) and April 2015 (the 42nd auction) the average selling price in all but one auction failed to reach the average cost of production (see Figure 13). The average biodiesel selling price in the auction amounted to USD 0.62 per liter, while average CPO production costs (excluding transportation costs and transesterification) amount to approximately USD 0.67 per liter according to Abrapalma (Brito 2014). Therefore, under current market conditions, there is little incentive to produce palm-based biodiesel.

Figure 13. Biodiesel prices

CPO = crude palm oil.

Source: ANP (2015)

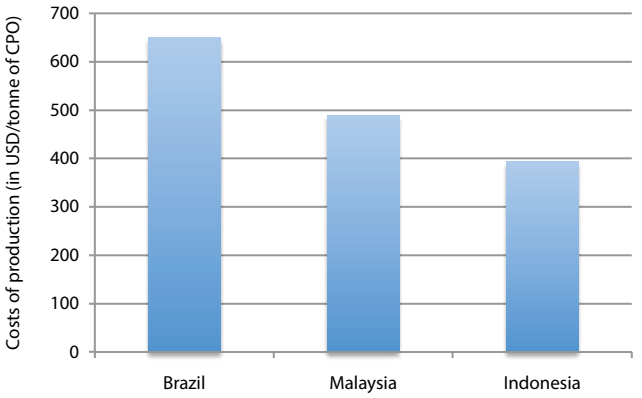

Figure 14. Cost of production in Brazil

CPO = crude palm oil.

Source: Brito (2014); Budidarsono et al. (2012); ERE Consulting (2012)

The comparatively high costs of production in Brazil have affected sector development more generally, as the uncertain futures of the ADM, Petrobras and Vale investments illustrate. Due to stringent labor and environmental laws and difficulties in obtaining large areas of deforested lands that are not subject to conflicting claims and have a clear tenure status, Brazil is one of the most expensive countries in the world to produce oil palm. For that reason, Brazil is often referred to as the last oil palm frontier. Secondary data suggests that the average costs of production in Brazil are 33.1% more expensive than in Malaysia and 65.3% more than in Indonesia (Figure 14). According to Agropalma, this is largely attributable to the comparatively high labor costs in Brazil, which is corroborated by the study conducted by the RSPO showing that labor costs in Brazil are the highest in all oil palm producing countries (Brito 2014). This is a considerably more important competitive disadvantage for the oil palm sector than for the soy and beef sectors, for example, which have a comparatively low labor intensity.

Although Brazil's domestic market and proximity to the US and EU markets could theoretically provide locational benefits, due to comparatively high transportation costs, even within Brazil producers struggle to compete with cheap imports from Southeast Asia. However, with Agropalma demonstrating that there is a business case for RSPO certification, Brazil's environmental laws and availability of suitable deforested land could be attractive to larger producers from, for example, Southeast Asia seeking RSPO certification and genuinely committed to zero-deforestation policies.

8 Lessons and policy recommendations

Our analysis of the evolution of the oil palm sector in Pará has yielded a number of important insights, relevant also to other sectors and countries, about some of the enabling conditions for fostering green and inclusive investments in agricultural frontiers:

- There is a need for a **phased implementation of smallholder inclusion initiatives** to allow for ample flexibility to make ad hoc changes to specific practices and/or to business model design before institutionalizing specific models and upscaling these within and/or replicating these across different socioecological systems. For example, SPOPP and new oil palm investors greatly benefited from the experiences of the Agropalma Smallholder Program. Besides the existing challenges, several problems were avoided this way.
- Programs aimed at modernizing smallholder production systems should ensure that **supply- and demand-side market failures are addressed simultaneously**. The high failure rates of past PRONAF projects and the apparent success of SPOPP illustrate that fully integrating smallholders into agribusiness value chains not only creates a guaranteed market for smallholder crops, but enhances the quality of input and service delivery since investors are also beneficiaries of high smallholder productivity.
- Especially for new crops that require large up-front investments or involve a long maturity period, **targeted public incentives may be required** to encourage agribusiness to productively integrate smallholders into their value chains and to reduce technical and financial barriers to participation for smallholders. With new entrants such as ADM, BBB and Biopalma being more inclined to engage family farmers than more established industry incumbents, market-based fiscal incentives such as the Social Fuel Stamp and SPOPP have proven to make important contributions to promoting more meaningful smallholder integration. Similarly, concessionary credits for smallholders that transfer default risk to the federal state reduce the capital outlay and risk exposure for investors. Moreover, for the federal state, the default risks tend to be comparatively low in more integrated schemes such as these since they involve a performance-based component (e.g. periodic loan payments are contingent on good management practices), repayments through companies, good technical assistance and extension services, and guaranteed off-take contracts, which function as a form of collateral. In the case of oil palm, this has allowed the banks to provide significantly larger loans to smallholders than are the norm under other PRONAF initiatives.
- **Clear and secure individual property rights** reduce the risk of land conflicts within and between communities in a situation where the introduction of profitable cash crops increases the value of and thus competition for land. Moreover, as our case studies have shown, it ensures that new crops are better integrated into existing farming systems and new lands are not opened up for production. Although this could generate food security risks, these risks are minimized in the Brazilian context with most smallholders in Brazil having access to comparatively large areas of land, the Sustainable Oil Palm Program only supporting the development of up to 10 ha oil palm to ensure sufficient land remains available for food crops, and some smallholders intercropping until their palms begin to become productive. It should though be acknowledged that in different contexts and with different crops, different approaches might need to be adopted to mitigate such risks.
- **Sectoral land use plans and guidelines and environmental monitoring and enforcement capacity** reduce the direct and indirect threat of frontier expansion and deforestation. With oil palm cultivation in Brazil recently having become restricted to degraded and deforested lands, and available land suitable for expansion identified through agro-ecological zoning, recent expansions have primarily taken place on comparatively unproductive and low conservation value lands. Since all oil palm production units, from large holding companies to smallholders, are registered in the Rural Environmental Registry, environmental management agencies are better positioned to hold accountable those in breach of sector regulations. Moreover, since companies are responsible for ensuring that outgrower oil palm cultivation does not conflict with forests, some environmental monitoring and enforcement responsibilities are transferred to the private sector.

Oil palm expansion in Brazil has demonstrated that the sector need not be synonymous with deforestation and abuse of local land rights. Instead, it has promoted a transition among many smallholders to a more land and labor efficient crop that makes important contributions to household incomes, although with limited impact on broader rural development. However, this paper does highlight a number of challenges, relevant to both companies and policy-makers alike, to ensuring sector development translates into broad-based growth:

- Many **smallholders face barriers to participation** in the oil palm sector. For example, since many smallholders are either indebted to past smallholder projects or have unfavorable household labor and income profiles, they are ineligible for participation in smallholder outgrower schemes. Although improved access to formal employment opportunities enables some non-participant households to capture gains from sector development, since returns to labor are typically higher for oil palm than for traditional farm-based livelihood options, employment is typically only desirable as a complementary livelihood activity for underutilized household members. As a result, the inequality gap within rural areas threatens to increase. Such challenges, however, are complicated to resolve since pushing for more equitable participation of potentially unproductive smallholders with comparatively high credit default risks may undermine the long-term economic viability of SPOPP and exacerbate rural indebtedness. More careful examination of alternative smallholder business models, where companies are able to exert greater control over the production process, could reduce such risks. Block farming through partnership and co-management arrangements, where companies absorb (part of) the establishment costs and undertake (some of) the plantation management activities could be a viable alternative, although in the particular case of Agropalma productivity was found to be lower when smallholders do not reside in close proximity to their plots. Successful examples to draw from include Indonesia's nucleus–plasma and one-roof management models.
- The opportunities generated by the **oil palm outgrower schemes have started leading to processes of land concentration**. Although the design of the smallholder oil palm schemes has been strongly influenced by political objectives of preserving and protecting family farming, in practice, the price of land in oil palm producing areas has been rapidly increasing. This has encouraged some non-participant households to sell their land to, for example, migrants and existing smallholder outgrowers seeking to expand their area under production. Since existing oil palm smallholders are not encouraged by companies to expand beyond 10 ha on their own plots and are unable to plant independently, some are beginning to exploit loopholes to accumulate more plots. These increasingly dynamic rural land markets are undesirable from Brazilian political and socioeconomic perspectives since they drive land concentration. Though potentially warranting the introduction of land transfer restrictions, because of lack of clarity about land ownership and limited oversight, it may be more feasible to discourage land sales by increasing the inclusiveness of sector.
- Despite some positive results to date, **oil palm outgrower schemes remain a risky proposition**. In the case of Biopalma, there are credible risks that it will be unable to provide the type of technical support network needed to accommodate and ensure the productivity of its large and geographically dispersed network of poorly vetted smallholders. Moreover, many new companies lack agronomic expertise and regional experience, which could undermine the quality of technical support. The new entrants hiring young agronomists from the south and southeast of Brazil with little or no knowledge of the sector or of the Amazon, like BBB and ADM, are more likely to create tensions across the communities. This illustrates that new entrants should be encouraged to pursue a rational and careful approach to smallholder integration. Since project failure could have far-reaching negative socioeconomic impacts, policy-makers should consider limiting the expansion rates of outgrower schemes until projects have proven to be economically viable and able to deliver on their contractual commitments. This will also increase the likelihood that when companies divest from projects (like Vale and possibly Petrobras), projects are attractive to suitable investors and no significant disruptive restructuring will be required.
- Increased availability of formal employment due to **processes of rapid commercial expansion in the oil palm sector create social disruption in neighboring villages**. As observed in Vila do Palmares and Forquilha, the influx of migrant workers from other regions often increases pressure on already struggling local services such as education and health, while also having a negative impact in terms of increasing violence associated with alcohol, drug abuse and prostitution. Public bodies in collaboration with companies should address these issues beforehand by increasing investment in social infrastructure and law enforcement.

9 Conclusion

This paper has shown that public incentives, combined with a supportive policy and regulatory framework, can enable the sustainable commercial expansion of palm oil within socially and environmentally sensitive biomes. In the Brazilian oil palm sector, the federal government has been able to leverage private sector resources, technical expertise and market networks in support of both rural development and environmental management objectives. Clear sectoral expansion guidelines and ongoing initiatives to demarcate individual rural properties, combined with improved enforcement capacities through the adoption of technologies to monitor deforestation at the plot level, have ensured that expansions over the 2010s in the oil palm sector have taken place predominantly on previously deforested lands. Moreover, since the private sector is increasingly held accountable for the overall environmental performance of their supply base, some degree of privatization of environmental monitoring and enforcement is observable in the oil palm sector; thereby, alleviating pressures on under-resourced local environmental management agencies.

This study also suggests that by fully integrating smallholders into the agribusiness supply chain, both market and credit default risks can be significantly reduced, which in the context of the Brazil's incipient oil palm sector has enabled SPOPP to provide significantly larger loans to smallholders than are typically viable under traditional smallholder credit schemes. This has enabled smallholders to overcome technical, financial and market barriers to participation that obstruct smallholder adoption of high value crops that involve high establishment costs and/or long maturity periods. Oil palm smallholders with mature plots in the study sites on average are able to generate almost five times more income from oil palm alone than the regional average household income. This highlights that oil palm expansion in the Amazon and smallholder integration into agribusiness supply chains, more generally, could make important contributions to delivering on Brazil's family farming policies and addressing rural market failures. Additionally, oil palm's comparatively high returns to land and labor will help enhance land use efficiency in the Amazon, while enabling smallholders to more profitably utilize their land and household labor. However, rising inequalities between oil palm outgrowers and smallholders not cultivating oil palm, along with lack of positive spillovers, may exacerbate land concentration processes and detract from the sector's potential to contribute to broad-based growth.

Despite the many economic and environmental merits of oil palm expansion in the Amazon under current policy conditions and early optimism about long-term sector prospects, the sector increasingly appears to face an uncertain future. Firstly, in the current expansion area companies struggle to gain access to land that meets environmental criteria and is titled or legally eligible for regularization. Secondly, due to comparatively high labor and transportation costs, production costs are considerably higher than in Southeast Asia, which limits the capacity of many Brazilian oil palm producers to compete on price in international markets. Thirdly, unfavorable conditions over recent years in the domestic biodiesel end-market have undermined the economic viability of investments targeting the renewable energy sector, which has led to the downscaling of many investor expansion plans.

Future price conditions in palm oil end-markets will clearly play an important role in shaping sector prospects. However, the future of the sector in Brazil is also very much linked to its capacity to realize competitiveness enhancements through chain upgrading. This relates in particular to reducing the costs of production through process upgrading (e.g. productivity enhancements) and enhancing product value through product upgrading (e.g. value addition through greater vertical integration and/or access to RSPO premium markets).

10 References

Adami M, Gomes AR, Coutinho AC, Esquerdo JCDM and Venturieri A. 2015. *Dinâmica do uso e cobertura da terra no estado do Pará entre os anos de 2008 a 2012*. Anais XVII Simpósio Brasileiro de Sensoriamento Remoto. João Pessoa, Brasil, 25–29 April. National Institute for Space Research (INPE).

Agropalma. 2014. *Relatório de Sustentabilidade 2013*. Accessed 26 October 2015. http://www.agropalma.com.br/arquivos/relatorios/2013---Relatorio-de-Sustentabilidade---Portugues---final-1432586731.pdf

Alves SAA. 2011. *Sustentabilidade da agroindústria do Estado do Pará*. Thesis (PhD). Piracicaba, Brazil: Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo.

Andrade RMT and Miccolis A. 2010. *Biodiesel in the Amazon*. Working paper 113. Nairobi, Kenya: World Agroforestry Center.

Andrade RMT and Miccolis A. 2011. *Policies, institutional and legal framework in the expansion of Brazilian biofuels*. Working paper 71. Center for International Forestry Rearch: Bogor, Indonesia.

[ANP] Agência Nacional do Petróleo, Gás e Biocombustíveis. 2015. *Boletim Mensal do Biodisel, Maio de 2015*. Accessed 5 October 2015. http://www.anp.gov.br/?id=472

Assunção J, Gandour C and Rocha R. 2012. *Deforestation slowdown in the Legal Amazon: Prices or policies?* Working Paper 1. Rio de Janeiro, Brazil: Climate policy Initiative.

Backhouse M. 2013. *A desapropriação sustentável da Amazônia. O caso de investimentos em dendê no Pará*. Working Paper 6. Berlin: Fair Fuels?

Banco Central do Brasil. 2015. *Investimento estrangeiro direto*. Accessed 5 October 2015. http://www.bcb.gov.br/?INVED

Becker BK. 2010. Recuperação de áreas desflorestadas da Amazônia: Será pertinente o cultivo da palma de óleo (Dendê)? *Confins* 10.

Boari A. 2010. O desafio das pesquisas com a etiologia do Amarelecimento Fatal (AF) da cultura da palma de óleo. *In* Filho AR et al. eds. *Zoneamento agroecológico, produção e manejo da cultura de palma de óleo na Amazônia.* Rio de Janeiro, Brazil: Embrapa Solos.

Bonelli R. 1998. *A note on foreign direct investment and industrial competitiveness*. Discussion Text 584. Rio de Janeiro, Brazil: Instituto de Pesquisa Econômica Aplicada (IPEA). http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.463.3461&rep= rep1&type=pdf

Brazil. 2014. *Ministério do Desenvolvimento Agrário*. Portaria MDA n81, 26 November 2014. Accessed 26 September 2015. http://www.lex.com.br/legis_26224832_PORTARIA_N_81_DE_26_DE_NOVEMBRO_DE_2014.aspx

Brito B and Cardoso Jr D. 2015. *Regularização fundiária no Pará: Afinal qual é o problema?* Belém, Brazil: Instituto do Homem e Meio Ambiente da Amazônia (Imazon).

Brito M. 2014. *Porquê o Óleo de Palma não avança no Brasil?* Presentation at Conferência Internacional BiodieselBR. São Paulo, Brazil, November 2014.

Budidarsono S, Rahmanulloh A and Sofiyuddin M. 2012. *Economics assessment of palm oil production*. Bogor, Indonesia: World Agroforestry Centre.

Bunker SG. 2003. Da castanha–do-pará ao ferro: Os múltiplos impactos dos projetos de mineração na Amazônia brasileira. *Novos Cadernos NAEA* 6(2):5–38.

Butler RA and Laurance WF. 2009. Is oil palm the next emerging threat to the Amazon? *Tropical Conservation Science* 2(1):1–10.

Carvalho ARV de, Baldani VLD and Reis VM. 2001. *O Dendê (Elaeis guineensis Jacq.)*. Document 138. Seropédica. Rio de Janeiro, Brazil: EMBRAPA Agrobiologia.

Castro AMG de, Lima SMV and Silva JFV. 2010. *Complexo agroindustrial de biodiesel no Brasil: Competitividade das cadeias produtivas de matérias-primas*. Brasília, Brazil: Embrapa Agroenergia.

Dean W. 1989. *A luta pela borracha no Brasil: Um estudo de história ecológica*. São Paulo, Brazil: Livraria Nobel.

Embrapa. 2006. *Embrapa Amazônia Oriental e o Agronegócio do Dendê no Pará*. Belém, Brazil: Embrapa. http://www.infoteca.cnptia.embrapa.br/handle/doc/394940.

Embrapa. 2010. *Zoneamento Agroecológico do Dendezeiro para as Áreas Desmatadas da Amazônia Legal.* Belém, Brazil: Embrapa.

ERE Consulting Group. 2012. Study on the restoration cost and returns from the oil palm industry. Kuala Lumpur, Malaysia: Roundtable on Sustainable Palm Oil.

FAO. 2013. *Trends and impacts of foreign investment in developing country agriculture: Evidence from case studies*. Rome: Food and Agriculture Organization of the United Nations.

FAO. 2014. FAOSTAT. Rome: Food and Agriculture Organization of the United Nations. Accessed 8 October 2015 http://faostat3.fao.org/home/E

Furlan Jr J, Kaltner FJ, Azevedo GFP and Campos IA. 2006. *Biodiesel: Porque tem que ser dendê*. Belém, Brazil: Embrapa Amazônia Oriental.

Glass V. 2013. *Expansão do dendê na Amazônia brasileira: Elementos para uma análise dos impactos sobre a agricultura familiar no nordeste do Pará*. São Paulo, Brazil: Repórter Brasil. http://reporterbrasil.org.br/documentos/Dende2013.pdf.

Greenpeace 2012. *Greenpeace scorecard on palm oil producers*. Accessed 26 October 2015. http://www.greenpeace.org/international/en/publications/Campaign-reports/Forests-Reports/Palm-Oil-Scorecard/

Gunarso P, Hartoyo ME, Agus F and Killeen TJ. 2013. *Oil palm and land use change in Indonesia, Malaysia and Papua New Guinea*. Reports from the Technical Panels of the 2nd Greenhouse Gas Working Group of the Roundtable on Sustainable Palm Oil (RSPO). Kuala Lumpur, Malaysia: Roundtable on Sustainable Palm Oil.

Homma A. 2009. A imigração Japonesa na Amazônia (1929-2009): Passado, presente e futuro. *In* Aragón L, ed. *Migração Internacional na Pan-Amazônia*. Belém, Brazil: Núcleo de Altos Estudos Amazônicos da Universidade Federal do Pará.

Homma AKO, Menezes AJEA de, Monteiro KFG, Santos JC dos, Rebello FK, Costa DHM, Gomes Jr RA, Sena AL dos S and Mota Jr KJA da. 2014. *Integração grande empresa e pequenos produtores de dendezeiro: O caso da comunidade de Arauaí, município de Moju, Pará*. Belém, Brazil: Embrapa Amazônia Oriental.

[IBGE] Instituto Brasileiro de Geografia e Estatística. 2013. *Municipal agricultural production*. Accessed 26 October 2009. http://www.sidra.ibge.gov.br/

[INPE] National Institute for Space Research. 2014. *Projecto TerraClass-2012 Mapeamento de uso e cobertura da terra na Amazônia Legal Brasileira*. Accessed 26 October 2015. http://www.inpe.br/noticias/arquivos/pdf/TerraClass_2012.pdf

[INPE] National Institute for Space Research. 2015. *Projeto PRODES, Taxas anuais de desmatamento na Amazônia Legal*. Accessed 26 October 2015. http://www.obt.inpe.br/prodes/index.php

Instituto Observatório Social. 2013. *O comportamento sócio-trabalhista na produção do óleo de palma do dendê no Estado do Pará com foco nas empresas Agropalma, Biovale/Biopalma, Petrobras Combustíveis*. São Paulo, Brazil: Instituto Observatório Social. http://www.observatoriosocial.org.br/sites/default/files/05-07-2013_11-palma_dende-para_0.pdf

Langevin MS. 2011. Social inclusion, environmental sustainability, and Brazil's national biodiesel production and use policy: The critical case of Agropalma. *Renewable Energy Law and Policy Review* 3:223–232.

Lima P. 2014. FDI in Brazil: Some considerations. *Jindal Global Law Review* 5(1):33–58.

MacMillan G. 1995. *At the end of the rainbow? Gold, land and people in the Brazilian Amazon*. New York, USA: Columbia University Press.

Mello FF, Cerri CE, Davies CA, Holbrook NM, Paustian K, Maia SM and Cerri CC. 2014. Payback time for soil carbon and sugar-cane ethanol. *Nature Climate Change* 4(7):605–609.

Monteiro K. 2013. *Análise de Indicadores de Sustentabilidade Socioambiental em diferentes sistemas produtivos com palma de óleo no Estado do Pará*. Thesis (PhD). Belém, Brazil: Universidade Federal Rural da Amazônia.

Müller AA, Furlan Jr J and Celestino Filho P. 2006. *A Embrapa Amazônia Oriental e o agronegócio do dendê no Pará*. Document 257. Belém, Brazil: Embrapa Amazônia Oriental.

Nahum JS and Malcher ATC. Dinâmicas territoriais do espaço agrário na Amazônia: A dendeicultura na microrregião de Tomé-Açu (PA). *Confins* 16.

Nepstad D, McGrath D, Stickler C, Alencar A, Azevedo A, Swette B, Bezerra T, DiGiano M, Shimada J, Motta R et al. 2014. Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains. *Science* 344(6188).

Nepstad DC, Stickler CM and Almeida OT. 2006. Globalization of the Amazon soy and beef industries: Opportunities for conservation. *Conservation Biology* 20(6):1595–1603.

Oliveira G. 2011. *Land regularization in Brazil and the global land grab*. A paper presented at the Land Deal Politics Initiative (LDPI) conference on land grabs, Institute of Development Studies – University of Sussex, April 2011.

Pacheco P. 2009. Agrarian reform in the Brazilian Amazon: Its implications for land distribution and deforestation. *World Development* 37: 1337–1347.

Pacheco P and Benatti JH. 2015. Tenure security and land appropriation under changing environmental governance in lowland Bolivia and Para. *Forests* 6:464–491.

Padula A, Santos M, Ferreira L and Borenstein D. 2012. The emergence of the biodiesel industry in Brazil: Current figures and future prospects. *Energy Policy* 44:395–405.

Pina AJA. 2010. Produção sustentável para a cultura de palma de óleo na Amazônia: Experiência da Marborges Agroindústria SA em Moju (Estado do Pará). *In* Ramalho Filho A, Motta PEF, Freitas PL and Teixeira WGT, eds. *Zoneamento agroecológico, produção e manejo para a cultura da dendezeiro na Amazônia*. Rio de Janeiro, Brazil: Embrapa Solos.

PNUD. 2013. *Atlas do desenvolvimento humano no Brasil*. Accessed 26 October 2015. http://www.atlasbrasil.org.br/2013/

PwC. 2013. *Doing business and investing in Brazil*. Sao Paulo, Brazil: PwC.

Ramos P ed. 2007. *Dimensões do agronegócio brasileiro: Políticas, instituições e perspectivas*. Brasília, Brazil: Ministério do Desenvolvimento Agrário.

Rebello FK. 2012. *Da lenha ao óleo de palma: A transformação da agricultura no Nordeste Paraense*. Thesis (PhD). Belém, Brazil: Universidade Federal Rural da Amazônia.

Repórter Brasil. 2010. *Agricultura familiar e o programa nacional de Biodiesel: Retrato do presente, perspectivas de futuro*. Accessed 28 October 2015. http://reporterbrasil.org.br/documentos/AgriculturaFamiliar_Biodiesel2010.pdf

Repórter Brasil. 2015. *O dendê na mira da lei*. Accessed 8 October 2015 http://reporterbrasil.org.br/wp-content/uploads/2015/03/LivroDend%C3%AA2015_final.pdf

Rico JAP and Sauer L. 2015. A review of Brazilian biodiesel experiences. *Renewable and Sustainable Energy Reviews* 45(C):513–529.

Rocha M and Castro A. 2012. *Fatores limitantes à expansão dos sistemas produtivos de palma na Amazônia*. Discussion Text 43. Brasília, Brazil: Embrapa.

Sacramento E. 2012. *A violência no campo mojuense*. Belém, Brazil: Editora Açai.

SAGRI. 2013. *Secretaria de Agricultura do Estado do Pará. Programa de Dendê: Estado do Pará*. Workshop do programa de produção sustentável da palma de óleo no Brasil. February 2013, Belém, Brazil.

Schmink M and Wood CH. 2012. *Conflitos sociais e a formação da Amazônia. Tradução de Noemi Miyasaka Porro e Raimundo Moura*. Belém, Brazil: EDUFPA.

Silva JS de. 2006. *Produtividade de óleo de palma na cultura do dendê na Amazônia oriental: Influência do clima e do material genético*. Thesis (Master). Viçosa, Brazil: Universidade Federal de Viçosa.

Suframa. 2003. *Potencialidades regionais. Estudo da viabilidade econômica. Dendê*. Manaus, Brazil: Suframa. http://www. suframa.gov..br/publicacoes/proj_pot_regionai s/dende.pdf.

USDA. 2015. *Oilseeds: World markets and trade*. United States Department of Agriculture. https://apps.fas.usda.gov/psdonline/circulars/oilseeds.pdf

Venturieri A. 2011. Evolução da área plantada com palma de óleo no Brasil, com enfase no estado do Pará. *In Agroenergia em revista* 2(2):18. http://jornalggn.com.br/sites/default/files/documentos/revista_agroenergia_ed2.pdf

Venturieri A. 2012. *Da dinâmica do uso da terra às mudanças do clima: Passado, presente e futuro da expansão da palma do óleo na Amazônia Oriental*. Seminário Clima, Dinâmica e Biodiversidade de Florestas Amazônicas. Belém, Brazil, June 2012.

Verner D. 2004. *Poverty in the Brazilian Amazon: An assessment of poverty focused on the state of Pará*. World Bank Policy Research Working Paper 3357. Washington DC, World Bank. 1–66.

Villela AA. 2009. *O Dendê como alternativa energética sustentável em áreas degradadas da Amazônia*. Masters dissertation. Rio de Janeiro, Brazil: Instituto Alberto Luz Coimbra de Pós Graduação e Pesquisa de Engenharia, Universidade Federal do Rio de Janeiro.

Villela AA, Jaccoud DB, Rosa LP and Freitas MV. 2014. Status and prospects of oil palm in the Brazilian Amazon. *Biomass Bioenergy* 67:270–8.

Weinstein B. 1993. *A borracha na Amazônia, expansão e decadência (1850–1920). Tradução lólio lourenço de Oliveira*. São Paulo, Brazil: HUCITEC.

World Bank. 2015. *Foreign direct investment, net inflows*. Accessed 8 October 2015. http://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD

Annex

Research activities are still ongoing, so the tables in this annex represent interviews conducted before 8 May 2015.

Table A1. Key informant interviews

Name of interviewee	Affiliation	Type of organization	Date(s) interviewed
Adriano Venturieri	Embrapa Amazônia Oriental	Federal research institution	14/10/2013
Rene Poccard	French Agricultural Research Center (CIRAD)	Research institution	14/10/2013
Cássio Pereira	Amazonian Environmental Research Institute (IPAM)	Nongovernmental organization (NGO)	26/11/2013
Arlete Almeida	Museu Goeldi	Research institution	02/12/2013
William Assis	Federal University of Pará (UFPA)	Federal university	03/12/2013
João Nahum	UFPA	Federal university	03/12/2013
Diana Castro	Secretary of State of Environment	State government	05/12/2013
Claudia Kahwage	Secretary of State of Environment	State government	05/12/2013
Sérgio Menezes	Secretary of State of Agriculture	State government	06/12/2013
Devandro	Ministry of Agrarian Development	Federal government	12/12/2013
Márcio Amorim	Secretary of State of Environment	State government	19/12/2013
Alfredo Homma	Embrapa Amazônia Oriental	Federal research institution	14/03/2014
Paulo Barreto	Imazon	NGO	03/04/2014
Imã Vieira	Museu Goeldi	Research institution	24/04/2014
Shinji Matzaki	Tomé-Açu Cooperative	Cooperative	19/05/2015
Alberto Oppata	Farmers Union of Tomé-Açu	Municipal trade union	19/05/2015
Michinori Konagano	Agriculture Municipal Secretary of Tomé-Açu	Municipal government	19/05/2015
Eduardo Ieda	Abrapalma	Private sector association	06/08/2014
Ieda Fernandes	Abrapalma	Private sector association	30/10/2014
Karoline Marques and Luis Barbosa	Conservation International	NGO	22/01/2015
Salete	Moju Farmers Union	Municipal trade union	02/02/2015
Wando Matias	Moju Farmers Union	Municipal trade union	02/02/2015
Manuel Libório	Moju Farmers Union	Municipal trade union	03/02/2015
Alexandre	Moju Rural Workers Union	Municipal trade union	04/02/2015
Pompeu	EMATER Moju	Municipal body	05/02/2015
Astrogildo	EMATER Moju	Municipal body	05/02/2015
Nazaré	Santa Maria (Quilombola) Association	Community association	11/02/2015
Claudia	Santa Luzia (Quilombola) Association	Community association	11/02/2015
Tereso	Curuperé Association	Community association	21/02/2015
Assis	Vila União Association	Community association	23/02/2015
D. Raimunda	Bacuriteua Association	Community association	26/02/2015
Sr. Geraldo	Km 40 (Olho d'Água Association)	Community association	03/03/2015
Lula	Vila Moraes Association	Community association	05/03/2015

continued on next page

Table A1. Continued

Name of interviewee	Affiliation	Type of organization	Date(s) interviewed
Marc Piraux	CIRAD	Research institution	09/03/2015
Campião	Soledade Project II Association	Community association	25/03/2015
Luisinho	Former EMATER officer in Arauaí	Municipal body	25/03/2015
Manuel Evangelista	Tailândia Farmers and Rural Workers Union	Municipal trade union	30/03/2015
Guilherme	Federation of Organs for Social and Educational Assistance (FASE)	NGO	02/04/2015
João Meirelles	Instituto Peabiru	NGO	06/04/2015
Thiara	Instituto Peabiru	NGO	06/04/2015
Izabella	Imazon	NGO	07/04/2015
Edy	Municipal Secretary of Environment	Municipal government	13/04/2015
Benedita	Workers Consortium	Oil palm farmers consortium	14/04/2015
Almir Araújo	Alto Moju Oil Palm Association	Community association	14/04/2015
Cristina Hoss	Tailândia Farmers and Rural Workers Union	Municipal trade union	20/04/2015
Valdir Hoss	Tailândia Cooperative	Cooperative	20/04/2015
Marcos Ene	Embrapa Amazônia Oriental	Federal research institution	23/04/2015

Table A2. Private sector surveys and interviews

Name of interviewee	Company name	Date(s) interviewed
Marcello Brito, Ricardo Tinoco, Zeno Martins, Cíntia Moura, Jorge Brandão, Tárcio Costa, Sebastião Sinimbu, Homero Sousa and Túlio Dias	Agropalma	28/04/2014 to 01/05/2014; 22/01/2015
Roberto Yokoyama	Denpasa	25/11/2014
Celso Yamaguchi	Dentauá	16/01/2015
Diego di Martino, Leonardo and Romualdo	Archer Daniel Midlands (ADM)	20/03/2015; 20/01/2015
Eduardo Leão, Juliana Magalhães, Javan Silva, Aílson Monteiro, Rita Melo, Fernando Leal, Núbia Sá and Camila Lima.	Biopalma	20/05/2014 to 22/05/2014; 21/05/2015
Eduardo Alves	Mejer-Yossan	08/12/2014
Ernesto Miyagawa	Palmasa	03/12/2014
	Belém Bioenergia Brazil	Refused contact
Silvio Santana	Marborges	28/08/2015

Table A3. Community visits, interviews and focus group discussions

Name of community	Type of participant(s)	Type of interview	Date(s) interviewed
Água Preta, Calmaria II, Moju Municipality	Agropalma and Biopalma oil palm outgrowers and non-participants	Focus group discussion, semi-structured interview	09/12/2014
Nova Israel, Calmaria II, Moju Municipality	Agropalma and Biopalma palm outgrowers and non-participants	Focus group discussion, semi-structured interview	09/12/2014
Vale do Piriá, Moju Municipality	Biopalma oil palm outgrowers and non-participants	Focus group discussion, semi-structured interview	10/12/2014
Nossa Senhora das Graças, Moju Municipality	Quilombola community, non-participants	Focus group discussion, semi-structured interview	10/12/2014
Juquiri, Moju Municipality	Quilombola community, non-participants	Semi-structured interview	10/02/2015
Santa Luzia, Moju Municipality	Quilombola community, non-participants and Marborges workers	Semi-structured interview	11/02/2015
Santa Maria, Moju Municipality	Quilombola community, non-participants and Marborges workers	Semi-structured interview	11/02/2015
São Sebastião, Moju Municipality	Quilombola community, non-participants and Marborges workers	Semi-structured interview	11/02/2015
Vila União, Moju Municipality	Non-participants and Marborges workers	Semi-structured interview	20/02/2015
Curuperé, Moju Municipality	Non-participants and Marborges workers	Semi-structured interview	21/02/2015
Bacuriteua, Moju Municipality	Non-participants and Marborges workers	Semi-structured interview	23/02/2015
Castanhandeua, Moju Municipality	Non-participants and Marborges workers	Semi-structured interview	26/02/2015
Ramal do São Pedro, do Xibé e do Severo, Moju Municipality	Non-participants and Marborges outgrowers	Semi-structured interview	27/02/2015
Vila do 40, Moju Municipality	Non-participants, Biopalma outgrowers and Agropalma and Biopalma workers	Semi-structured interview, questionnaires	03/03/2015
Vila Cardoso, Moju Municipality	Non-participants, Biopalma outgrowers and Agropalma and Biopalma workers	Semi-structured interview, questionnaires	04/03/2015
Vila Moraes, Moju Municipality	Non-participants, Biopalma outgrowers	Semi-structured interview, questionnaires	05/03/2015
Arauaí, Moju Municipality	Non-participants, Agropalma and Belém Bioenergia Brasil (BBB) outgrowers	Semi-structured interview, questionnaires	13/04/2015
Vila APEI, Moju Municipality	Non-participants, Agropalma and BBB outgrowers	Semi-structured interview, questionnaires	14/04/2015
São Vicente, Moju Municipality	Non-participants, Agropalma outgrowers	Semi-structured interview, questionnaires	14/04/2015
Curuperezinho, Moju Municipality	Non-participants, Agropalma outgrowers	Semi-structured interview, questionnaires	15/04/2015
Soledade, Moju Municipality	Non-participants, Agropalma outgrowers	Semi-structured interview, questionnaires	06/04/2015

Table A4. Household surveys

Name of community	Number of participant surveys	Number of non-participant surveys	Number of employee surveys	Dates
Calmaria II, Moju Municipality	60	30	0	30/03/2015
Arauaí, Moju Municipality	120	60	0	26/04/2015

DOI: 10.17528/cifor/005861

CIFOR Working Papers **contain preliminary or advance research results on tropical forest issues that need to be published in a timely manner to inform and promote discussion. This content has been internally reviewed but has not undergone external peer review.**

Over the past decade, the Brazilian government has actively promoted oil palm in the Amazon biome as an alternative biodiesel feedstock to soy. Because of oil palm's comparatively high productivity, it places less demand on land than soy and could thereby contribute to reducing pressure on the Amazonian forest. Although oil palm has long been a leading driver of deforestation and social conflict in major producer countries in Southeast Asia, the Brazilian government has put in place a number of mechanisms to ensure oil palm is cultivated sustainably and the sector is inclusive of the rural poor. Through research conducted in Brazil's leading palm oil producing state of Pará, this paper analyzes the evolution and dynamics of the Brazilian palm oil value chain and the economic, environmental and social challenges faced by the sector. In so doing, it shows that under the right institutional and regulatory conditions, the palm oil sector can expand sustainably and inclusively within forested ecosystems. This though translates into considerably higher production costs for producers, thus undermining the international competitiveness of the Brazilian palm oil sector.

CGIAR RESEARCH PROGRAM ON Forests, Trees and Agroforestry

This research was carried out by CIFOR as part of the CGIAR Research Program on Forests, Trees and Agroforestry (CRP-FTA). This collaborative program aims to enhance the management and use of forests, agroforestry and tree genetic resources across the landscape from forests to farms. CIFOR leads CRP-FTA in partnership with Bioversity International, CATIE, CIRAD, the International Center for Tropical Agriculture and the World Agroforestry Centre.

CGIAR Fund

UKaid from the British people

Center for International Forestry Research (CIFOR)
CIFOR advances human well-being, environmental conservation and equity by conducting research to help shape policies and practices that affect forests in developing countries. CIFOR is a member of the CGIAR Consortium. Our headquarters are in Bogor, Indonesia, with offices in Asia, Africa and Latin America.