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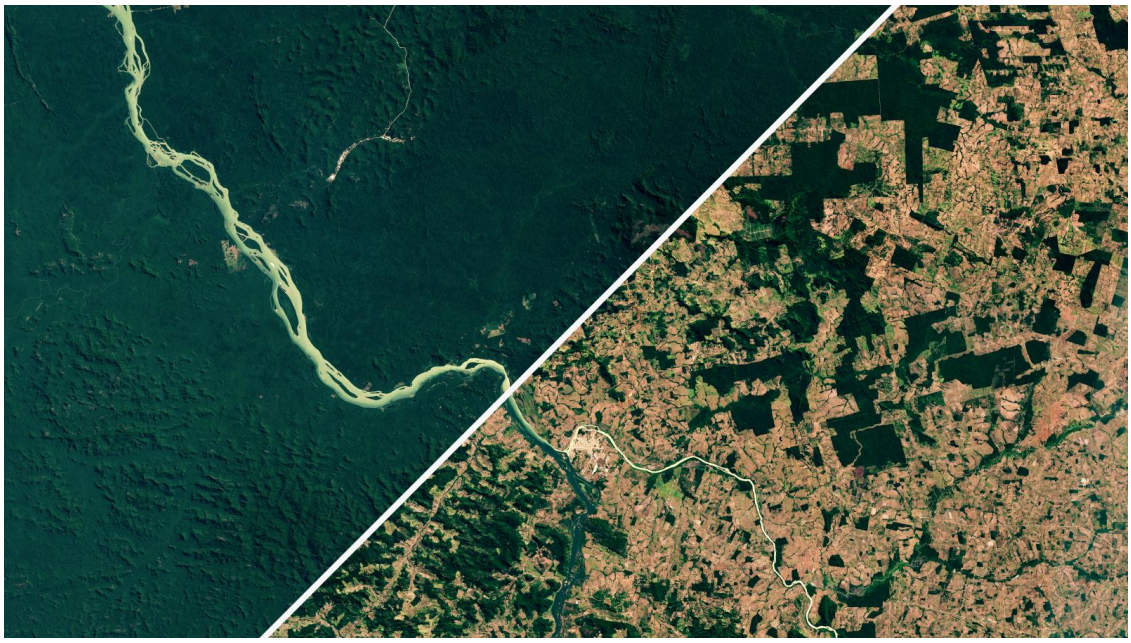

A Product Chain Organization study of Brazilian soy

The role of financial actors

Master's thesis in Industrial Ecology

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Division of Environmental System Analysis
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The role of financial actors

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Cover: Land use change between 1986 and 2018, São Félix do Xingu, Brazil (NASA).

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Abstract

Deforestation in Brazil is a result of a complex network of actors and their interests around farmland and agricultural products' chains. A particular interest by foreign investors on Brazilian farmland has also increased after the global financial crisis, leading to a process of financialization. The complexity of interests and financialization make sustainable management and governance of global product chains very difficult. What is needed, is an understanding of how this system of interests works and how this leads to negative impacts, in order to find mitigation solutions.

The aim of this thesis project has been to describe and model the actor-network around the soybean product chain in order to support its sustainable management. The method used consisted in a Product Chain Organization (PCO) study which has looked at the actors, especially focusing on financial actors, along different steps of the chain, identified using a life-cycle perspective. The focus on financial actors resulted in following both the product chain and the financial chain. For doing so, a document study on soybean companies, foreign investors, Brazilian communities and deforestation policies has been performed as well as two interviews to some important financial actors.

The model created showed the importance of specific types of actors along the chain and the links between them. Some investors own very large shares of agricultural funds or companies for farmland investments. Hence, they can exert a strong influence on how agricultural funds and their farmland investments are managed, with the power of having a highly positive or negative impact on a local level. So far, the main limitation of investors in their approach to sustainable investing is due to the subordination of environmental and social benefits to financial ones. Thus, there is still a gap between sustainability commitments and actual outcomes. The method used proved that LCA studies and PCO studies can complement each other. PCO studies, looking at the interactions of actors responsible for the actual global flowing of products, provide opportunities for minimizing the impacts identified by LCA studies. Moreover, this thesis project has shown that there is scope for all types of financial actors to reduce deforestation and build more sustainable global product chains. Remote actors, such as foreign investors, have a concrete influence on a local level and the power of changing the fate of vast areas of territories. Thus, the financial root is of interest and worthy of further study for sustainable management.

Key words: Deforestation, soy, Brazil, Financialization, Product Chain Organization, Sustainable management, Life Cycle Assessment.

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Introduction

Brazil is home to two of the most important biomes on Earth, the Amazon and the Cerrado. Observing them from above, they show very different landscapes, passing from the homogeneous, dark green-colored vegetation of the Amazon's tropical rainforest in the North of the country, to a more arid and rugged-looking Cerrado's savannah as we look more South and to the West. What they have in common is the importance of their vegetation for climate stability, biodiversity, and other ecosystem services, of which we all, globally, can benefit. However, as shown by the cover image of this thesis project (NASA), for the past 30 years or so (Kaimowitz and Smith, 2001), they have both been subjects of extensive deforestation. The landscape has rapidly transformed to a mosaic of swathes of cleared vegetation, now used for agriculture or cattle grazing to serve global commodity markets.

More and more resources are necessary for a continuously increasing global population that needs to be fed. Findings means and spaces for producing enough food necessary to sustain all of us, has become one of the greatest challenges of our time. So far, this has come at the expense of native vegetation in different parts of the world, including important biomes such as the Amazon and the Cerrado. In addition, the agricultural sector, such as the soybean sector, has branched out different supply chains, from food to animal feed and cosmetics. This has undoubtedly contributed to the clearing of land for extensive monocultures. Thus, deforestation is affecting climate and environmental resilience through increased greenhouse gas emissions, loss of biodiversity and mineralization of soils.

When looking at a product chain, such as that of the soybean, the system built around it is extremely complex. The product flows all around the globe in many different forms, passing through a range of technical processes, involving different stakeholders and other types of actors, with many social and environmental impacts. All these interactions and their development are both difficult to track and assess. When it comes to soybean or other agricultural commodities, the most visible consequence is exactly that mosaic of swathes of agricultural fields that once was a forest or a savannah.

For more sustainable management and governance of commodity chains, minimizing their social and environmental impacts, there is a need for understanding how complex systems around them work. Many specialized studies can become too narrow or provide a too fragmented picture of how environmental, social, political, financial aspects interact to create the current situation. A more comprehensive picture of

product chains, build on all these different angles that have been specifically explored, might give new and interesting insights and lead to more environmentally, socially and economically sustainable solutions.

The soybean constitutes an interesting case since its growing importance on the global market, implying growing sustainability challenges. Greater sustainability challenges in countries such as Brazil, where soybean production compete with the protection of important biomes. Soy expansion in this country threatens not only the existence of vast vegetation areas but also the lives of all indigenous communities that have always lived there. In addition, the current political situation is threatening areas that so far have been environmentally and socially protected, to favor the agribusiness. In order to paint a picture of the increasing importance for sustainable production and consumption of soybean, some background is given on market development, ecological situation, and logistics.

1.1 The rise of soy

Soy is a high protein and energy agricultural product which can be used in different ways: as feed, food and fuel. Around three-quarters of soybean production is destined to animal feed, due to the rise in global meat production and the decline of its relative cost. Between 1967 and 2007 pork production rose by 294 per cent, egg production by 353 per cent and poultry meat by 711 per cent (McLeod, 2011), with consumption of soy and industrial farming being crucial elements of these trends. China, the most populous country in the world supporting over 20 per cent of world's population, has also become the world's largest pork producer and consumer, therefor the largest soy importer. Giving some proportions, China imports of soy are three times the amount of EU and 12 times that of Japan, but this change has come only in the last twenty years (Brown-Lima et al., 2010)

Only 6 per cent of soy produced is used directly as food. Whole beans can be eaten as vegetables or further processed and incorporated into other food products, such as soy flours and lecithin, a protein additive and emulsifier. Soy can also be used in baked products as margarine, in fried products and as cooking oil. Two per cent of total soy production is converted into biodiesel, which is predicted will continue driving demand for soy, with a sharp rise in production by 2025 (WWF, 2014).

As shown in Figure 1.1, soy plays an important role in many different supply chains and its demand has exponentially grown in the last decades. In the last 50 years, the production of soy has grown tenfold, from 27 to 269 million tons, with an extensive land use equivalent to the area of France, Germany, Belgium and the Netherlands (WWF,2014). With an increasing world population demanding for more protein sources, soy is especially important as agricultural crop producing more protein per hectare than any other major crop. However, this comes at a cost. The increased demand for soy requires the direct or indirect conversion of forest, grassland and savannah to agriculture, with enormous environmental impacts. In fact, the fastest growth in recent years occurred in South America, home to the biggest and most

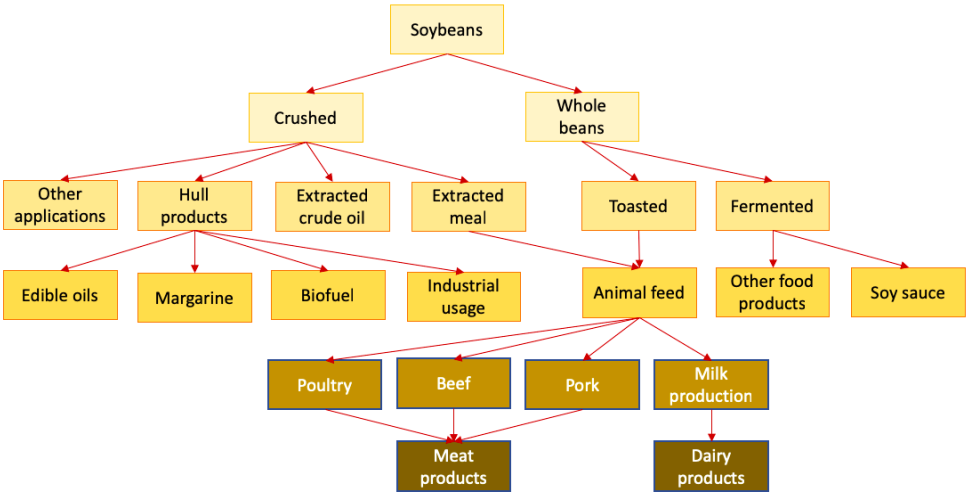

Figure 1.1: Products derived from soy (WWF, 2014)

important biomes on Earth, which have been threatened by conversion to agricultural land at a tremendous pace. In South America, soy production grew by 123 per cent between 1996 and 2004, and this growth is not predicted to stop: the Food and Agriculture Organization of the United Nations (FAO, 2007) suggests soy production will almost double by 2050 (WWF, 2014).

1.1.1 Soy production in Brazil

The first big increase of soy production in South America started in 1973 after US imposed an embargo on soy exports (Faminow and Hillman, 1987), worried about the repercussions of a rising overseas demand over its domestic feed supply chain. This event lead South American governments to increase soy production. They supported the expansion of agricultural frontiers through subsidized credit, investments in infrastructures and agricultural research, technical assistance to producers and price support. These politics made soy production increase twelve-fold between 1970 and 1980 in Brazil, Argentina and Paraguay. In the next decades, this trend continued to be sustained by the increasing global demand for animal feed. The expansion took place mainly in northeastern Argentina, southern Brazil and eastern Paraguay, where conditions were most favorable to soy varieties introduced from the US (West et al., 2018).

What lead soy production to move toward tropical regions, which traditionally were not suitable for this type of crop, were substantial government investments which quickly pushed agronomic improvements, expanding soy production northwards, reaching the Amazon and the Cerrado (Kaimowitz and Smith, 2001).
In Brazil, the great boom in soy expansion was driven by both the US embargo in 1973 and by the need to generate currency to pay for imports such as petroleum. At the time, Japan provided technical assistance to increase soybean production on marginal frontier land (Brown-Lima et al., 2010). Until the 1980s Brazilian soybean production was concentrated in the traditional farming regions in the south of

the country, including São Paulo, Santa Catarina, Paranà and Rio Grande do Sul (Kaimowitz and Smith, 2001). In the following years soybean production continued to grow and the Brazilian government started investing in developing new soybean varieties as well as different planting techniques.

In 1997, the agricultural expansion reached the Cerrado and the Amazon. While in 2000 the top exporters of soy were still the traditional regions in the south of the country, this situation drastically changed in 2009. EU tripled its imports of soy and China's imports increased so much to to just dwarf those of EU. China became Brazilian soy first importer and since its sourcing regions are mainly Mato Grosso, Mato Grosso do Sul, Bahia and Goias, these states became top producers and exporters of soy (Brown-Lima et al., 2010). These huge quantities of soy exported have required an extensive work in agricultural land conversion from native forest, savannah, grassland or pasture. At the same time, US could not bring that much new land into agricultural production, due to the competition of soy with other crops such as corn. This implies that Brazil is now competing with US for the position as first global soy producer, both converting land, increasing yields and replacing other crops with soybeans.

For this reason, the Brazilian soy production system has received pressures from conservation NGOs (Gibbs et al., 2015), the media and consumers, being concerned about high deforestation rates and eager to a more responsible sourcing of soy. However, most of the concern has come from European more than Chinese buyers (Brown-Lima et al., 2010).

1.2 Soy deforestation in Brazil

Increasing soy production is associated with deforestation. In order to create agricultural land has occurred and still occurs in different Brazilian states. In the last ten years, most soy deforestation in Brazil has occurred in the transition area between the Amazon and the Cerrado in Mato Grosso state, and in the Matopiba region of the Cerrado, defined as the world's fastest growing soy frontier. In this period, Chinese imports have been associated with much of the soy deforestation.

The biome that has been mostly affected by soy deforestation has been the Cerrado, while just for a minor extent the Amazon biome, mainly due to stricter regulations imposed by the Brazilian Forest Code. As showed in Figure 1.2, the Amazon biome only have some areas with low direct soy expansion, while Cerrado has been affected more or less everywhere. The whole Matopiba region has been subject to high soy expansion at a very high rate, as well as some areas in the Mato Grosso State.

1.2.1 The Brazilian Amazon

The Amazon rainforest has been highlighted as one of the fundamental biomes able to influence global climate stability due to its importance in the global carbon cycle. In the Earth System, the carbon cycle acts as a buffer to maintain the planetary

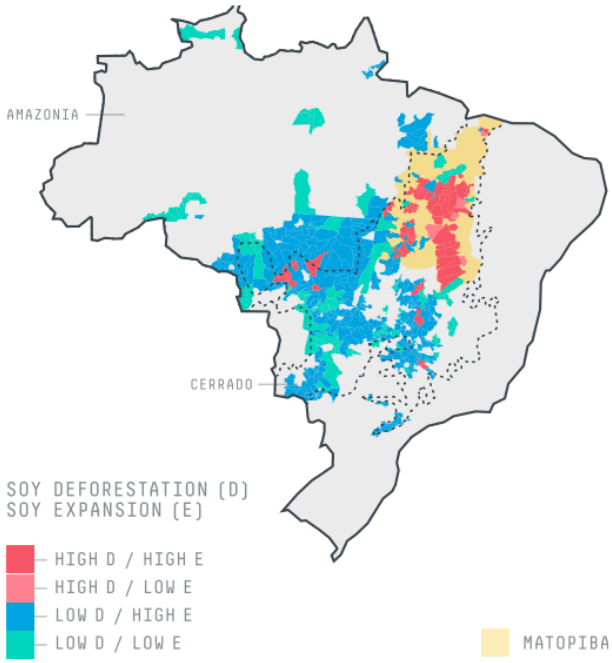

Figure 1.2: Frontiers of soy expansion in Brazil, 2010-2016, (West et al., 2018)

environment within well-defined limits (Steffen, 2006), which ensure stability to the System itself. It stores between 135 to 180 billion tons of carbon on its extension of 5.5 billion of square meters (Gaffney et al., 2018), and its contribution to evapotranspiration has a high influence on rainfall. It is also the largest and most diverse tropical rainforest, home to one in every 10 species on Earth. One-fifth of the Amazon has already been cleared from native vegetation and during 2000-10 around 3.6 million hectares of forest were lost yearly (WWF, 2014). Using the Brazilian government deforestation monitoring data from PRODES, an estimated 1.8 million ha of soy in 2016 were under native vegetation in the year 2000 (West et al., 2018). Together with other types of crops and cattle ranching, soy undoubtedly played a major role in deforestation of this area.

1.2.2 The Cerrado

The Cerrado, which lies mostly in Brazil, is recognized as the world's most biodiverse savannah (CDP, 2018). It's a vast land that includes dry grassland, woodland, forests and wetlands, holding 5% of the world's biodiversity, and of its more than 11.000 plant species, nearly one half are found nowhere else on Earth. Its trees may seem smaller than the ones in the Amazon, but they have a deep root system which holds 70% of the biomass underground. In fact, this "upside-down forest" is able to store about 265 tonnes of carbon per hectare (Castro and Kauffman, 1998). This important ecosystem is now threatened by extensive land conversion. Estimates on how much native land remains intact are diverse, with the Brazilian government stating that a 53% still remains untouched (MMA, 2010), while other studies assessed that the percentage might be as low as 35% (Klink and Machado,

2005; Durigan et al., 2007)

In the Cerrado, soy accounts for 90% of its cultivated crops and, in 2013/2015, 52% of Brazilian soy was produced in this area. From 2000 to 2014 its agricultural area grew by 87% (Filho and Costa, 2016), with a conversion to soy mainly from pastures in Mato Grosso and Goias and mainly from native vegetation in the region of Matopiba, northeast of the Cerrado, where the states of Maranhao, Tocantis, Paui and Bahia are merged. Considering the Cerrado's aptitude for modern agriculture and its capacity to feed the world, a balance between conservation and agricultural expansion has become one of the biggest challenges for this area.

Within the Cerrado, the Matopiba region is considered one of the most threatened regions by soy expansion and conversion from native vegetation in the near future. In Matopiba only, from 2000 to 2017, soy expanded by 310% (West et al., 2018) at very high deforestation rates, and there are different signals indicating that soy-associated deforestation will increase in the coming years. Firstly, there is still a large availability of native vegetation which could be potentially be cleared for new agricultural land; secondly, a large amount of investments in soy infrastructure such as crushing facilities and soy storage are ongoing in the region. The combination of these two factors can be considered as preconditions for deforestation because of the lack of legal protection of the area, or at least much lower than the protection guaranteed to the Amazon region by the Forest Code (Vieira et al., 2018).

1.2.3 The political threat to the Amazon, the Cerrado and to their indigenous communities

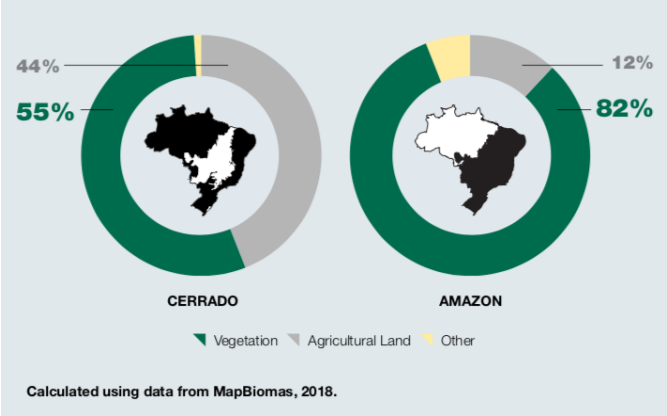

Figure 1.3: Proportion of remaining vegetation and agricultural land in the Cerrado and Amazon (CDP, 2018)

Agricultural land conversion has led to impacts on both the Amazon and Cerrado areas. As shown in Figure 1.3 today only about 55% of the Cerrado biome remains intact, while the Amazon, thanks to stricter Legal Reserve Requirements from the Forest Code, still holds 82% of its native vegetation (CDP, 2018). Furthermore,

since 2000, the deforestation rate in the Cerrado has been 2,4 times higher compared to that of the Amazon.

Indigenous land has been linked to healthier forests and lower carbon dioxide emissions from deforestation and forest degradation (Stevens et al., 2014). It accounts about 13% of Brazil territory, corresponding to 117 billion ha of land. This land is home to about 850,000 people organized in 300 tribes (Boadle, 2019). At the moment there are 462 indigenous lands officially registered (Gonzales, 2018).

Unfortunately, the data recorded in 2018 seem to increasingly threaten the Amazon and indigenous lands. The number of protected areas is probably going to change by the switch of responsibility from FUNAI to the Ministry of Agriculture on organizing these reserves. Such change of responsibility puts a lot of risks not only to the lives of thousands of tribal people, but also to the rich ecosystems they have always been living in balance with. In addition, according to data from the Instituto Nacional de Pesquisas Espaciais (INPE), during the presidential election season between August and October 2018, there were 8,000 cases of deforestation alerts in the Amazon rainforest, and more than 1,690 square kilometers of forest were cleared in just three months. Compared to the previous year, deforestation rate in 2018 was 48.8 percent higher than the same period. Rondônia has been the third-most deforested state in the Amazon, making up to 20 percent of the total deforestation during that period. Bolsonaro's electoral speeches have indeed started a process of legitimization of land grabbing. His political project has given hope to all those land grabbers aiming to increase land deals with big companies, usually backed by foreign investors.

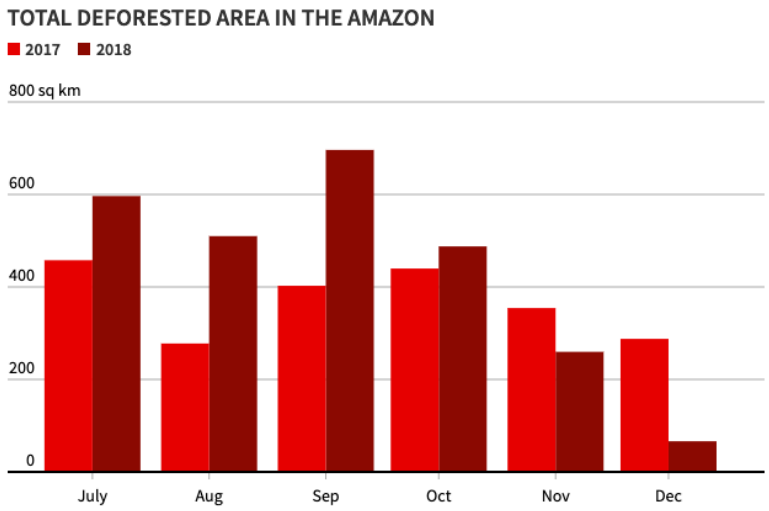

Figure 1.4: Total deforested area in the Amazon, comparison between 2017-2018, (Boadle, 2019)

Bolsonaro presidential election's campaign has been based on a propaganda in favour of large infrastructural projects and commercial development by opening up more native territory. His words in 2017 in Mato Grosso: "*If I become president, there*

won't be one square centimeter of land designated for indigenous reservations" or *"[...]I'm not getting into this nonsense of defending land for Indians"* (Watson, 2018) have led dozens of men to enter protected indigenous land claiming for their stakes. Armed with machetes, chainsaws and firearms, they threat indigenous people to set fire to their villages or use violence to force them out of their land. Bolsonaro's election has further worsened the situation and such type of attacks have increased 150 percent since he was elected in late October, according to the Indigenous Missionary Council (CIMI), a Brazilian advocacy group. "The number of invasions and attacks on indigenous reservations rose and deforestation skyrocketed nearly 50 percent during Bolsonaro's presidential campaign. Bolsonaro has railed against what he sees as excessive federal protections for indigenous people" threatening also the ecosystems which these people have always sustained and protected. (Boadle, 2019). According to him, the excessive federal protections to these communities represent an impediment to agribusiness, and he aims to weaken these protections in their favour. To fulfill this aim, one of his first political actions as president has been to take FUNAI's (Fundação Nacional do Índio - Brazil's Indian Affairs Department) authority to set reservation boundaries to give it to the Ministry of Agriculture, which is dominated by rural interests. In charge of dealing with indigenous land issues is Nabhan Garcia, a right-wing farming organizer who has always been fighting against reservations (Boadle, 2019). Although these latest events are particularly

Figure 1.5: The Munduruku are an example of indigenous community that has lived in the Sawré Muybu in the heart of the Amazon, for generations. In addition to preserving their way of life, the demarcation of Sawré Muybu ensures the conservation of 178,000 hectares of Amazonian rainforest. Markus Mauthe / Greenpeace 2016

dangerous for tribal people and the environment they live in and protect, it is also important to note that land grabbing has always been a problem in the country. The Constitution adopted by Brazil in 1988, establishing the end of the dictatorial period, recognizes the respect for the cultural identity of indigenous people and the rights they have on the lands they live in. But the spread of land grabbing and

illegal logging demonstrate that the state protects the rights of indigenous peoples only theoretically (Rylands and Brandon, 2005). Much more often, in the case of disputed territories, it is the oligarchies of the agricultural sector that prevail. In addition to indirectly allow this type of process - thanks to a "bland" legislation - the Brazilian administrations have for decades also financed an invasive infrastructure and mining sector (Network for social justice and human rights, 2018).

Other risks threatening tribal people are also coming from the new Minister of Infrastructure Tarcísio Gomes de Freitas, considered one of President Jair Bolsonaro's most capable ministers, which aims at creating "a second revolution in Brazilian agribusiness" (Branford, 2019). His strategy includes seeking foreign investors, to push forward with new roads and railways which could potentially open the Amazon and the Cerrado biomes to land grabbers, illegal loggers, illicit ranchers and industrial agribusiness (Branford, 2019). Two important infrastructural examples that would affect the biomes are the Ferrogrâo (Grainrail) and FIOL (the Railway for the Integration of the Center-West). Infrastructural projects such as railroads, highways and port have always been fundamental for the economic development of the region, but at the same time have always been related to an increase in deforestation. Studies have shown that more than 70 percent of deforestation occurs within 50 km of paved roads, while at most 7 percent occurs along unpaved roads (IPAM, 2000). Moreover, infrastructure investments usually create strong connections between big agricultural traders and specific regions of production, which gain more control over such regions, shaping development trajectories and the sustainability of agriculture, including soy (West et al., 2018).

What happens locally in Brazil, however, is not only determined by local dynamics. The political plans mentioned above, can't be implemented without capital, which is channeled here from different countries. Foreign capital invested in farmland or in agricultural companies with unsustainable practices, trigger local dynamics with potential impacts on the environment and local populations. The main purpose of land grabbers, is to sell the land to big companies or big investors. Land grabbers' actions are induced by the concrete possibility of finding a market also for land acquired clearing native vegetation or forcing populations to leave their homeland. A "revolution of Brazilian agribusiness" is also a possible option because there are international economic interests in such plans.

1.3 The need for a bigger picture of interests

The network and the interests surrounding agricultural production as that of soy are complex and diverse. This makes sustainable management of global product chains difficult, especially since a lot of the literature is specialized, providing a fragmented view of these complex systems. There is, therefore, a need for more comprehensive studies integrating material, social, environmental, political and financial aspects in order to find sustainable, coordinated solutions.

In addition, global product chains are shaped by global interests. This interest

is expressed in channeling capital in areas of production, with possible environmental and social repercussions. Financial actors, given their economic power, are the driving force of product chains. What is known about them, is that they have a strong link with local dynamics around product chains. However, the type of influence that they have, their interactions with other different actors and their link with environmental and social issues have seldom been elaborated in literature. Hence, it is necessary to better understand their influence on global product chains in order to identify the positive and negative aspects of it. As Brazil is a resource-rich country from which different countries benefit, we need to find ways to have a "remote control" with sustainable outcomes.

1.4 Aim of the project

This project is an attempt to make a comprehensive description and model of the soybean product chain. Such a comprehensive model should look at the technical processes, at the local and remote actors involved in each process and at their interactions. In particular, the focus on the relationship between financial actors and farmland, aims at re-materialize concepts such as capital, resources and value into practical activities, giving them a context, the soybean market in Brazil. In fact, financial capital is often imagined as an abstract entity, which "circulates around the globe as a function of its profit-seeking imperative, impacting on households, communities, companies, regions, and ecosystems" (Ouma, 2016). However, as the impacts are far from abstract, so is financial capital and whoever directs it.

The purpose of such model is to provide support to sustainable management and governance of product chains. Looking at the product chain of Brazilian soybean from agricultural land creation to retail and consumption, the report will try to answer to the following research questions:

With a perspective on more steps of the product chain (agricultural land creation, production and trading):

- What are the differences between financial actors at these different steps of the chain? Do they have different ways of interactions or different ways of approaching sustainability?

Zooming on the product chain's step linked directly to high environmental and social impacts (agricultural land creation):

- How financial actors operate on land?
- What is their relationship with local actors? Can this relationship be improved to reduce deforestation and land grabbing?

Moreover, since this type of comprehensive and interdisciplinary approaches are still not very diffused, a reflection will be done on the methodology used in this report, answering these other research questions:

- How the understanding of the relationship between actors in the wealth chain and the product chain can complement LCA studies?
- What are the differences when looking at the whole product chain compared to focusing on only one step?

1.5 Limitations

This thesis project has looked at different steps along the product chain and have been generally described from agricultural land creation to retail and consumption. However, the analysis has been focused on agricultural land creation, production and trading, being these three steps placed in Brazil and their direct relation to deforestation and local social problems. Moreover, thanks to the abundance of studies on foreign investors in the first step of agricultural land creation, a special focus has been given to those. Consequently, for the first step it was possible to better reconstruct the relationships between investors at different levels (from those closer to the product flow to those more remote and "indirect"), while for the production and trading steps it was only possible to study the interactions between local actors and investors directly linked to them. Hence, it is possible that the analysis of the influence of some financial actors in the first step compared to the others may be biased, given the greater amount of data available for this phase. In the production and trading phase, the relation between investors closer to local actors (more often asset managers) with more remote ones (different asset managers' beneficiaries) and their influence on the product chain, is left for further research.

2

The state of knowledge on the link between finance and farmland

Financial actors and capital are often considered as abstract entities. This section aims at explaining their concrete influence in the Brazilian context. Therefor, financial actors' relation to farmland and the soybean product chain will be described.

2.1 The role of financial actors in Brazilian farmland and soy production

Investors' interest in farmland has increased after the world financial crisis of 2007/2008. This growing interest has lead to a process called "financialization", the transformation of land into a "materialized financial asset" (Fian International, 2018), as a consequence of the power and influence of global finance. Financial actors channel capital into land purchases and land-based activities aiming to diversify their portfolios, increasing returns and lowering risks. They saw in farmland a good opportunity of investment due to the increasing demand for food and the growing per-capita meat consumption requiring an increase in production of protein-rich feed such as soy (Steinweg et al. 2018). Financial actors operate in different ways with different implications on a local scale. Two principal ways by which capital is channeled into Brazilian land purchases are (Van Gelder et al., 2002):

- Debt, by banks and credit agencies;
- Equity, by insurance companies, pension funds, mutual funds, university endowments, investment firms, private investors.

In addition to these more traditional ways of investing, investors have increasingly turned to a strategy of direct farmland purchases, building complex structures of local subsidiaries to directly control the land. Pension firms, endowments and pension funds are among the leading actors involved in this process of financialization and creation of "global wealth chains" (Seabrooke and Wigan, 2014), but also the main actors indirectly causing episodes of land grabbing (Fian international, 2018).

Global Wealth Chains (GWCs) are defined as connected forms of capital aiming at creating wealth through the construction of opaque corporate structures. The relocation of wealth operated by the GWCs usually results in braking loose from the location of value creation, increasing inequalities (Seabrooke and Wigan, 2014) and environmental problems, such as deforestation and its consequences in the specific case of Brazil (Steinweg et al., 2018). An example of GWCs are the net of interna-

tional financial actors around farmland investments achieved by complex corporate structures and ownership chains.

In Brazil, the interest in farmland has been focused particularly in the Cerrado, because of its geographical position, ecological characteristics, and the reduced requirements of Brazil Forest Code in this area, a regulatory framework for land use and environmental conservation on rural properties, with the aim of protecting native vegetation. According to the Forest Code, all rural landowners must maintain a proportion of their land as Legal Reserve (LR), and while in the Amazon biome the proportion is 80%, in the Cerrado is only 20% (Rogerson and Døvre, 2018). Another important and investment-attractive region within the Cerrado biome, now considered the new soybean frontier (GRAIN and Rede Social de Justiça e Direitos Humanos, 2018), is the Matopiba region. Here, institutional investors together with agribusiness have adopted business models based on the acquisition of land, clearing it from its native vegetation and transforming it into farmland (Steinweg et al., 2017). The Brazilian State has also played an important role in facilitating these processes, helping agribusiness expansion through significant subsidies. Just considering soy monocultures, they have started to expand into Matopiba from 2000 and since then they have expanded continuously, due to the need of new area of investments by global finance.

The drop of commodity prices on the world market after the financial crisis of 2007/2008 and the parallel rise of land prices in Brazil, led to extensive land speculation and the creation of "land-companies", more interested in acquiring, selling, leasing and managing land, than in actual agricultural production (Fian international, 2018).

2.1.1 Land grabbing and financialization of land

Land speculation and large-scale farming nourished by financial actors' need of revenue streams have resulted in significant environmental (Steinweg et al., 2018) and social impacts (GRAIN and Rede Social de Justiça e Direitos Humanos, 2015). In fact, both phenomena are often linked to the process of "*grilagem*", a particular form of land grabbing. A lot of new farms are created from land formally owned by the state where local communities have lived for generations, using the land for hunting, harvesting fruit and collecting fire-wood (GRAIN and Rede Social de Justiça e Direitos Humanos, 2015). Land grabbers, more commonly called "*grileiros*", are local criminals which often use violence and intimidation to displace these communities from their land, putting fences to prevent them from accessing the land. Police and local governments are usually corrupted and involved in the land speculation process and rarely defend the people forced to leave their land. Grileiros mainly act with the hope of selling the land to potential interested actors such as big companies or investors. Thus, once the they have fenced and illegally acquired the land, they falsify land titles to legitimise the illegal land occupation (Fearnside, 2008). The next step for them is to sell the land to big companies which are most of the times connected to international investors (GRAIN and Rede Social de Justiça e Direitos

Humanos, 2015). Channeling enormous flows of money in these areas of Brazil, investors have thus, indirectly and unconsciously, fuelled this process.

2.1.2 Foreign investors in Brazil and their link to deforestation

Using Land Matrix, an open access platform sharing information about land deals, it is possible to observe that there have been more than 1,6 million hectares of land transferred from Brazil to foreign investors since the year 2000. When looking specifically at soy, land deals involve 447,566 hectares, almost 30% of all land deals with foreign investors. From the Chain Reaction Research (Steinweg et al. 2018) on foreign farmland investors in Brazil, it is reported that 10 foreign investors hold 1.5 million hectares of Brazilian farmland, with the Cerrado and especially the Matopiba region, being "at the heart of farmland investment growth". Only eight companies backed by foreign investors control 868,488 ha of farmland. In these foreign-held farms there have been 423,242 ha of deforestation since 2000, even though deforestation rates have decreased significantly in the last six years (Steinweg et al. 2018).

In 2010, the Brazilian government tried to contain this massive land acquisitions by foreign investors delivering a law, Brazil's Attorney General, which stipulated that foreign investors couldn't own more than 25% of rural land in any municipality, and investors of the same nationalities could own a maximum of 10% of a municipality's lands. However, some foreign investors have find ways to bypass the legislation, creating "opaque structure" to make their investments appear more Brazilian than they are (GRAIN and Rede Social de Justiça e Direitos Humanos, 2015).

Even though financial institutions are not physically based or operating in Brazil, they are subject to potential financial downsides and business risks that might compromise the profitability of their portfolio. Related to soy, but also to other types of crops and farmland investments, some of the major risks identified for companies and investors are (CDP, 2018):

- Operational risks: if soy production involves deforestation or is not sustainably produced, this has direct and indirect impacts on ecosystem services, which can lead to lower productivity and higher production costs;
- Market risks: investors or companies without responsible environmental policies may suffer from a reduced market appetite for deforestation-related soy and other commodities, and not being able to access markets for deforestation-free products.
- Reputational risks: increasing global awareness about climate change, deforestation and environmental issues in general, has simultaneously increased public attention to such problems, putting pressure on companies linked to deforestation and other social and environmental risks in the Cerrado and the Amazon;
- Regulatory risks: as international pressure to act on climate change and to halt deforestation increases, regulations are likely to change, posing risks to

companies and investors which haven't started a path toward more responsible and more sustainable sourcing yet;

A recent study, (Galaz et.al 2018), which have started from market-based information about the soybean sector in Brazil, have identified big soybean companies according to their market share and then linked them to a small set of financial actors. The companies identified starting from their share on the market are mainly responsible for processing and trading, and export soybean to consumer countries. Among these companies, many of them are committed to zero-deforestation policies as part of their sustainability strategy and are part of the Soy Moratorium, a zero-deforestation agreement to protect the Brazilian Amazon, and also among Cerrado Manifesto Statement of Support's signatories, to demonstrate their committment to the production of more sustainable soy from the Cerrado. However when it comes to financial actors, only one big foreign investor in Brazilian farmland, Nuveen, holding almost 300,000 hectares of land in Brazil (Nuveen, 2018) and 1/3 of it dedicated to grains, has drafted a zero-deforestation policy last year (Steinweg et al. 2018) valid both in the Amazon and in the Cerrado biomes (Nuveen, 2018). Hence, looking at Figure 2.1 showing the total amount of soy that is exported from Brazil under zero-deforestation commitments, it is possible to observe that it amounts to only 44% of soy produced in Cerrado, and 46% of the soy from the Matopiba region (CDP, 2018). Regarding the Amazon, thanks to the stricter regulations imposed by the Forest Code, the percentage of soy exported under zero-deforestation commitments is much higher, 93%. Given the current climate crisis and the importance of the Cerrado biome in preserving fundamental ecosystem services, improvements for including zero-deforestation commitments in this area are needed, both by companies and big investors.

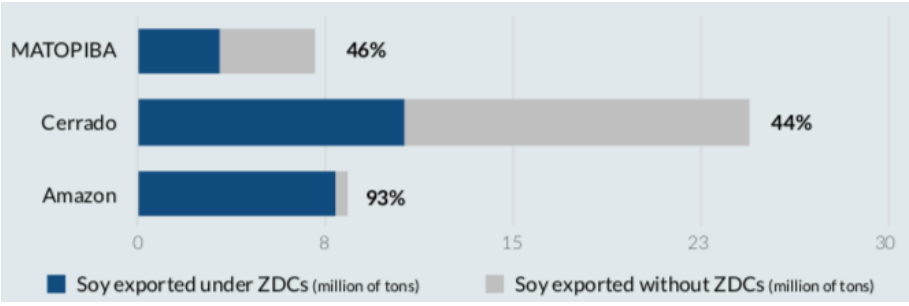

Figure 2.1: Percentage of soy exported under zero-deforestation commitments (ZDCs) in the Amazon and the Cerrado in 2015 (Trase data, 2017)

3
Method

3.1 Framework: IE and PCO

The method used in this report is built on several ways to look at product chains. The study of the interconnections between different types of actors along product chains and their interaction with the biosphere is an Industrial Ecology's peculiar feature. For this reason, different approaches commonly used within this field have been mixed together to provide novel insight to product chains and to the role that some specific actors, such as financial actors, not ordinarily considered in this type of analyses, can have on the chain.

Figure 6.1 visually represents the framework used for this study, where the product flow represents the physical flow of a product or material along the chain, from resources extraction to disposal. It's the backbone of the whole system, and it has interactions with both physical and human actors. A product flow relies on the resources provided by the biosphere inevitably creating impacts, whether in the form of extraction of material or in releasing pollutant emissions. These technical processes are usually covered by Life Cycle Analysis (LCA), which models the flow looking at environmental information along the chain. However, the product doesn't flow by itself.

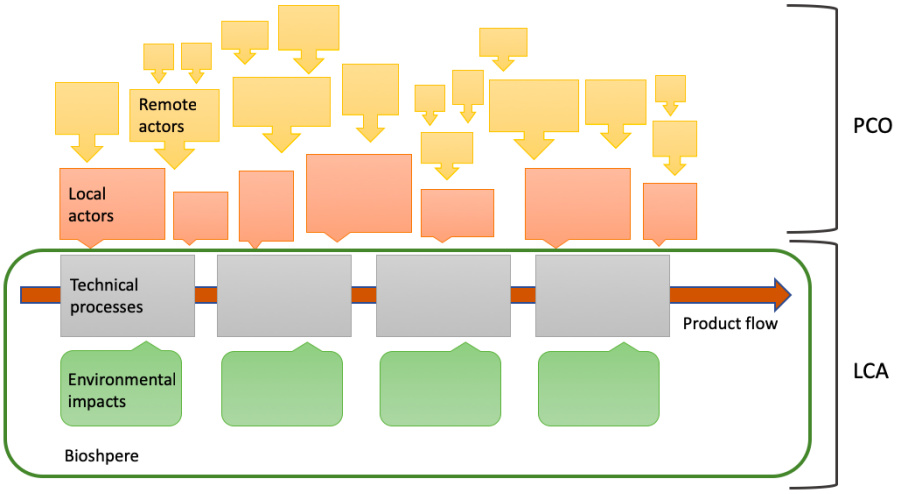

Figure 3.1: Framework of the study

A number of actors such as people working in factories, companies, organizations,

governments, are responsible for shaping the product flow according to specific needs. In this study, the actors considered are divided into two classes: local actors, directly involved in handling the product, such as laborers and companies managing and organizing the flow, in the country where each step of the chain is located; remote actors, such as organizations, investors, companies from different sectors and countries, that have an interest in the product or a relationship with local actors, but don't directly put their hands on the flow. Despite their physical distance, such remote actors can have an important role in shaping the product chain, with social and environmental effects. The inclusion of the net of human actors when thinking about product chains is a typical element of Product chain organization studies (PCO), which can take into account social and economic factors.

3.2 Design of the study

This study combines the vision of technical processes related to the Brazilian soybean product chain, its ability to flow and its environmental implications typically considered in LCAs, with the organizational side covered by PCOs, where the network of human actors, through the work of people, companies, and organizations that allows the flow to exist and move forward, is also taken into account. In the following sections, both the methodologies are defined, explaining in which ways they have been used in this study.

3.2.1 The product chain from an LCA's perspective

Environmental factors and impacts within a product chain are considered when performing Life Cycle Analysis (LCA). With LCA products are followed from raw material extraction from natural resources to disposal, and in order to perform this type of studies, a lot of environmental information are collected and analyzed. The goal is to assess the amount of resources utilized throughout the life cycle of the product, but also to measure the outflows in terms of pollution, expressed with different types of environmental impact categories. An LCA is used to understand specific critical points in a product life cycle, whether is excessive use of natural resources or release of pollutant emissions in the environment for one single product, but also to compare environmental performances of products with the same function. The definition of system boundaries depends on the goal and scope of the study, which can include the whole life cycle of the product from "cradle to grave", or be focused on only some of the processes excluding such as, for example, the user and disposal phase. Geography is also included in the system boundaries, but usually, the time dimension is excluded. (Baumann and Tillman, 2004)

In this report, the life cycle thinking has been initially used to map all different steps characterizing soybean product chain, from agricultural land creation to retailing and consumption. Life cycle findings on soybean - sourced in Brazil or in different parts of South America - have been used to understand and describe the technical processes involved in soybean cultivation, production and processing and to have information about the differences in environmental impacts among the product

chain's steps, from agricultural land creation to export. The consultation of LCAs including land use change (LUC) impact assessment have been prioritized, given the importance of this process for the biomes considered in the study. However, since social and economic aspects are not included in LCA, only used as weighting factors to compare environmental impacts among each other, another method to look at product chains has been combined to have a more comprehensive picture of the actor-network around the product chain, its relation with the technical processes and their impacts.

3.2.2 The influence of different types of actors: a PCO's approach

Behind every product or material chain, moving in different parts of the world, there is a complexity of actors that allow the product to be manufactured, handled, shipped, transported, transformed. The PCO methodology aims at showing the tangled relationship between "people and matter" (Baumann, 2012), a link which is often missing in current academic approaches. It consists in mainly two steps, using first a life cycle approach in drawing a basic life cycle of the product, and then mapping all the actors involved with it, studying how these actors are organized, how they interact with each other and with the product flow, reconstructing the network they create around it. Depending on the problem and on the scope of the study, PCOs can be focused on different aspects (Baumann, 2012).

In this project, PCO has been used when tracking the actors involved in each step of the soybean product chain, previously identified with a life cycle approach. Specifically, this study has mapped some of the most important actors operating in Brazil and more distant ones, especially focusing on financial actors, looking at how they relate with Brazilian organizations, companies, workers, its environment, and the soybean product flow. The focus on financial actors derives from the recent attention that has been given to the connection between the Earth systems and finance (Galaz et. al 2015; Galaz et.al 2018). In this regard, the need for scholars to further investigate different financial actors' link to social-ecological effects has been highlighted. Hence, a particular focus on data collection will be given on the steps on the chain where the relation among financial actors, local actors, and social and environmental impacts, has not been thoroughly described before.

3.2.2.1 Global Wealth Chains

Within the study of financial actors as remote actors affecting the soybean product chain, this report will also look at the complex corporate structures of some big investors, such as pension funds and endowments, linked to the product chain step identified as more directly linked to environmental degradation in Brazil. In this regard, it has been acknowledged the need for having a clearer picture on GWCs' impacts on developing countries, given the currently visible contradiction of the latter hosting GWCs as a developmental strategy, but on the contrary, being tremendously impacted by them. Pension funds and endowments are responsible for this process

(Seabrooke and Wigan, 2014), hence their corporate structure will be described more in depth.

3.3 Data collection, method, and analysis

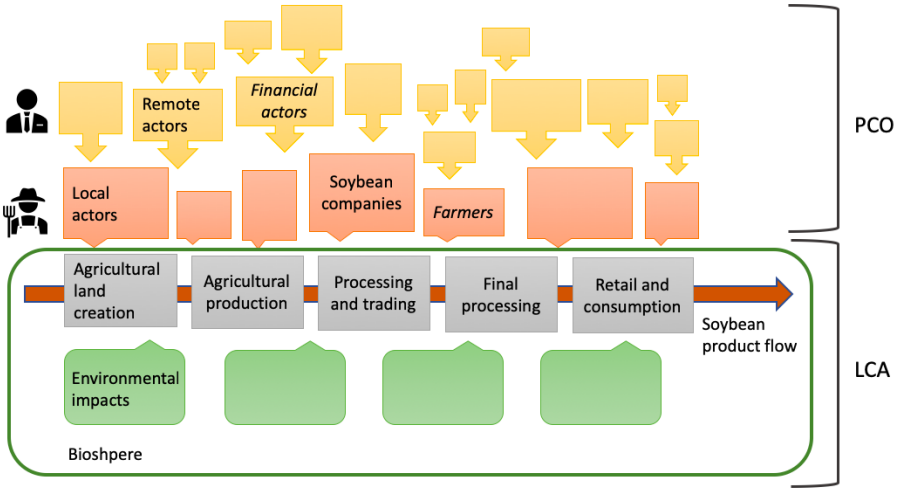

Figure 3.2: Visual representation of the method used in the report

A literature study has first been conducted to have a better understanding of the characteristics of the soybean product chain. In this phase, LCA and LCIA on land use change, land occupation, and transformation for soybean production in Brazil have been used. The product chain with all its steps have been constructed, collecting technical information about processes and environmental impacts for the different steps.

Then, the study has focused on identifying the actors involved. Once identified they have been placed in the step or steps of the chain where they were recognized having the most influence on. In addition, they have been differently classified and vertically placed on the framework if local actors, more directly involved with handling soybean, or remote actors, such as financial actors. Once collected the information about the different steps and its actors, an overall picture of the product chain has been depicted, describing with a general view each step of the chain.

Thereafter, a more detailed description of agricultural land creation has been given, choosing to zoom in this step given its importance for land clearing and its environmental and social implications. Here, the "intricate interplay" between local actors, such as farmers, laborers, ranchers, land grabbers, big soybean production companies, and financial ones, such as pension funds and endowments, have been more thoroughly described. Of these financial actors, involved in GWCs, it is reported how their corporate structures is built, how they engage with their subsidiaries, what are the social impacts related to the presence of their companies on land and

the deforestation related to their land occupation.

Always within financial actors in the agricultural land creation's step, two interviews have been conducted in order to have more information about one specific GWC operating in Brazil that has been linked to social and deforestation problems, build on a system of farmland investments by pension funds from different countries. The first interview has been carried out with Nuveen, the asset manager of an agricultural fund owning extensive areas in Brazil. The second one has been carried out interviewing the Second Swedish National Pension Fund (AP2), investing in the Brazilian agricultural fund managed by Nuveen. The questions asked focused on their zero-deforestation policy, on how the asset manager-beneficiaries relationship influenced the drafting of the policy, and on future improvements planned for more sustainable investing. The purpose has been to understand the type of interactions that occur between asset manager-beneficiaries, and how the interactions could be related to impacts on land.

Thereafter, the role of financial actors in different steps of the chains is analyzed, comparing financial actors interaction and approaches to sustainability in agricultural land creation, production and trading. Moreover, a more detailed analysis of the first step is to be given. The analysis also includes a reflection on the interdisciplinary method used, especially reflecting on the additional understanding that it can provide compared to more traditional approaches. Finally, results are discussed comparing them with previous related findings.

4

The Soy Product Chain Organization

This chapter will provide the reader with a general overview over the soybean product chain. All the steps are also presented, explaining their impacts and the principal actors identified. Since the importance of the first step of the chain in the deforestation problem, its actors are not be presented here but deeply described in Chapter 5.

4.1 The product chain

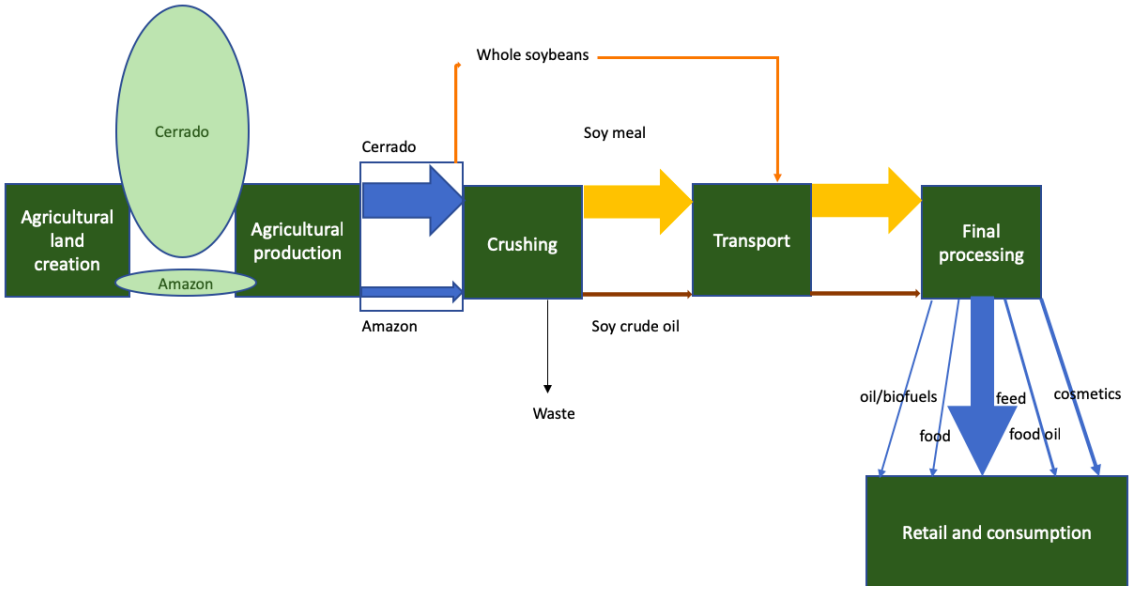

Figure 4.1: Product chain of soy. Each box represent the technical steps along the soybean product chain. The arrows between each step give approximate proportions of the soybean flows. The two circles between agricultural land creation and agricultural production represent the area (ha) used respectively in the Cerrado and Amazon biome for soybean cultivation. The blue box surrounding the two arrows represent the total production coming from both biomes.

Many studies have looked at the soybean product chain to understand its steps and related environmental impacts. Dalgaard et al. (2008) and Castanheira and Freire

(2013) have looked at the whole product chain until transport to Europe, with Castanheira and Freire (2013) taking into account land use change scenarios in their LCA; Lathulliere et al. (2017)'s LCA have focused on land use change impacts of soybean; West et al. (2018) have looked at soybean trade flows among different steps of the chain. Based on these study, it has been possible to build a schematic figure (Figure 4.1) on soybean product chain.

The flowchart describes soybean product chain from agricultural land creation to retail and consumption, including approximate proportions of soybean volumes between each step. The agricultural land used for soybean in the Cerrado is around twelve-fold the land used in the Amazon biome. The two arrows coming out of the agricultural production step give some proportions of the soybean produced respectively in each biome, of which a 6% is used as whole soybeans mainly for food production and directly sent to final processing; the remaining 94% is sent to crushing facilities to be converted into soy meal (about 79%) and crude oil (about 18%), while 3% of the input is left as waste. Once processed in the crushing plant, soy meal and oil are sent to final processing industries, mostly in the consumer countries. Whole soybeans are also an input of the transport process, since they are also sent to final processing industries but without previous treatment. The final processing step includes processing from different types of industries, hence the outflows are different types of products. To roughly estimate the different sizes of the outflows, approximate information for global productions have been used (WWF, 2014), since exact proportions for Brazilian soybean have not been found. The majority of the soybean produced is converted into feed (about 75%); 2% is used as biodiesel; 6% is used as food without any further processing. The remaining 20% is used for food oil and by the chemical industry for cosmetics or pharmaceuticals.

The consumption of soybean produced in Brazil occurs in Brazil itself, but in major part is exported abroad. In Figure 4.2 it is possible to observe the soy flows sourced in the Cerrado and Amazon, which through the work of the soy traders reaches different countries in the world. Excluding domestic consumption, China is the first importer and the Netherlands appear to be the second one, accounting for more than one-fifth of the soy that arrives to EU (WWF, 2014).

4.1.1 Agricultural land creation

Soy product chain starts with agricultural land creation. According to the World Bank database, in 2016 the percentage of agricultural land in Brazil was 33.9% of the total land, and of this 33.9% of land, soy is about 12%. Such percentages are necessary to support the enormous internal and particularly external demand. When looking at the whole life cycle of soybean (Castanheira and Freire, 2013), land use change appears to be a very crucial element within soybean greenhouse gas (GHG) balance, including also other different impacts.

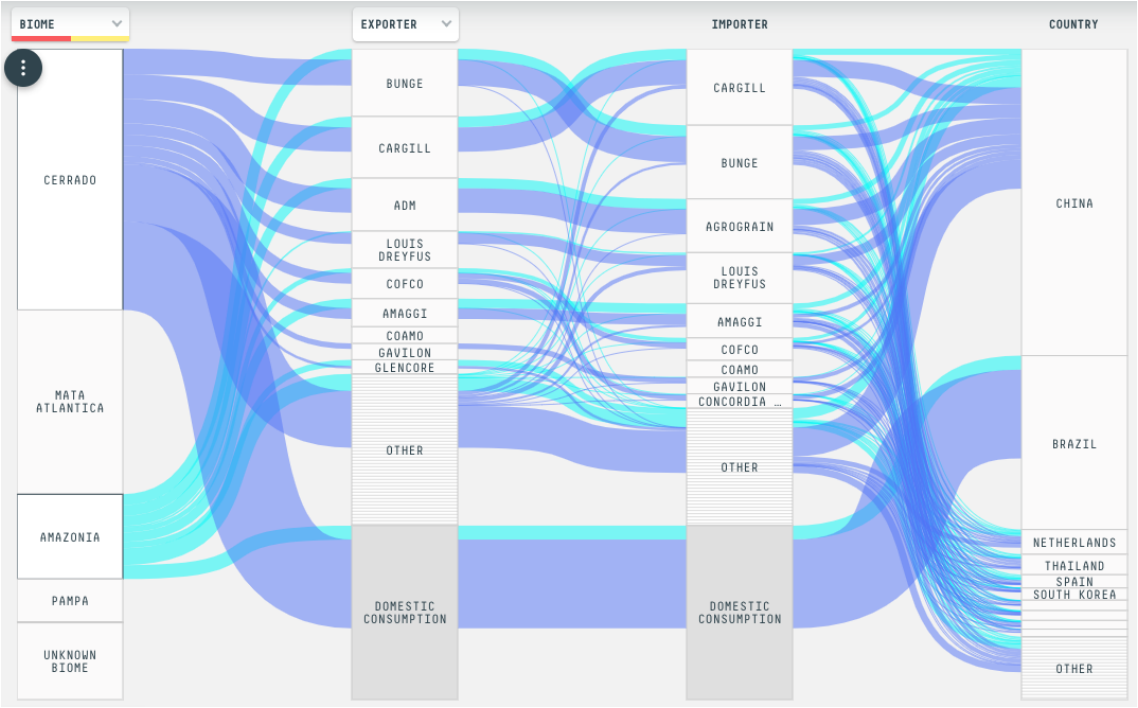

Figure 4.2: Soybean flows from the two biomes to countries of consumption (Trase data 2017)

4.1.1.1 The process

The agricultural land used for soy cultivation can be either created converting native vegetation (direct conversion), or converting pastures (indirect conversion). To create agricultural land, trees are usually removed by charcoal producers and the rest of the vegetation is collected by tractors and bulldozers and then burned (Mattson et al., 2000). To better understand how this process is carried out, social aspects are very important. Chapter 5 will provide more information about the actors involved and how they relate to driving this process.

4.1.1.2 Environmental implications

Land use change due to conversion to soybean crops has multiple impacts, and they largely change according to the previous state of the land converted (Castanheira and Freire, 2013) Soybean is usually grown in monocultures, with high repercussion on biodiversity. Clearing diversified vegetation to replace it with monocultural crops in such biodiverse region such as the Cerrado or the Amazon, always carries the risk of removing a great number of species per hectare. Today, especially in the Cerrado, only a small part of the land is protected, and those protected areas are not even widely distributed, but grouped in areas not to interfere with the airplaine spread of pesticides (Ratter et al., 1997) A more evenly distribution of protected areas would have helped, to some extent, biodiversity protection, creating the possibility to animals and plants species to use habitat corridors, making them less vulnerable to land conversion. (Mattsson et al., 2000).

Lathuilliere et al., (2017) performed a LCA of soybean focusing on land transformation and occupation impacts to biodiversity and ecosystem services in Mato Grosso, a region comprising both the Amazon and Cerrado biomes. What emerged from the

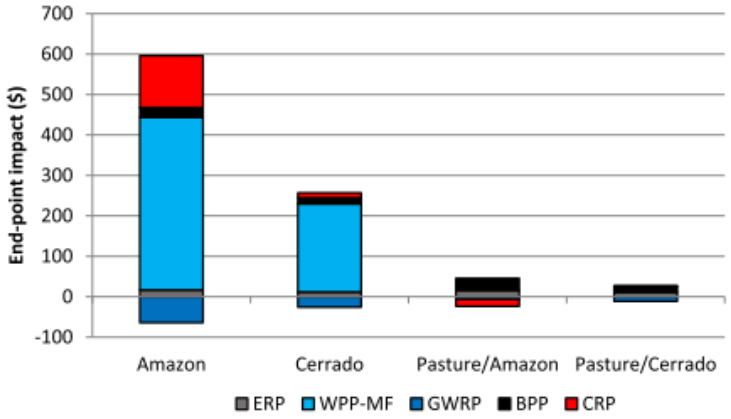

Figure 4.3: End-point land transformation impacts ($) for one tonne of soybean produced in 2010 in the Amazon and Cerrado biomes of Mato Grosso, Brazil, considering direct conversion of natural vegetation to soybean (Amazon and Cerrado), and a pasture transition (Pasture/Amazon, Pasture/Cerrado) (Lathuilliere et al, 2017)

study, were lower impacts when converting soybean cultivation from pasture, compared to native vegetation. Clearing native vegetation from the Amazon resulted the most impactful choice, as showed in Figure 4.3.

Another study (Castanheira and Freire, 2013), taking into account different land use prior to soybean cultivation and focusing on GHG emissions, also found that degraded grassland should preferably be used for soybean cultivation.

However, the main risk of the use of conversion from pasture or degraded grassland that could be used for cattle grazing, is to push this type of activities in other areas of further deep in the Amazon, where there is still land available, increasing the risk of deforestation (West et al., 2018).

4.1.1.3 Policies and commitments

Agricultural land creation is a crucial step within soy product chain because of all the environmental aspects that it involves, described above. Depending on the biome, whether is the Amazon or the Cerrado, agricultural land creation is regulated by the Brazilian Forest Code, which imposes different percentages of native vegetation that must be preserved on private lands, much higher in the Amazon compared to the Cerrado. Moreover, the "Soybean Moratorium" has been established in 2006 to control agricultural land creation related to soybean production. It is a multi-stakeholders initiative that limit soybean cultivation and its sponsors are committed not to buy or finance soybean crops established in the Amazon Biome after 2008. It has been agreed between the Brazilian government, environmental NGOs and

different companies and traders among the Brazilian Association of Vegetable Oil Industries (ABIOVE) and the National Association of Cereal Exporters (ANEC), which together account for the commercialization of more than 90% of Brazilian soybean (Cattelan and Dell'Agnol, 2018). The benefits in the Amazon biome have been impressive, since the soy planted in recently cleared land decreased from 30% in 2006 to only 1% by 2014. However, its main limitation is that it doesn't include the Cerrdo biome in its scope, which is a highly biodiverse savannah, important for climate stability and biodiversity as well as the Amazon biome. Not covering this area, the Soy Moratorium might decrease agricultural expansion in the Amazon, but it also might push soybean-associated land conversion in the Cerrado, which already holds less strict regulations from the Forest Codes and where, in fact, took place the most recent soy expansion, as shown in Figure 4.4.

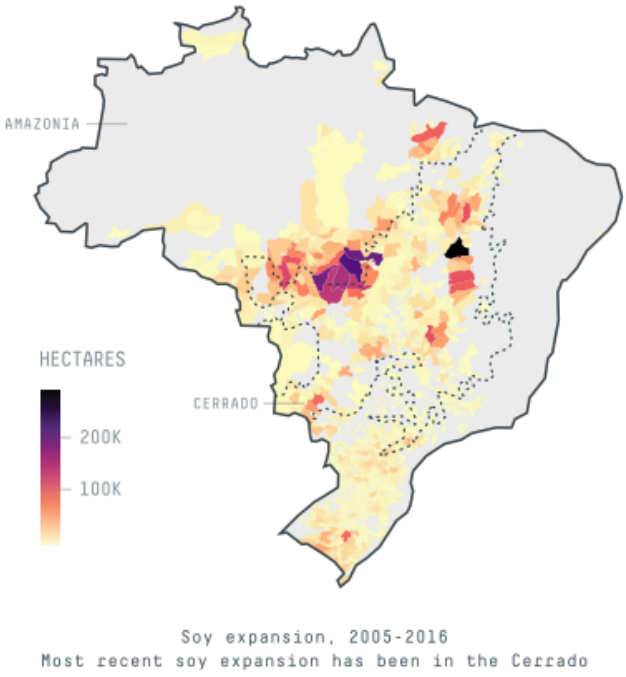

Figure 4.4: Soy expansion, 2005-2016 (West et al., 2018)

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In response to that, the Cerrado Manifesto has been released in 2017 which includes a call for action from civil society stakeholders and an implementation plan to reduce deforestation in the Cerrado. Over 70 large corporations had already signed on to the agreement in 2018, including major retailers, fast-food chains and big brands such as McDonalds, Tesco, L'Oreal, Nestlè, Unilever, Carrefour, IKEA and ICA gruppen. However, large companies such as Cargill, ADM and Bunge – which all benefit from the agricultural land in the Cerrado – haven't taken part of the initiative yet. Nevertheless, their participation is considered essential to the Cerrado Manifesto's success (Belmaker, 2018).

Although many improvements in reduction of deforestation and direct conversion

from native vegetation have been made between the first and second half of the 2000s, with a reduction in deforestation related to soybean passing from 455 m2 per year per tonne of soybean in 2001 - 2005 to 97 m2 per year per tonne of soybean in 2006 - 2010, there has been a parallel increased use of land, water and fertilizer equal to 30% linked to likewise environmental impacts (WWF, 2014)

4.1.2 Agricultural production

Since 2018, Brazil is the world's biggest soybean producer in the world (West et al., 2018). Soybean is an annual crop grown in moderate, sub-tropical and tropical climates (WWF, 2014), and in Brazil average productivity rated have been able to triple since 1970. Total soy production in Brazil has significantly grown also in the last two decades, and according to Trase data (West et al., 2018), from 2000 to 2016, total production has increased from about 45 million tons per year to more than 90 million tons, and the area of production has risen accordingly. 4.5) The

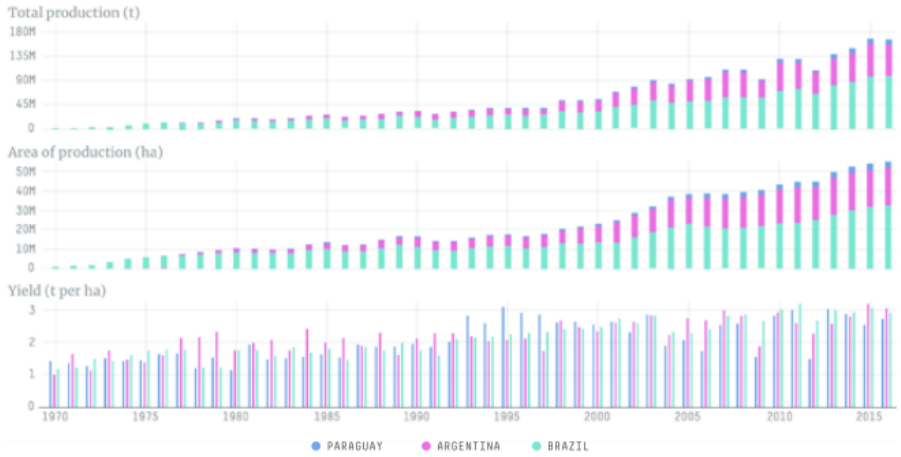

Figure 4.5: Trends in soy production in Brazil, Argentina and Paraguay (West et al., 2018)

production from 2003 to 2017 in the Cerrado biome increased from 19 million tones to 46 million tons; in the Amazon from 2 million tones in 2003 to almost 15 million tons (West et al., 2018).

4.1.2.1 The process

Once the clearing is complete, the soil is ploughed and prepared for planting. Soybeans are usually planted in October or November when rains start, and then is harvested in April or May. They can be grown by themselves occasionally, but mainly in rotation with other crops, such as winter wheat or maize (Mattson et al., 1999). Although the low natural fertility of the soil, especially in the Center-West of the country, this region has the highest agricultural potential, needing the application of very little quantities of nitrogen input for very high yields. (Raucci et al.,2014) In fact, 70-85% of the nitrogen requirement is supplied by biological fixation (Alves et al., 2003). However, due to problems with erosion, most of soybean

areas in Brazil are cultivated under the no-tillage system (Raucci et al., 2014) and this increase the need for herbicide treatment. Also, insecticides are used rather extensively (Mattson et al., 2000).

4.1.2.2 Enviornmental implications

Focusing the Cerrado, where much of the production is located, related to soybean cultivation the soil loss amounts to 8 tonnes per ha and year, (Mattson et al., 2000) and loss soil organic matter is also a serious problem, mainly due to warm climate, dry winters, quick decomposition of crop residues (Castro and Logan, 1991). Moreover, the use of heavy machinery reduces the porosity of the soil (soil compaction), which can contribute to a reduction of crop yields (Mattson et al., 2000)

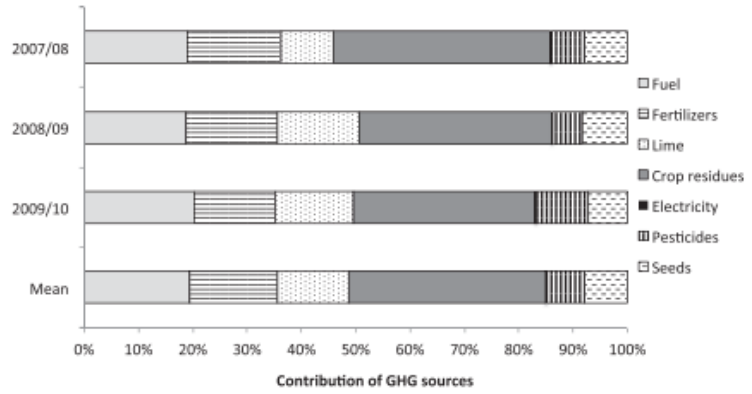

Figure 4.6: GHG sources in soybean production in Mato Grosso (Raucci et al., 2014)

Agricultural cultivation is considered an "hotspot" for global warming potential (Dalgaard et al,. 2008), and when considering GHG emissions from the operations of production, crop residues result to be the main factor of contribution, which represents 33-40% of total emissions, followed by the use of fossil fuels for the agricultural operations, 20% of total emissions. The use of pesticides (herbicides, fungicides and insecticides) accounts for 6-10% of GHG emissions, but has other important environmental impacts Figure 4.6.

4.1.2.3 Yields and production

What makes growing soybean very attractive in agriculture, is its ability to tie up nitrogen in the soil. Being nitrogen a primary element for growing crops, the rotation of soybeans with other types of crops means that the next ones will require less fertilizer inputs. This is also linked to its ability to respond more quickly to changes in the global market prices, compared to other multi-annual crops such as palm oil, because if prices are lower, agricultural land can be easily converted in other crops and viceversa (WWF, 2014). Recently, due to droughts in Argentina and a

possible trade war between US and China, there has been a marked rise in Brazilian soy prices. In this regard, and also because of the growth of Chinese demand and domestic consumption, the United States Department of Agriculture (USDA) had forecasted a 2% increase in soy harvest in Brazil in 2018. (Einstein-Curtis, 2018)

Crop yields are an important factor regulating soybean production, as well as other steps of the chain. High yields, in fact, are critical to secure food and energy supply while preserving environmental quality and natural resources. Agricultural yields differ according to the growing region in the country, with substantial gaps between one region and another. According to 2011 data (Figure 4.7, Mato Grosso, in the northern part of Brazil, was the region with the highest yield (2778 kg/ha) while the lowest yield was in Rio Grande do Sul, in the very South of the country (1880 kg/ha). It is important to notice though that in this southern region agricultural expansion is no longer an option, whereas states such as Mato Grosso it is still occurring together with an increase of yields (Santhelas et al., 2015). In general, Brazil has increased

		2011		
State	Average yield (kg/ha) (1990–2011)	Yield (kg/ha)	Area (million ha)	Production (million tonnes)
Mato Grosso	2778	3222	6·46	20·80
Rondônia	2619	3170	0·13	0·42
Paraná	2599	3393	4·56	15·46
Distrito Federal	2533	3355	0·05	0·18
Goiás	2475	3008	2·57	7·70
Minas Gerais	2374	2899	1·02	2·94
São Paulo	2368	2756	0·49	1·27
Mato Grosso do Sul	2367	2922	1·76	5·08
Santa Catarina	2290	3258	0·46	1·49
Maranhão	2262	2961	0·53	1·57
Tocantins	2243	3012	0·40	1·19
Bahia	2216	3360	1·05	3·51
Piauí	2094	2982	0·38	1·14
Rio Grande do Sul	1880	2875	4·08	11·72
Brazil	2400	3121	24·03	74·82

Figure 4.7: Average soybean yield between 1990 and 2011, and yield, area and total production in the 2010/11 growing season in the main Brazilian production states (Santhelas et al., 2015)

both production and agricultural area since 1961, with yields increasing more than the production area. This has been possible thanks to mechanization, improvements in soil fertility, investment in agricultural research and innovation. However, higher yields are linked to an increased use of fertilizer and pesticides, with impacts on soil and groundwater (Santhelas et al., 2015).

Genetically modified (GM) crop technology has played a major role in increasing agricultural yields. Today, more than 90% of the soy production in Brazil is GM. Introduced in 1990, it has considerably stimulated soy production and expansion. New seed types allowed producers to both increase yields and start cultivating areas that were not agriculturally viable before (West et al., 2018).

4.1.2.4 Some powerful actors

In this section some of the most powerful actors - mainly big companies - in soybean production will be listed, linking them to their investors when the information retrieved allow that.

- O Telhar Agropecuaria, backed by Altima Partners (UK hedge fund) and Capital Group (US private equity firm), is a major soy producer in Mato Grosso (Levicharova et al., 2018). This company began as an association of Argentine cattle farmers in the 1980s and started to be involved in grain production in the 1990s. According to GRAIN data (Grain, 2012), in 1999 O Telhar was one of the largest soy producers in Brazil, farming on rented land. Foreign investors entered the company after 2006, and in 2012 it was farming 800,000 ha of Brazilian land. According to Steinweg et al. (2018) today O Telhar holds 86,574 ha of land in the Matopiba region.
- SLC Agricola, backed by Valiance Asset Management limited (a UK-private equity fund), is also one of the biggest soy producers (Fian international, 2018) operates 15 large farms, spread across six Brazilian states – Mato Grosso, Goiás, Bahia, Piauí, Maranhão and Mato Grosso do Sul, including farmland holdings in the Matopiba region (Kuepper et al., 2017). Through its real estate joint venture SLC LandCo it holds 87,000 ha, although its total holding amount to about half million he of land in Brazil, with some 300,000 ha planted with soy (Fian international 2018). Between 2011 and 2017, the deforestation associated with its farmland holdings amounted to 39,887 ha of land (Kuepper, 2017), and a deforestation of 66,234 ha only in the Matopiba region between 2000 and 2017 (Steinweg et al., 2018). SLC farms are located in areas, such as Santa Filomena in Pauì, where illegal land grabbing is common, and SLC Agrícola's business partners have faced legal charges (Kuepper, 2017). SLC Agricola is also linked to another big investor, Mitsui and Co, from Japan, forming with them the joint venture SLC-MIT Empreendimentos Agrícolas S.A., another soy producer with about 87,000 ha of land holdings in Matopiba, linked to about 12,000 of land deforested.
- Agricola Xingu SA is another big soy producer linked to the Japanese investor Mitsui and Co. With SLC-MIT and Xingu, Mitsui and Co formed the so-called Multigrain Group in 2011, which now owns 120,000 ha of farmland in Brazil. Xingu's soybean production is non-genetically modified, with the aim for Mitsui to ensure a stable and trustworthy supply to Japan and other markets (including China) (Mitsui and co., 2019).
- BrasilAgro is a Brazilian rural real estate firm, which produces soybean holding 11 properties, but mainly focuses on acquiring 'non-productive' or 'underutilized' land, generating revenues by clearing, developing land and selling it. It is backed by Cresud, an Argentine corporation.
- Other important producers are Gruppo Amaggi, Agrex do Brazil, Terrasanta, Brookfield Brasil and Grupo Bom Jesus. Levicharova et al., (2017) looked at the ESG policies of these last soy producers together with the ones listed above, giving them a score between 0 and 100 according different criteria, evaluating

the overall presence and scope of ESG policies, the inclusion or exclusion of environmental standards, the adherence to key criteria on human and labor rights, and performance on transparency and good governance practices. The companies registered a score of 31 out of 100, showing a lack of environmental awareness and commitment to zero-deforestation policies, even though the trend is tacking off by key buyers. In fact, what emerged is that the scores are driven by policies on governance and disclosure, human and labor rights and the overall scope of the commitments, more than being driven by environmental standards. Figure 4.8 devides the companies mentioned above in low-scoring and high-scoring, comparing them with the scores in ESG policies of their investors.

Policy scores	Low-scoring producers	Mid-scoring producers
	Brasilagro	Grupo Amaggi
	Terra Santa	Agrex do Brasil
	Brookfield Brasil	SLC Agricola
	Grupo Bom Jesus	Agricola Xingu
	O Telhar Agropecuaria	
Avg score producers	18	49
Avg score investors	32	28

Figure 4.8: Average ESG policies of soy producers compared to their investors' scores. (Levicharova et al., 2018)

- Commercial banks, international asset managers and self-funding are the principal forms of financing for agricultural activities. Domestic lending is associated to high costs, since private sector banks are afraid to provide long-term credit, because of the unpredictable risks related to the agricultural sector (Levicharova et al., 2018).
- The Brazilian Development Bank or Banco Nacional de Desenvolvimento Econômico e Social (BNDES) is also a very important actor, disbursing rural credit and mostly benefiting large commercial farmers. In 2016/17, 21% of subsidized credit lines were addressed to large producers and about 12% to family farms (Levicharova et al., 2018).

4.1.2.5 The relationship between production and finance

Soybean is usually grown on big plantations by very large agricultural enterprises but, less frequently, it can also be cultivated on a smaller scale on family farms working in cooperatives. In big farms, manual labor is usually limited and it involves some direct planting, manual weeding and stone removal to avoid damages to harvesters. The massive increase of production since 1970 has been possible thanks to a "debt-fueled" modernization of agriculture (Network for social justice and human rights, 2018), using financial mechanisms such as subsidized credit, tax exemptions, above-cost pricing policies and the cancellation of already subsidized debts (Jùnior, 2002)

One of the main causes driving territorial expansion of soybean production, especially in the Matopiba region, has been asset price inflation's stimulation. Financial asset price inflation occurs when there is a speculative increase in the price of a certain asset which is attracting new investors, consequently dropping when the financial bubble bursts. Commodity prices started to drop when the global financial crisis erupted in 2008, hence speculative capital was transferred to low risk securities, such as agricultural land and food commodities, included soybean. In this situation pension and hedge funds in search for returns, invested in this type of commodity basing their trades on specific future prices and promises of expanded production. As a result, soybean producers as well as the processing industry and traders, started acquiring more and more resources in order to obtain more capital in exchange for pledges to expand production. This mechanism, called financial "simulation", is in turn able to push market prices of soybean and other commodities to increase. Consequently, high commodity prices led both the territorial expansion and the increase of soybean production, with a greater expansion of big corporations, able to exploit land as an asset, promising large-scale production and increased profits to investors (Network for social justice and human rights, 2018). Observing the graph 4.9, it is

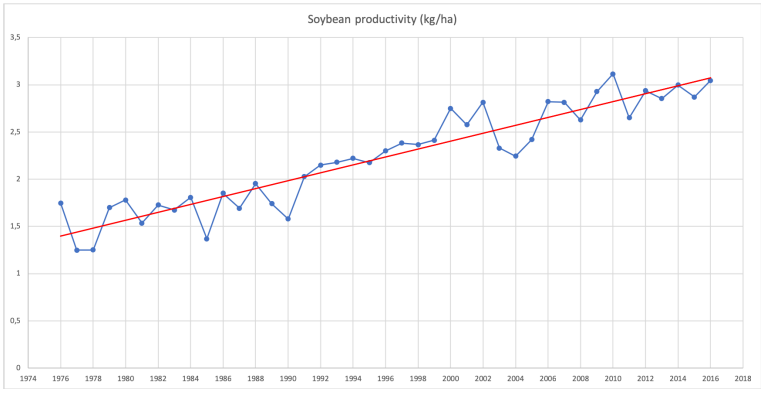

Figure 4.9: Soybean productivity from 1976 to 2016 (Data from: Network for social justice and human rights, 2018)

possible to notice three main peaks in soybean productivity beyond the trend line. The first two correspond to the years 2000 and 2002, and the third one in 2010. Such high productivity values followed, respectively, two important events. In 1999, BNDES powered agricultural production offering subsidized credit and in 2008 the global financial crisis begun, pushing foreign investments in Brazilian farmland. In both cases, after a couple of years, soybean producers increased their production and productivity levels by expanding into new areas and adopting new techniques to increase their yields, such as the use of genetically modified (GM) crops. Right after the crisis in 2008, the fall of productivity as well as production was linked to the momentary restriction on credit, which affected the 2008-2009 harvest. However, the agricultural area kept expanding also in periods of decreased production and productivity. Only in Matopiba, this resulted in a 235% increase of area dedicated to soybean between 2000 and 2014, jumping from 1 million to 3.4 million hectares.

4.1.3 Processing and trading

As showed in Figure 1.1, soybean is used for many different purposes. The first processing step starts in crushing facilities, where raw soybeans are turned into the principal products of soybean: animal feed and oil.

4.1.3.1 The process

Once harvested, soybeans are bought, collected and sent to crushing facilities or processing industries. Globally, of total soybean production, around 87% is crushed (Oil World, 2019). The rest is usually used for direct human consumption, sent to specific food industries or used as seeds. Some products derived from non-crushed seeds are for example tofu, soy-sauce or other meat or dairy substitutes. Crushing plants are used to mechanically crushing the soybeans to extract soy oil and separate it from soy meal. During this process, about 79% of the soybean is turned into meal, which is subsequently toasted, dried and grinded. The protein content of the end-product is between 44% and 48% - depending if the hulls are removed or not before the crushing - and that makes it a perfect ingredient for livestock feed, but also for protein-rich food or non-food purposes. In crushing plants, soybean can also be processed into crude soy oil (around 18%) which is then transferred to oleochemical plants or refineries. Crushing plants can either be located close to soybean growing area o near a harbour. (Van Gelder and Dros, 2002) In Brazil, most of the total soy-crushing capacity is in the south of the country, even though Matopiba has seen a 75% increase in crushing capacity between 2005 and 2015 (West et al., 2018). After being crushed, soy is exported to consumer countries or used for domestic consumption.

4.1.3.2 The environmental implications

According to Norris et al., (2016) - considering soybean produced and crushed in US, but not shipped overseas - soybean milling in crushing facilities has most contribution in the impact categories of resource depletion and climate change, compared to the other impact categories included (human health, ecosystem quality, water withdrawal). Another LCA study (Da Silva et al., 2010) - which considered soybean production and shipping to Europe, but without including crushing processing prior to export - highlighted the importance of the transport phase compared to the production phase, which in terms of climate change, acidification and cumulative energy demand in Central West Brazil, is responsible for 40% of the impacts. Also, it is suggested that the mode of transport chosen and the distance to be traveled strongly influence environmental impacts. In this regard, (Dalgaard et al., 2008) suggests that shipping is much more environmentally friendly than transport by truck, although both choices have higer impacts on eutrophication and acidification compared to agricultural production.

4.1.3.3 The power of soy traders

Crushing plants are an important element in the processing and trading step, since they are mainly owned and managed by soybean traders, which can be very small,

local companies, but more often large, international corporations. Traders buy the product from farms, process it into crushing facilities and then export it to consumer countries. Only a bunch of traders are responsible for most of soy exports in Brazil: in 2016, the six largest traders - Archer Daniels Midland (ADM), Cargill, Bunge, Louis Dreyfus, Amaggi and COFCO - accounted for 57% of all Brazilian soy exports (West et al., 2018).

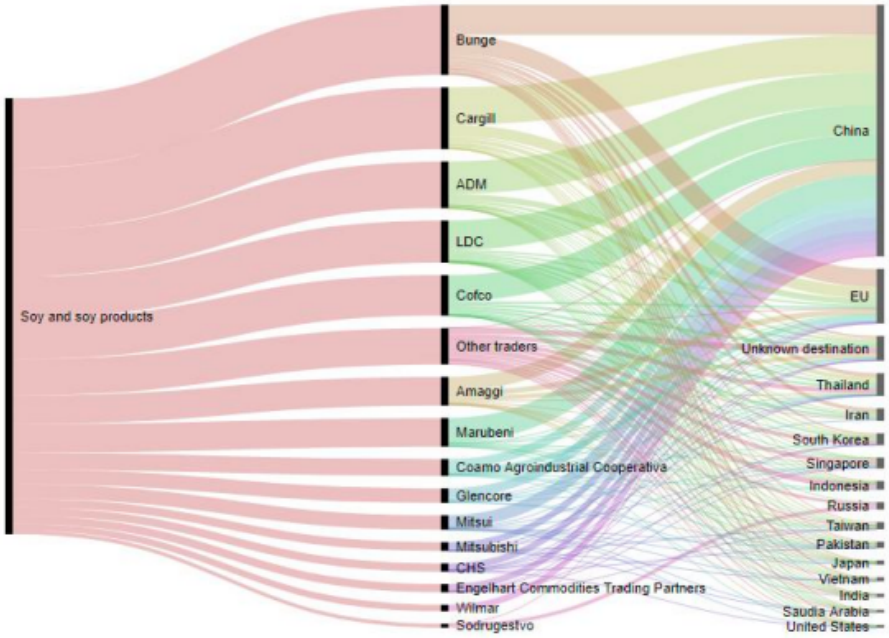

Figure 4.10: Major soy traders and destinations (Kuepper et al., 2017. Data from Panjiva)

Each of them owns between 2 and 8 crushing facilities and has different sourcing regions across Brazil. The relationship between traders and municipalities is very strong and, according to latest West et al. (2018) it was estimated that for some two-thirds of Brazilian municipalities exporting soybean, more then half of the exports were managed by a single trader, and in about one-fifth of municipalities only one trader was registered to handle all the exports. The soy infrastructures operated by big traders are not limited to crushing facilities, they also include silos, warehouses, but also railroads and port terminals. Hence, they play a very important role in shaping the economic development of the areas they are controlling, and are also very important players in shaping a more sustainable soybean sourcing (West et al., 2018).

In the following sections, some of the most important traders will be presented, describing their operations, their main sourcing areas and their steps to tackle deforestation problems. Also, for ADM, Cargill and Bunge, information about investors and financial characteristics will also be provided. In Figure 4.10 an overview of all different traders and soy destination is given.

4.1.3.4 Archer Daniels Midland

Archer Daniels Midland (ADM) one of the world's largest agricultural commodity traders (GRAIN, 2012), and among the largest processors in Brazil (Steinweg and de Wilde, 2018), it is headquartered in US and started operating in Brazil since 1997. It sources its soy mainly in Mato Grosso (West et al., 2018) and owns more than 30 silos in Brazil, as well 13 oilseeds processing plants. It also has operations in eight Brazilian ports (Steinweg and de Wilde, 2018). According to West et al., (2018), it also owns Brazil's largest crushing plant. ADM is the fifth largest soy trader in Brazil's Matopiba region, the last soy frontier, and it has been associated with 13,873 hectares (ha) of deforestation in its main sourcing municipalities in 2017. However, ADM doesn't publish a list of its soy suppliers - which does for its palm oil commerce - not willing to disclose the names of the farmers from which they source soy. Moreover, ADM doesn't even support the Cerrado Manifesto, which many of its clients support instead. To show its environmental commitment, ADM has published a no-deforestation policy in 2015, mainly focusing on traceability, transparency of its soy supply chains and on engagement with their suppliers (Steinweg and de Wilde, 2018). However, unlike its competitors Cargill and Bunge, ADM hasn't given a time-frame of commitment. The company has a Responsible Soybean Standard, a certification program which aims at bolster environmentally and socially soy production, but that tackles only illegal deforestation, leaving legal deforestation processes still possible (Steinweg and de Wilde, 2018).

When it comes to its financing strategy, its assets are 50% financed by its equity and that BlackRock, Vanguard, State Street (Galaz et al., 2018) and Maquarie Group (Steinweg and de Wilde, 2018) are among their biggest shareholders, all investment management firms which, on average, have weak forest policies. There are, however, other shareholders that, even though having less stake, have demonstrated to be more concerned to deforestation related to soy production, divesting by some other companies (SLC Agricola) which had been highly related to deforestation (Government Pension Fund of Norway) and engaging with Bunge about that. Some 20% of ADM's assets are either financed by gross debt. Also in this case, there are more environmentally concerned investors and less concerned ones. Among the first group, engagement or divestment possibilities are very low. Among the most concerned ones are Aegon and Aviva (pension and insurance funds, and asset management firms respectively from the Netherlands and from UK), and Deutsche Bank, with deforestation policies in place and signatories of the Cerrado Manifesto (Steinweg and de Wilde, 2018).

4.1.3.5 Cargill

Cargill is the second biggest soy exporter, preceded by Bunge and followed by ADM. It is a privately owned company registered in US, which started to operate in Brazil since 1965. Its assets include 6 crushing facilities, 140 silos and 5 port terminals, and it sources it soy mainly from the North and North-West regions in the Amazon (West et al., 2018). Cargill constructed a soy export harbour terminal in Santarém, Parà state, in 2003, one of the city where many land conflict have emerged. Af-

ter establishing the port in fact, this area has become attractive for soy cultivation, leading large landowners from the south of the country to buy or — more commonly — grab land, furthering conflicts (Van Solinge, 2010).However, the state from which Cargill holds much of the soy export market share (21%) is Maranhão, where is the largest exporter through its subsidiary Cargill Agricola and where, between 2010 and 2017, about 336,426 ha of land has been cleared for soy. More than half of these export are destined to the Chinese market. Also in Maranhão, the presence of Cargill, together with the one of other big traders, has had not only environmental, but also social impacts. Here, a number of agrarian land conflicts are present, but also cases of slave labor have been reported. Furthermore, the social and economic development of the territory is particularly difficult given the demand for skilled technicians, which lack in the area. Local research in Maranhão in 2018 also showed local communities to suffer from agrochemical pollution, lack of water and pesticide poisoning, all linked to soy production (Steinweg and Rijk, 2018). Cargill, in a venture with a London-based tractor maker company, Case New Holland, has started to provide barter-based financing to under capitalized farmers, bartering machinery for soy (Ewing, 2015). Barted-based financing has, however, become common also among other traders, such as Bunge and Louis Dreyfus.

Together with the other traders, Cargill is trying strengthen its commitments to eliminate deforestation from its supply chains. However, Cargill's efforts have not always been consistent. In 2014 Cargill was among the New York Declaration on Forests, which aimed at eliminating deforestation related to the production of agricultural commodities by 2020. One year later, Cargill published another deadline for its commitment for its supply chain, set in 2030 instead. Also, Cargill has a Forest Protection Action Plans in place, which encourage its suppliers to follow certain criteria and requirements (Cargill, 2015). The main problems with these plans, is that their requirements mainly relate to compliance with Brazilian legislation, such as the Braziian Forest Code. Following Brazilian laws, however, doesn't equal to reach zero-deforestation commitments. Furthermore, it mainly addresses illegal deforestation, while significant parts of the Cerrado and Maranhão are legally converted into agricultural crops (Steinweg and Rijk, 2018). Among its main customers (not only of soybean, but also other products), only two of them have signed the Cerrado Manifesto, Unilever NV and McDonald's Corp.

Regarding Cargill's financial means, it is a privately owned company whose shares are managed by family or trusts, mainly financed by debt, which as recently been totally paid off. Future bank loans with bank with deforestation policies may entail engagement with Cargill in this regard. Moreover, according to Steinweg and Rijk, (2018) from Chain Reaction Research, between 2013 and 2017, Cargill issued bonds from different investors, many of them are financial institutions from US with very low concern regarding deforestation, which thus entail no risk of divestment or direct engagement.

4.1.3.6 Bunge

Bunge is the largest soy trader in Brazil, responsible for 16% of soy exports. It buys, stores, transports, processes and sells soybean meal to produce animal feed and soy oil. Its power within the soybean sector in Brazil grew from 1997, altough it was already operating in the country, after acquiring of the largest soy processors at that time, Ceval. Today, Bunge owns and manage 8 crushing facilities, 140 silos and 6 port terminals (West et al., 2018). In Piauì, Bunge has the largest storage and processing capacity and the largest market share, a region were 123,917 ha of forest have been cleared to make space for soybean cultivation. Among many other places in Piauì, it also owns its newest silos in Santa Filomena (Drost et al., 2017), a municipality which has been highly affected by land grabbing and at the center of different legal issues (Fian international, 2018; Network for social justice and human rights, 2018; GRAIN, 2018; GRAIN, 2015; Steinweg et al., 2018). Their huge storage capacity allows them to connect with many different producers, which have their own silos, but are not enough to support the production. That implies that soy product inevitably end up in the hands on big traders such as Bunge. SLC Agricola, one of the largest soy producers, has been dependent on Bunge for storage capacity at least until 2017 (GRAIN, 2018), even though today Bunge does not buy soy from SLC anymore (Steinweg and Piotrowski, 2018). Other big producers linked to Bunge are BrasilAgro and Insolo Agroindustrial, a company which is backed by an important investor in the region, Harvard Endowment fund. Hence, a powerful actor such Bunge results to be the "bottleneck" of soy produced in Piauì (Drost et al., 2017).

As already observed for Cargill in Maranhão, also Bunge is operating in a state, Piauì, where social and environmental impacts linked to soy production are very high. Here, soy expansion has been responsible for 84% of the total agricultural expansion in the region, accompanied by land grabbing through intimidation and violence toward local communities, which have seen drastically reduced their access to natural resources, as well as feeling the agrochemical pollution and health impacts (Drost et al., 2017).

Bunge has a zero-deforestation policy for its supply chain, with 2020 and 2025 as deadlines for its goals. It encourages sustainable expansion and improvements of traceability of its supply chains. In 2015, together with other companies and NGOs, an open source decision support tool, (Agroideal, 2019), has been launched to help traders to choose their sourcing including environmental, economic and social aspects, providing them with information about their risks and opportunities. However, also for Bunge the same problem of allowing legal deforestation within its supply chain remains as well. As a results, some of its most important suppliers, SLC Agricola and BrasilAgro, have been linked to 19,683 ha of legal deforestation in Piauì from 2011 and 2017 (Drost et al., 2017).

Bunge is a publicly listed company, whose shareholders include Vanguard, BlackRock, State Street - the "Big Three" (Fichtner et al., 2017) - and many other US investment management firms, which have very poor deforestation policies. How-

ever, other investors such as Crédit Agricole (France), Goldman Sachs (US), JP Morgan Chase (USA) and Allianz (Germany), have stronger commitments toward deforestation, hence they might consider direct engagement or divestment if Bunge's social and environmental responsibility doesn't improve. When it comes to debt, it mainly consist of issued bonds. Also here, we find US-based asset managers with weak deforestation policies as well as more committed financial actors such as JP Morgan Chase (USA). AXA (France), Allianz (Germany) and Crédit Agricole (France). Among the group of banks providing Bunge with loans, most of them have very strong deforestation policies in place, and these might be the actors more inclined to push Bunge to be more responsible in the future (Drost et al., 2017).

4.1.3.7 COFCO and the Asian influence

COFCO is a Chinese company and one big new entry among the powerful group of soy traders in Brazil. It is China's largest food and agriculture company and has only recently entered the Brazilian market, in 2014, acquiring two exporters, Nobel (Singaporean) and Nidera (Dutch-based). Its assets include 2 crushing facilities, 25 silos ans 2 port terminals (West et al., 2018). Compared to the rest of the traders, COFCO owns a lower number of crushing facilities, due to its strategy of promoting domestic crushers (Brown-Lima et al., 2010). COFCO's presence in exporting soy from Brazil has increasingly expanded due to a rising demand and the U.S.-China trade conflict, and has recently reinforced its commitment to deforestation-free supply chains. COFCO International, the company's trading arm, has already a deforestation policy in place, although recent statements from the company showed that this is now a company-wide target, due to financial opportunities from deforestation-free commodities. In public statements, the company referred in particular to the last Tropical Forest Alliance (TFA) report (TFA 2020, 2017), which indicates all the financial risks related to supply chain linked to deforestation, and highlighting the need to redirect financial flows to "sustainable" agricultural production. Implementing TFA criteria, COFCO would put pressure on its suppliers to reduce deforestation, in order to avoid the risk of loosing the Chinese company as a customer. COFCO current rising concern about this issue, might be promising in this sense, giving a strong reason to many producers to stop unsustainable practices (Chain Reaction Research, 2019).

The future prospects for the Chinese company are of continuous growth. As its economy develops and the living standards increase in China, the annual demand for soybeans keeps rising, exceeding 100 million tons in 2017. Such demand can't be satisfied by internal production, hence in 2017 Brazil has been registered as the largest source of imported soybeans to China, with an import volume of 50.928 million tons (Research and markets, 2018). Despite being a new player on the Brazilian soybean trading scene, in 2018 it made almost 20% more shipments than those of 2017 (Gomes, 2019). To achieve this, it has a precise strategy on how to compete with the other big traders which have dominated the soybean scene for decades. In fact, the purchase of Nobel and Nidera allows COFCO to have soy supplies from Brazil and other top producers directly, processing then into animal feed at home, without the need of working with the other traders such as ADM, Bunge, Cargill

and Louis Dreyfus.

From Japan, several trading companies have also made a strong entry into the Brazilian soy industry. This includes Marubeni, Mitsui and Mitsubishi which own Gavilon, Multigrain and Agrex respectively, big soy producers. Their soy market shares are regularly increasing due to their imports to China and other Asian destinations. Marubeni is, in fact, handling around 20% of soybean imports to China, 10 million tons, out of 55 million tons of China's total soybean imports. Also, Mitsui Co declared to handle about 4 million tonnes between Brazil and China, with only one-tenth directed to Japan. Itochu, another Japanese corporations, works closely with COFCO and Ting Hsin, the largest instant noodle producer in China, as well as with other Chinese companies.

All these Japanese actors, Marubeni, Itochu, Mitsui and Co, and Mistubishi Corporation, show a similar global strategy: a project of increasing investments in South America (as well as North America), to increase their supply of grains, while investing in food industries, including food processing, retailing and restaurants, in Asian countries. Hence, Asian traders have increasingly integrated key supply chains at a global scale and becoming a major vector for investment (Bjorkhaug at al., 2018).

4.1.4 Final processing

Soybean meal can be directly sold as animal feed once processed in crushing plants. The crude oil extracted from the plant needs to be further processed sending it to a refinery. After different processes, such as bleaching, hydrogenating, and deodorizing, it can be either sent to other processing industries, or it can be directly sold to consumers. The final processing industries are (Van Gelder and Dros, 2002):

- Food industry: it uses all soybean forms, whole seeds, soy meal and soy oil. Seeds are used for tofu, sauces or different kind of meat substitutes, soy oil is used for margarine, mayonnaise, but also snacks, pastry or into instant coffee. Soy meal can be used in flour, cereals or baby food. For selling it as food, soybean has to go more often through hydrogenation compared, for example, to palm oil. This result in higher energy consumption and higher processing costs;
- Feed industry: soybean meals can be further processed mixing it with other meals or oil, and then used as livestock feed;
- Chemical industry: it uses soy oil to prepare lacquers, soy diesel, ink or paints, while soy meal can be used for pharmaceuticals or plastics;
- Cosmetic industry: it also uses both soy oil and meal, for detergents, soaps or cosmetics.

All the companies involved in this industries have considerable importance in influencing soy producers, asking for more sustainable sourcing and ensuring that soy expansion doesn't involve land clearing. In this industry multinationals such as Unilever, Danone, Procter and Gamble, Kraft and Nestle play a major role (Van Gelder and Dros, 2002).

4.1.5 Retail and consumption

Once soybean is finally processed and transformed in end-products, it reaches retailers and consumers. This step plays a significant role in influencing the rest of the chain, being the closest to the end-consumers. Retailers are very sensitive and responsive to public opinion and need to follow consumer's needs and requests. Hence, they can choose which type of product to serve to consumers and, especially in Europe, there has been much more concern and demand for more responsible soy sourcing. However, this has not been the case for China, now the leading importer of Brazilian soy, whose consumers have not showed as much concern over deforestation problems (Brown-Lima et al., 2010).

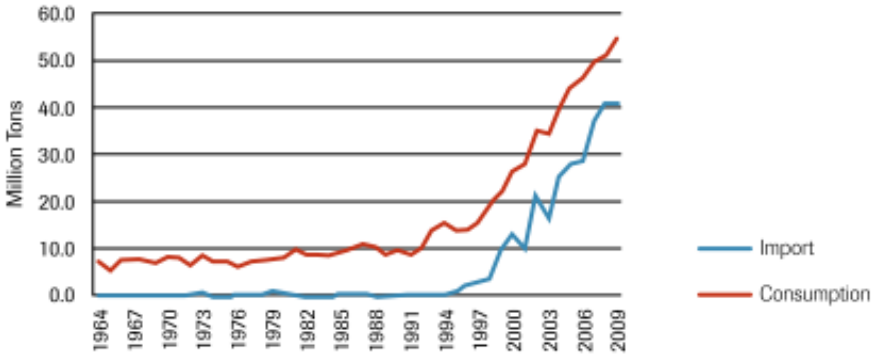

Figure 4.11: China's growing soybean consumption and import demands (Brown-Lima et al., 2010)

As shown in Figure 4.11 from 2000 onward China's soybean consumption has drastically increased and it is predicted to keep rising, due to the current party's plan to shift from small-scale to larger industrial animal farms to sustain its 1.4 billion population consumption in milk. In China, meat and dairy have become symbols of a modern society, able to feed and nourish its population. They are also used as a symbol recourse against foreign powers, which led the current party to identify as one of the country's priorities to shift from small-scale to large scale animal farms, in order to able to sustain the demand of its 1.4 billion people. To make dairy products' consumption increasing even more, official diet guidelines recommend people to eat the triple amount of dairies compared to their current consumption, leading to an increase of national dairy herds from a total of of 120.000 cows in 1949, to 13 million cows (Lawrence, 2019). These cultural dynamics and such numbers can be an explanation of the rapid increase in soybean import and consumption.

The main difference between China's soybean and meat consumption (meat is a product derived from soybean) compared to the rest of the world, is that in China meat and soybean are still sold via independent outlets more than large brands. In the rest of the world these products are mostly sold in the biggest retailers such as Warlmart (US), Carrefour (France) and Tesco (UK) or through fast-food chains such as McDonald's, Subway or Yum Brands (Taco Bell, Pizza Hut and KFC), which

are all US-based companies (WWF, 2014). However, this difference between Asian and Western consumption might be changing, due to the increasing integration of supply chains by Asian actors.

5

Agricultural land creation

Soybean product chain begins with creation of agricultural land from the conversion of vast areas of forest in the Amazon, savannah in the Cerrado, or pasture. Deforestation has been by far the most important factor allowing agricultural land to expand to meet the internal and external demand, which so far has been anything but sustainable. The hectares dedicated to soy in each biome are respectively 40% and 20%, showing that soy expansion played a major role in land conversion (West et al., 2018).

5.1 Actors in the product chain

Land conversion for agriculture is caused by a multiplicity of actors with different interests, highly influenced by Brazilian policies, such as the Forest Code. Soybean plantations can raise from already converted land used for cattle grazing or from land converted directly from native vegetation. Thereafter, the role different actors contributing to land conversion will be analyzed, considering both those responsible for direct conversion of land for soybean production and also actors that are indirectly linked to soybean, clearing land for cattle grazing or other purposes that can be subsequently used for soybean production. Fearsnide (2008) shows the principal actors responsible for impacts on the areas of Amazonas, Parà, Maranhão, Rondônia, Roraima and Mato Grosso, among which are: capitalized farmers, landless migrants or "sem terras", laborers, ranchers, landgrabbers or "grileiros", colonists, drug traffickers and money launderers and loggers. Each of these actors have a principal area where operates and contributes to deforestation in different ways.

5.1.1 Capitalized farmers

Capitalized farmers' responsibility of land clearing, mainly in the region of Mato Grosso and Parà, is strongly influenced by favorable Brazilian's tax policies. In fact, Brazil can be considered an agricultural tax shelter which has pushed capitalized farmers to buy up smaller farms and to aggressively compete for land into frontier areas. The result of Brazilian's tax treatment is that private and corporate investors undertake projects in agriculture capitalizing farmers, leading to unequal land ownership holdings and increased rate of conversion of forest to crops or pasture (Binswanger, 1991). From the 1970s, investments have been increasing both in the beef and soybean sectors, and deforestation has been directly proportional to the

price of these two commodities. A demonstration of this is the decline of soybean price by half between 2004 and 2007, followed by a drop in deforestation rate by a similar percentage between 2004 and 2008 (Fearnside, 2008).

Asset rich large firms such as Archer Daniels Midland (ADM), Bunge, Cargill, Louis Dreyfus, COFCO and Amaggi, as well as private foreign investors, are strongly related to capitalized farmers, owning and/or managing farms, or having them as suppliers. Investments in infrastructure are also very important elements in increasing direct and indirect land conversion and allow such big traders to establish long-standing connections with farms in specific regions of production (West et al., 2018). Related to that, concern is growing looking at the large amount of ongoing investment in soy infrastructures in the Matopiba region – the intersection of Maranhão, Tocantins, Piauí and Bahia states – which lies for more than 90% within the Cerrado (Williams, 2018).

5.1.2 "Sem terras" and small farmers

Although the Forest Code establish percentages of protected lands that have to be preserved in private properties, these areas have been historically threatened by landless migrants. The state of Parà, for example, has been highly affected by the migration of poor landless migrants or "Sem Terras", especially on its borders with the state of Tocantis and Maranhão, from which most of the migrants come from. This migration has been a phenomenon common to the whole country, involving migration of entire families seeking for free land, unaccompanied men moving to work as laborers, and more organized groups such as the Landless' Workers Movement. From the 1980s, new railways such as the Carajàs Railway used to carry the ore from the iron mine in Carjàs to the port near São Luis in Maranhão, as well as the BR-163 highway, made the way to about 100 families per week directed to Marabà, at the borders of the State of Parà. Some of the migrants were living in encampments along the highways, waiting for the opportunity to occupy some unproductive land from the estate owners, which had - and still have - to leave a portion of their land untouched for environmental protection, the so-called Legal Reserve (LR), according to the Forest Code, establishing that from 1964 (Castelo, 2015). As the Brazilian photographer Salgado reports in his projects "Terra: Struggle of the landless" and "Migrations", in 1997 and 2000 respectively, this part of migrants - especially people from the Landless Movement- belonged to that poor part of the population who decided not to move to the city, not giving up to the fact that the best arable land was concentrated in the hands of a rich minority:

> *"shielding themselves from the threat of delinquency and prostitution in the large urban centers, they prefer to remain in the encampments along the highways and await the opportunity to occupy the land so long dreamed of, even at the risk of their lives" (Da Cunha, 2004).*

In fact, their actions resulted in violent and frequent land conflicts, among which is the El Dourado dos Carajàs massacre in April 1996, where nineteen landless migrants were killed trying to occupy a private ranch (Fearsnide, 2008).

Sem Terras' actions have transformed and degraded the central portion of the state of Parà, including every fragment of forest left in the already deforested landscape (Figure 5.1). The land acquired has been usually converted into annual crops, including soy, or into pasture. This shows how the Forest Code failed its implementation due to problems in land allocation which has contributing to inequality and poverty both in the countryside and in the city, leading part of the population in grabbing land illegally. A more legal way of land conversion has been driven the

Figure 5.1: Deforestation on the borders between Parà, Tocantis and Maranhão

establishment of official settlements by colonists or small farmers. Also in this case, infrastructures have been fundamental in facilitating the movements, including the Transamazon Highway and the BR-364 Highway. During the 1970s and 1980s, these two important connections enabled colonists and small farmers to move and settle in the region of Rondônia causing a great explosion of deforestation in this region (Figure 5.2). Smaller framers' lots were subsequently bought and merged in bigger properties, devoted mostly to cattle and pasture. As showed in Figure 5.1, the same phenomenon has been observed along the Transamazon Highway, and around the area of Novo Repartimento, Parà, which by 2003 has become one of the fastest growing deforestation hotspots in Amazonia (Fearsnide, 2008).

5.1.3 Ranchers and land grabbers ("grileiros")

Much soy expansion in Brazil now occurs on land previously used for cattle grazing (WWF, 2014) and this practice is often considered more sustainable not involving direct conversion of forests. However, the risk is that it could indirectly contribute to deforestation pushing cattle production into the forest. By far, ranching for beef

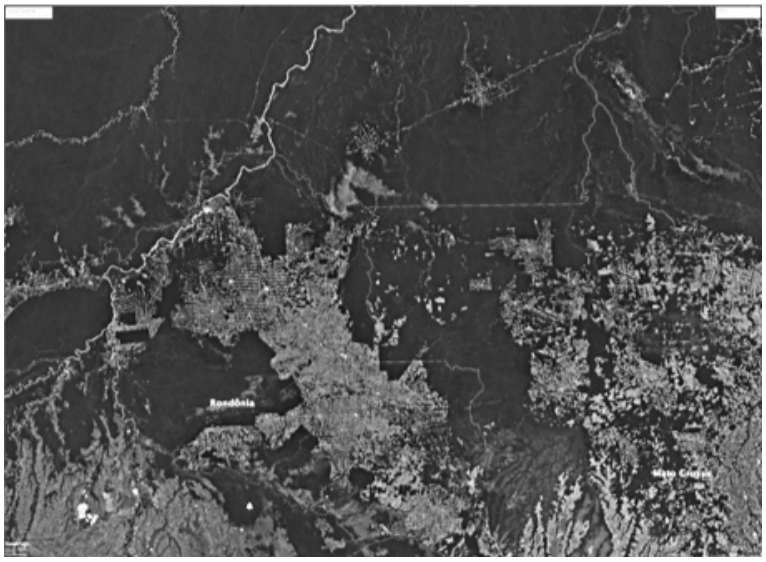

Figure 5.2: Deforestation in Rondônia

or milk production has been responsible for most of the clearing. This is mainly due to the huge profits made by ranchers enabled by government subsidies, but also by tax evasion and operations in laundering money from crime. Ranchers' land speculation related to inflation has also highly influenced deforestation before the 1994 Real Plan, a macroeconomic stabilization program which was able to decrease the 45% inflation in 1994 to only 1% in 1996 (Clements, 1997). A peak of deforestation was registered in 1995 with a subsequent decline in 1997 due to the release of investment capital by the Real Plan, which limited land speculation related to inflation. Fluctuation of beef prices are is strongly correlated to deforestation. When prices rise, ranchers usually hold their stocks for reproduction and growth, rather than selling them off, which causes prices to rise even more. An increased number of cattle requires more land, causing more deforestation.

Ranchers are linked to a number of other actors: landgrabbers or "grileiros", from which they can acquire the land; laborers, debt slaves, sem terras, that can end up working in their farms, or with which they can have conflict with; drug traffickers and money launderers that can acquire land or resources used by ranchers; capitalized farmers, to which they can sell the land if it needs to be converted into crops.

Illegal landgrabbers usually obtain large blocks of land taking advantage of the very confused and inefficient system of land claims in Amazonia, selling it to ranchers or other bigger organizations that can be more or less aware of the illegal origin of the land. Their movements along the BR-163 Highway linking Mato Grosso to Parà (Figure 5.3), have caused extensive land clearing that run alongside the road. High profits of ranchers and "grileiros" are, however, also further increased by the availability "cheap labor", which can actually be considered, to all intents and purposes, slavery. Sem terras seeking for employment as laborers, are often hired in deforestation crews. Their slavery is usually a consequence of being dependent on their employers for having food and other supplies. They buy their food on credit

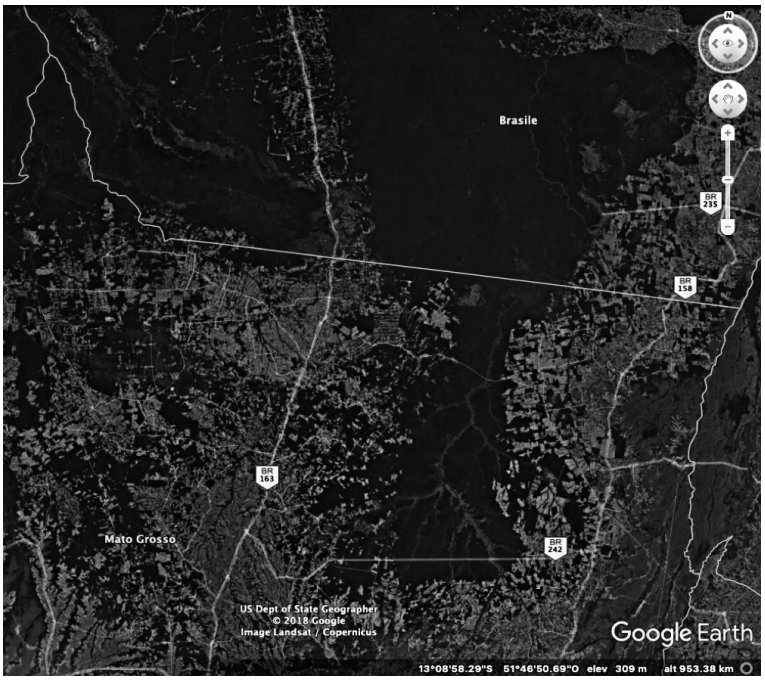

Figure 5.3: Deforestation along the BR-163 Highway, linking Mato Grosso and Parà

at inflated prices, accumulating debts that are impossible to compensate by labor credits. This mechanism makes possible for ranchers to "buy" slaves by paying off their debts from others. Still in 2006, a number of 25 000 slaves were found only considering the State of Parà (Fearnside, 2008). Thus, deforestation is facilitated by ranchers and grileiros having laborers for free, but also in case those same laborers avoided slavery, they would easily join the Landless movement or become landless migrants claiming for land and contributing to deforestation regardless.

The movements of population and investments in Amazonia (and their related deforestation) are generally based on the assumption that invading or claiming public land will eventually be rewarded by a permanent title (Fearnside, 2008). This phenomenon has characterized Brazilian history for over 400 years and will be stopped either by the depletion of all existing exploitable pieces of land, by enforcement and improvements of Brazilian national policies, or by a more considerate use of resources by all responsible parties.

5.2 The wealth chain: The responsibility of foreign farlmand investors.

The actors mentioned above, especially capitalized farmers, ranchers and land grabbers which act on a local scale, are strictly related to what might seem distant actors, based in other countries, but that indirectly fuel the dynamics explained above channeling capital. Financial actors such as pension funds, university endowments, and private equity can play a big role in that.

5.2.1 Foreign pension funds

People's savings meant for their pensions are usually entrusted to private or public companies with the task of increasing these savings and being able to guarantee them to workers when they retire. Such companies are addressed by governments or individuals. Pension funds and their asset managers are thus always looking for profitable markets in which to invest at very low risk. Recently, especially after the global financial crisis of 2007/2008, pension funds have started turning their attention to farmland. The reason is that they see into farmland a clear economic pattern of supply and demand, which in this case is based on a growing population which needs to be fed. Jose Minaya, president of infrastructure investments at TIAA-CREF, one of the biggest and most poweful American pension funds, explain with the following words their need to turn to farmland investments: "*The crisis has accelerated our agriculture programme. [...] What we saw in 2008-2009 was that the (agriculture) portfolio performed extremely well, and liquidity for us increased. The only thing that people had that was worth something was tangible assets - land*" (Davies, 2012). Furthermore, they are usually looking at countries with very low land prices, such as Australia, Sudan, Uruguay, Russia, Zambia or Brazil, and from which a double stream of profits is possible: the income streams from the exploitation of land with crops, dairy or meat production and the possible speculation of that land, whose value increase with time, allowing them to resell it at higher prices.

Pension funds can be considered among the heaviest players on the financial industry and "any movement on their art generates huge waves" (GRAIN, 2015). In Brazil, some of the most influential ones are US, Swedish and Canadian pension funds. This report will be mainly focused on the US and Swedish ones, since they are respectively the first and the second biggest investors in some important agricultural funds in Brazil. They are also interconnected in a companies' structure from two to four level of ownership, which enables them to manage extensive territories. In response to such growing interest in the country's farmland from international investors, Brazil attorney General reinterpreted a law from 1971 (5,709) in 2010, making the country's restriction on foreign investments in farmland also valid for Brazilian companies controlled by foreigners (Künzli, 2013).

An illustrative example showing how this system works is taken from the network which starts from the big US pension fund TIAA, which involves the Swedish pension fund as well as other pension funds from different countries.

5.2.1.1 The TIAA's "empire" in Brazil

TIAA (Teachers Insurance and Annuity Association) is one of the earliest and most significant of the big pension fund management companies to have invested in farmland (GRAIN, 2015). Based in New York, it manages the retirement accounts of around five million teachers and social service workers from 16 000 organizations, and is the largest international investor in agricultural lands (Fian International, 2018). Founded in 1918, it was named TIAA-CREF (Teachers Insurance and Annuity Association — College Retirement Equities Fund) until 2016, shortened to

TIAA. In this report, it will always be used the shortened version TIAA also referring to periods prior to 2016. When the name TIAA-CREF Global Agriculture LLC is used, it is referred to TIAA's agricultural fund.

TIAA started purchasing farmland in Brazil in 2007 and, in 2012, it launched its first international agricultural lands fund called TIAA-CREF Global Agriculture LCC, or more commonly, TCGA I, corresponding to a value of 2$ billion. In 2015 it launched a second agricultural land fund, the TIAA-CREF Global Agriculture II LCC, or TCGA II, worth 3 $ billion. These two agricultural funds, TCGA I and TCGA II, are fuelled by international pension funds' money. Most of the farmland in Brazil is owned and managed through these two funds (Fian International, 2018)

In 2008, TIAA together with Cosan, Brazil's largest sugar producer, established a Joint Venture, Radar Propriedades Agrícolas S/A (Radar) (Steinweg and Thoum, 2017), a company registered in Brazil with the purpose of identifying and acquiring land in Brazil which could be suitable to be converted into different plantations and crops, and that could be sold at a profit within few years (GRAIN, 2015). Initially, TIAA owned 81% of Radar, not directly, but through its 100% Brazilian subsidiary Mansilla Participacoes Ltda, while Cosan owned the remaining 19%. By November 2012, Radar had already acquired 392 farms in Brazil, corresponding to 151,468 ha of land and around 1 $ billion in value. Cosan is a Brazilian company that has always been characterized by taking advantage of fluxes of foreign capital for the acquisition of land. Its ambitions for expansion have always been very strong, explicitly stating its objective of transforming millions of hectares of land into crops (GRAIN, 2015). Cosan's land speculation ventures with TIAA fit neatly within this larger ambition (GRAIN, 2015). Controlling Radar, whose principal business is to speculate on farmland, Cosan and TIAA can both make profits by selling the land acquired at higher prices few years later, and by the operations on the farms, which are usually rented out to Cosan and TIAA themselves.

Still in 2012, TIAA created TIAA-CREF Global Agriculture LCC, (TCGA I) as another financial vehicle to channel capital into Brazilian farmland. Through this fund other institutional investors from other countries invest in farmland (as the Swedish AP2 and the Canadian CDP and bcIMC).

A way for TIAA to invest and acquire vast areas in Brazil - bypassing the legislation which restrict investment in farmland also for Brazilian companies controlled by foreigners - is to avoid to acquire land directly through Radar. In fact, TCGA funds are invested through another separate company called Tellus Brasil Participações S.A., registered in Brazil and owned by TIAA-CREF Global Agriculture LLC for 49% and by Cosan for 51%. But again, TIAA doesn't own directly that 49% of Tellus. Tellus is owned 48.9% by Terraviva Brasil Participações Ltda and 0.47% by Nova Gaia Brasil Participações Ltda, both companies registerd in Brazil. According to TIAA's 2017 own statements, Terraviva Brasil Participações Ltda is owned 99.99% by Nova Gaia Brasil Participaco Ltda, in turn 100% TIAA subsidiary, and 0.01% by TIAA-CREF Global Agriculture LLC (TIAA, 2017). Practically, through

this controversial system of subsidiaries, TIAA owns by 50% Tellus which is responsible for investing its funds in farmland.

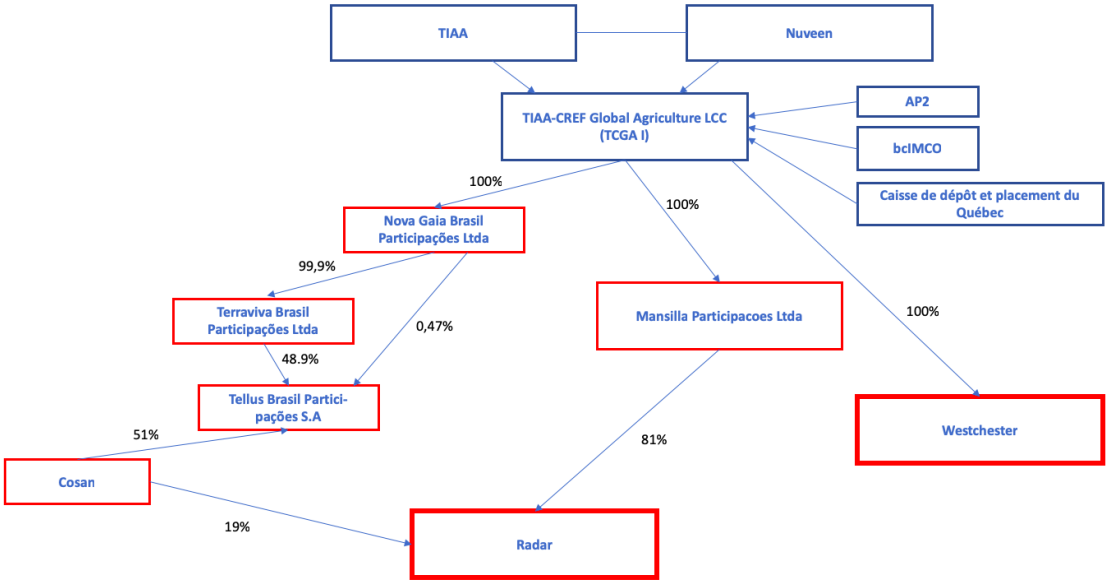

Figure 5.4: TIAA-CREF farmland investments in Brazil. In blue: foreign entities; In red: Brazilian entities (Data from: GRAIN 2015; TIAA, 2017; Fian international 2018)

In 2014, TIAA-CREF bought its global asset management company Nuveen for 1.6$ billions, who is now its 100% subsidiary. Through Nuveen, TIAA possesses and manages 768,902 hectares of land in five different countries on four continents for a value of 8$ billion (Pennington, 2016). In Brazil it holds 299,025 ha of land (Nuveen-TIAA, 2018). Farmland ownership in Brazil from TIAA is spread in different parts of the country. According to 2018 data from Chain Reaction Research on foreign investors, the size of farmland holding in the Matopiba states by TIAA through Nuveen are 80,989 ha. The rest of the farmland is in the States of Mato Grosso, Minas Gerais, Goiás, Mato Grosso do Sul and São Paolo (Figure 5.5 where TIAA owns most of its lands in Brazil, around 45% (Fian international, 2018). Nuveen's work in Brazil is supported by its affiliated asset manager, Westchester, a critical stakeholder in their farmland investment approach. Westchester identifies, acquires, and monitors farmland investments and is also responsible for the negotiation of the lease and crop management contracts. Based in Brazil, Westchester personnel is able to work directly with farmers and crop managers withing the local communities to ensure that Nuveen's Guidelines are met locally (Nuveen-TIAA, 2017).

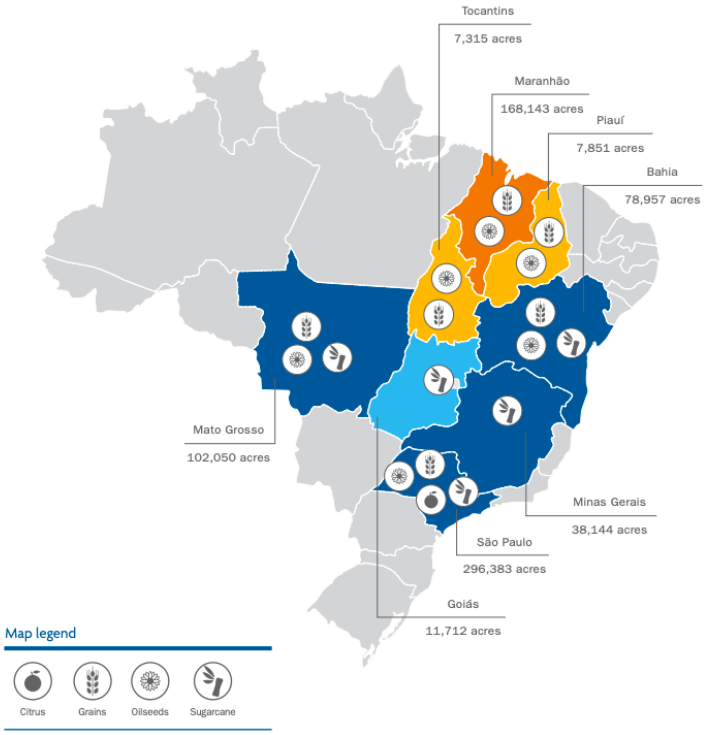

Figure 5.5: TIAA's Brazilian farmland holdings.
(Source: TIAA, 2016)

5.2.1.2 TCGA I

Table 5.1: TCGAI ownership shares by different pension funds (Source: Fian international, 2018

Investor	Country	%	US $ millions
TIAA Global AG Holdco LCC	USA	41.7	834
AP2	Sweden	23.0	450
CDP	Canada	12.5	250
bcIMCO	Canada	12.5	250
ÄVWL	Germany	5.0	100
National Pension Service of Korea	Korea	4.5	100
TIAA-CREF	USA	0.8	16

Through the fund TCGA I, TIAA owns farlmland in Piauì (3,177 ha), Maranhão (47,346 ha), Tocantis (2,960 ha) and Bahia (10,367 ha) (TIAA, 2016), the states which make up the so-called Matopiba region. As shown in Table 5.1, after TIAA channeling in TCGA I 834 $ million, the second biggest investor in the fund is the Swedish pension fund AP2, investing in TCGA I 450 million, which constitute 23% of the total fund. Canada is in third position as a country investor, through its two pension fund asset managers, Caisse de dépôt et placement du Québec (CDP) and the British Columbia Investment Management Corporation (bcIMC). Between

2011 and 2013, at least thirteen have been the farms acquired through the TCGA I fund, issuing over US$236 million in debentures to Radar and Nova Gaia Brasil Participacoes Ltda (GRAIN, 2015).

One of the farms which are owned by TIAA/Nuveen through TCGA I, is the Ludmila farm (Figure 5.6) in the municipality of Santa Filomena, State of Pauì, part of the Matopiba region. This farm is particularly representative of the dynamics happening in Matopiba, as well as in other parts of Brazil where the practice of *grilagem* is widespread. This region has been on target by many different institutional investors in addition to TIAA, namely the UK private equity fund Valiance Asset Management limited, which operates through SLC Agricola and the Harvard Endowment fund through InSolo Agroindustrial. They both own farms on the same plateau where the TIAA's farm Ludmila is located. Plateaus, also called *chapadas*, are highlands which have always been used collectively by local populations as grazing land or to hunt or gather fruits or wood (Fian international, 2018). They have always played an important role in the lives of the local people (GRAIN, 2015). Being formally state-owned land, (*terra devolutas*), this fact raises suspicions as to how large companies have been able to legally acquire them. Agribusiness has always been attracted by *chapadas* because they are particularly suitable for machinery and because the land prices are still relatively low when compared with some other regions where soybean farming is already more developed. The increase in soybean production in the area over the past years has mainly occurred through the expansion of large scale agriculture on the *chapadas*.

Figure 5.6: Ludmila Farm in Pauì (Nuveen Farmland Map, 2018)

The Ludmila farm, owned by Nuveen, has an area of 3,180 ha and as reported from

Nuveen's own data, it is used to grow "row crops" such as cereals, soybeans, corn and cotton.

Two different organizations, the NGO Grain and the FIAN International, respectively in 2015 and 2018, did field visits in Pauì and Maranhao, around Santa Filomena and other foreign-owned farms, and interrogated the communities living in the lowland areas, the *baixões*, such as the communities of Sete Lagoas, the Cabeceira do Angelim, the Melancias and the Baixão Fechado. What emerged from both visits was the same situation: local people complained that land grabbers were using violence to drive them off their lands and were then selling the lands to agribusiness companies. The communities of Sete Lagoas and Cabeceira do Angelim had their land fenced off by land grabbers. The latters were forced to leave both their lands on the *chapada* (specifically Chapada da Fortaleza, where Tellus' Ludmila Farm is located), and then were also expelled from the lowlands, *baixões*, where they had moved. The Melancias, a community situated in the State of Pauì, is living on the banks of the River Uruçuí Preto. For generation they had been sustained by the resources in both the *chapada* and the *baixões*. Expelled from the *chapada*, they are now confined to leave in the *baixões*, although here they suffer the consequences of the industrial farms surrounding them. They reported a drying process of the river with repercussions on their ability to fish and gather fruits from the trees and plants relying on the water from the river, which are also dying and disappearing. The heavy use of pesticides in the *chapadas* by industrial farms, is also impacting the river, with serious consequences on fisheries, on but also on bees, which they claimed are also disappearing. Health consequences are also as serious: they reported to see more cases of respiratory problems, cancer and skin diseases (Grain, 2015). The Baixão Fechado community, located in the Municipality of Santa Filomena, has also been expelled from their *chapada* and are also being pushed away from their *baixões* from land grabbers, to make the way to soybean plantations. Their community has been dealing with the Harvard-owned farm Fortaleza, and the TIAA-owned farm Ludmila, reporting their "constant harassment by land grabbers, gunfights and high degrees of violence" and pointing out as particular worrisome the conflict with Ludmila Farm, with which the community started a legal dispute over land ownership eight years ago, still ongoing (Fian international,2018). According to other interviews taken during a mission by GRAIN, 2018, the residents of Baixão Fechado also say that "public authority is non-existent and that the government has not taken the necessary measures to secure their rights" and that "the deforestation caused by both farms Fazenda and Ludmila, and the large amounts of water the farms use for irrigation, have badly affected their access to water which was previously plentiful and of good quality" (GRAIN, 2018). The following are the words from José Branco, a resident of the Baixão Fechado community, interviewed during Fian International's mission in 2017:

> *"They use pesticides such as Roundup. It destroys all of our crops, including the broad bean crop. We used to be a top producer of broad beans in the region. Now we are losing all of our broad beans... They spray that poison from their airplanes and it contaminates everything. A bunch of pests appear, like the white- fly which we can't kill, and they destroy*

everything"

These words from native people are a testimony of what have been, so far, the consequences of the establishment of foreign-owned farms in the Matopiba region. Among these farms, there are also the ones owned and managed by TIAA through Nuveen and the TCGA I fund. Capital coming from US, Sweden, Canada, Germany and Korea has partly contributed to what Josè Branco, and his community, clearly pointed out. Soybean expansion is leading this process, since all these farms are destined to that and other crops. Here are two other examples of TIAA/Nuveen farms, owned through TCGA I, in Maranhao (Nuveen Farmland Map, 2018), that, as explained in next section, have been linked to a famous Brazilian land grabber:

- **Sagitario**:
  State/Province: Maranhao
  County: Balsas
  Crops: Soybeans, cotton or corn
  Tillable Acres:21490
- **Marimbondo**:
  State/Province: Maranhao
  County: Alto Parnaiba
  Crops: Soybeans, cotton or corn
  Tillable Acres::25989

5.2.1.3 The link between TGCA I and land grabbing

Euclides De Carli is one of the biggest land grabbers in the Matopiba region, especially in Pauì and Maranhao, where TIAA and other institutional investors own much of their farmland. He is very well known in the region for having illegally grabbed over 1 million hectares of land in Brazil, including 13 farms in Maranhao, by means of frauds and falsifications. Carli is defined as "lord of the land" by Judge Heliomar Rios, from the rural court of Bom Jesus, in Piauí (Camargos, 2018). Carli is also accused of using armed criminals to expel people from their land and of ordering the assassination of a farmer who who refused to sell their land at low prices to the businessman (JusBrasil, 2011). One of the strategies used by Carli to obtain properties in the Matopiba region involves the use of intermediaries (figuratively called "oranges" in Brazilian) and a triangulation scheme with three registry offices, according to the lawsuit. Also according to that, the notary offices are suspected of having been conniving with the scheme because they even accepted a proxy signed by dead people (Camargos, 2018). According to a professor at the Federal University of Western Pará, who studies land conflicts in southern Piauí:

> *"His name causes fear in the communities and families from which he wants the land [...] "There is a consensus that Carli is a powerful figure who always wins."*

If, on the one hand, Carli is accused of stealing land, on the other hand he is considered to be modernizing the Northeast by opening the way for large soybean and cotton companies to enter southern Maranhão and Southwest of Piauí. Among its clients are agribusiness giants such as Cargill, SLC Agrícola, Bunge, Agrinvest and international funds, such as TIAA (Camargos, 2018). However, this process has been observed to have both social impacts on local population and environmental

impacts, since deforestation on foreign held farms represent 22% of the overall deforestation in Matopiba between 2000 and 2017. According to agrosatelite measures, an overall of 1.94 million hectares of forest in Matopiba has been lost during this period (Steinweg et al., 2018).

In 1990, De Carli created the company CODECA (Colonizadora de Carli) for soybean farming "with the goal of promoting the development of the Brazilian agricultural sector" (Network for social justice and human rights, 2018). This company has been reportedly linked to *grilagem* (Steinweg and Thoum., 2017). Different official documents (Radar oficial, 2007) can prove that Tellus acquired the Sagitario and Marimbondo farms from land that was previously owned by De Carli. In fact, in July 2007 CODECA applied for a license to produce grains on both farms (Radar oficial, 2007), asked for a for the renewal of a license to pursue agricultural activities (Estado do Maranao, 2007) and in 2010 CODECA got the license to establish installations on both farms. In 2011, Tellus, together with all the network of subsidiaries (Cosan S.A., Terraviva Brasil Participações Ltda, Nova Gaia Brasil Participações Ltda and Radar S.A.) announced the aquisition of Sagitario and Marimbondo farms, asking for a permit of water supply in 2013 (JusBrasil, 2013).

It has not been possible to show the link with similar evidence between the Ludmila and Laranjeiras farms, present on Nuveen's Farmland map, and Mr. De Carli. According to Steinweg et al. (2018), between 2010 and 2017, some 2,381 ha were deforested at these two farms. Also, a fire that broke out here spread and caused further damage to 110 ha native vegetation.

It has not been possible to GRAIN (2015) and other organizations to access the official documentation to substantiate that De Carli was involved in the sale of the Ludmila and Laranjeiras farms to Tellus. However, what is known is is that the farm has been named in the context of legal proceedings concerning the cancellation of illegally acquired deeds. An extension of 124,000 hectares of CODECA's land claims have been cancelled by Piaui's agrarian court (Steinweg et al., 2018). Moreover, the Brazilian Institute for Colonization and Agrarian Reform (INCRA) registered a request for a title deed on Ludmila farm by Euclide De Carli's daughter, which is an indication that TIAA (through Radar) might have bought this farm from De Carli (Fian International, 2018).

Radar actually acknowledged that it bought land from Mr. De Carli in the south of Maranhão and Piauí, and part of this land was deforested and leased out for soybean production (Network for social justice and human rights, 2018). According to The New York Times (Romero, 2015), also Cosan recognized that its venture with TIAA-CREF acquired farmland controlled by De Carli, although denying any criminal suits found by their reviews related to his name. Cosan affirmed that *"the evaluation conducted, needed to observe official documents and information that ground the safety of the acquisition"*, but public documents are easily accessible with a simple online research, revealing the land-grabbing accusation against Mr. De Carli.

Entrepreneur Euclides de Carli is accused in Piauí and Maranhão of being one of the largest land grabbers. In Piauí he is accused of using jagunços (hired gunmen) to take land from small farmers in the region of Santa Filomena. There have been reports of homicide crimes against small farmers who refused to sell their land at low prices to the businessman. In Maranhão the denunciations occur in the same way as in Piauí. The businessman works with soybean planting in both states and owns thousands of hectares of land (Camargos, 2018).

5.2.1.4 TCGA I and deforestation

The size of land holdings in Brazil reported in Nuveen's Farmland Sustainability Report (2018), corresponds to 299,025 hectares, acquired through different funds: Radar, TCGA I and TCGA II. Data until 2018 reported by Steinweg et al., (2018) has showed extensive deforestation linked to Nuveen and its TCGA and Radar funds considering the Matopiba region only, and there are still high shares of native vegetation outside of the legal reserve, which might be under deforestation risk:

Size of Farmland in Matopiba (ha):
Nuveen: 80 989
Radar I:10 000
TGCAI: 68 037
TCGAII: 2 462

Deforestation (ha) since 2000:
Nuveen: 72 753
TCGAI (2012): 55 920
TCGAII (2015): 8 208
Radar I: 8 625

Sum of native vegetation - Sum of native vegetation outside of legal reserve (ha):
Nuveen: 27 155 - 11 754
TCGAI: 22 153 - 11 390
Radar I: 3 584 - 364
TCGAII: 1 418 - 0

5.2.1.5 TIAA/Nuveen steps and strategies to tackle environmental and social issues

The first big step for TIAA-CREF toward responsible investments in farmland has been to take part to the group of UN Principles for Responsible Investment ("PRI") signatories, developing the Principles for Responsible Investment in Farmland, the "Farmland Principles", to guide all other institutional investors who wished to invest in farmland in a responsible manner. After that, in 2012, the same year TCGA I was born, TIAA released its first Responsible Investment in Farmland Report and has issued this type of reports every year since then.

Figure 5.7: Deforestation in Santa Filomena, Pauì, between 2001 and 2018, where the area of the Ludmila farm is located. In pink are highlighted the areas with a loss of forest cover higher than 30%. Spots in light green represent forest cover higher than 75% (globalforestwatch.org)

In 2014, TIAA bought Nuveen for 6.3 billions. TIAA made this decision in response to the business pressure posed by 2006 US Pension Protection Act, which had been to the advantage of rivals such as Vanguard and Fidelity (Norton, 2017). With the acquisition of Nuveen from TIAA, Nuveen became responsible for the management of the TCGA entities, investing in farmland with production two kinds of crops: row crops, including soy, corn, cotton, or sugarcane and permanent crops, including vines or trees, planted once and then producing crops over many years (Nuveen-TIAA, 2017).

According to Nuveen's Sustainability Director, Allison Spector, since the acquisition of Nuveen, the sophistication and rigor for responsible investing has continued to grow. There has been more attention to avoid the direct and indirect environmental and social impacts, with a deeper understanding of how these risk looked like from the point of acquiring new farmland, managing and operating it, leasing it and working it with local tenants, collaborating with the government and other local organizations. The due diligence process before acquiring new land has also drastically increased in becoming more sophisticated, with a parallel intention of risk mitigation and identification of new opportunities to create new value from a social and environmental point of view. Since it took some time for Nuveen to be integrated into TIAA, more activities on the ESG side (Environment, Social, Governance) were carried out when Nuveen was fully integrated, after 2015/2016 (Spector, Sustainability Director, Interview).

Up to date, Nuveen is the only foreign farmland investor with a zero-deforestation policy in Brazil. It has been adopted in August 2018 to ensure that their invest-

ments in Brazil discourage the depletion of forested areas and native vegetation on land they own or intend to acquire. Nuveen has in fact acknowledged the heightened concern that their "presence alone may indirectly encourage landowners to clear forested areas or native vegetation in anticipation of a sale", and wanted to be aligned with multinational companies operating in Brazil which have a similar goal. In this regard, according to Allison Spector:

> *"part of the reason why we drafted the policy is to say once and for all that we won't purchase land from land grabbers, and we're not gonna change our policy necessarily if the regulation changes. One reason why we have the zero-deforestation policy out there is to discourage land grabbers from trying to sell us, or thinking that there will be a buyer, when it has been put clear on our policy, that holds even if the regulations have changed"*

Being the zero-deforestation policy based on the most relevant deforestation protocols such as the Soy Moratorium Protocol and the Grãos Verdes Protocol, Nuveen is now formally committed not to purchase land in Brazil that has been cleared from native vegetation after different dates, depending on the biomes. For the Cerrado biome the date is May 2009 or later, in accordance with criteria set forth by the Roundtable for Responsible Soy. For the Amazon Biome, the date is July 2008. These dates are also aligned with the UN Convention to Combat Desertification, the Brazilian Forest Code and other Federal laws designed to protect specific natural resources of the country. (Nuveen, 2018). One problem related to Nuveen's zero-deforestation policy highlighted by Steinweg et al., (2018), is that the policy language suggests that its scope does not extend to farms already held in its portfolio, thus they might still accept legal clearing. However, according to Allison Spector, Sustainability Director, their zero-deforestation policy is based on the fact that deforestation is bad for the environment. The ultimately reason for them to deforest land, where that would still be possible, would be that they could have additional profits from that land. Nuveen's strategy to avoid this dynamic is to build a strong relationship with their investors (such as the Swedish AP2, or the Canadian bcIMCO9) and shared objectives with them, among which is to achieve zero-deforestation investments in farmland. So, if even Nuveen or other actors involved in the corporate structure had the intention to make more profits out of a weakened environmental regulation, Nuveen would need to respond to all their investors. Hence, in order to avoid deforestation even where it might still be possible, investors' influence and requests to their asset manager plays a big role.

5.2.1.6 The role of the National Swedish Pension Fund AP2

In this regard, the National Swedish pension fund AP2 has played a big role, making zero-deforestation policies a priority and working with Nuveen to draft one, even though, according to Allison Spector, to draft such type of policy a total alignment from all other investors was required, and finally found.

The AP2 had forestry investments prior to the agricultural investments in the TCGA funds where, since then, they were using certification schemes (such as the Forest Stewardship Council) and already required their managers to follows those schemes. Once they started investing in the TCGA funds there were not any international

certifications and they worked together with TIAA and other investors to create a common understanding of what was considered responsible investments in farmland, drafting the Responsible Investment Principles. The aim of AP2 was to combine responsible investments with large-scale farmland assets although, according to Christina Olivecrona, AP2's Sustainability Analyst, organic standards are still not applicable to their farmland investments.

The work of AP2 with the other investors and their in the agricultural funds TCGA I and II with their asset manager Nuveen is done TCGA board. Here, Nuveen reports to its investors audits' results, how farmland guidelines are respected and farms' compliance with domestic legislation. On the board, AP2 and the other investors can communicate and express their preferences on how they want their investments to be managed by Nuveen. In this context, AP2 pushed Nuveen for drafting a zero-deforestation policy. According to Christina Olivecrona, this was a reaction after reading NGOs reports' about farms installed on recently deforested areas, facts that really surprised the AP2 fund. Once aware of the problems of deforestation related to their investment, they felt the need of doing something about it. As Christina Olivecrona said in the interview conducted for this project, AP2 didn't want to be involved in such types of problems, and that it was quite obvious that clear expectations of each other, between AP2 and their asset manager, had to be clearer, and asked for the draft of the zero-deforestation policy valid whatever the local legislation in place. According to Christina Olivecrona, for AP2 is fundamental that farms are respecting laws and regulations, and have also pushed Nuveen to improve their transparency and to perform audits on the farms.

5.2.1.7 Disentangling TIAA/Nuveen from land grabbing

The zero-deforestation policy in 2018 has been a big first step for Nuveen to discourage land grabbers to clear land to be sold to foreign investors. Up to now, according to Allison Spector, almost all of the assets comply with the zero-deforestation policy, except *"a couple of places that now would not be eligible, but the team is working to remedy those particular situations. But almost everything is retroactively compliant"*. Furthermore, Nuveen is trying to find new and better ways to check land rights as part of their due diligence process. Since the Brazilian Government has databases but are not always up-to-date, Nuveen developed its own tools to satellite data to triangulate and understand how the land had been used at different periods of time. Also, land is also controlled with tools that can monitor that the land continues to be managed in the way it should. According to Nuveen (2018), due diligence processes are followed before acquiring property, covering the examination of legal ownership rights, the suitability of third-party managers, joint-venture partners, tenants or operators and financial risk and return. It is also reported their effort to go beyond title searches, reviewing existing farmland licenses, using government GPS data to substantiate ownership land claims. Due diligence is also conducted for confirming the seller's ownership rights. It is also mentioned their consideration for indigenous people and land, checking their exact location and their cross-referencing with farm boundaries, to avoid purchases that overlap with protected territories.

Regarding soy, one third of Nuveen's portfolio is in grains, and in its 2017 report on "Ethical conduct and responsible stewardship of the environment," Nuveen encourages its soy producers to adopt RTRS (Roundtable Responsible Soy standards), and today 30% of their tenants are RTRS certified.

5.2.2 University Endowments

Endowments are financial assets donated to universities or colleges and are intended to be invested for high returns in order give additional income for future investing and expenditures. Typically, universities depend on these investments return for supplementary income, hence a targeted return is set and long-term guidelines for a certain asset allocation are followed, which enable to yield the targeted return at low risk. Each university is regulated in a different way on the amount of money to spend yearly. For many of them, this amount is about 5% of the endowment's total asset value, which in cases of very rich universities such as Harvard, can worth large sum of money (Phung, 2019). As pension funds, university endowments started to turn their investments to farmland after the food price crisis in 2007, which made agricultural land appealing, and the financial crisis in 2008, which increased the appeal of more tangible assets (Moran, 2018). Also common to pension funds' investment strategy in countries like Brazil, is the construction of an "opaque corporate structure" (GRAIN, 2018), channeling money into farmland through complex systems of local subsidiaries.

5.2.3 Harvard University Endowment in Brazil

Harvard is a school worth billions of dollars, and with its $37.1 billion endowment fund, is one of the leading farmland buyer among US universities (Preqin, 2017). Before 2007/2008, it had already have some experience with farmland investments in the acquisition of global timberlands, linked to local destructive effects (Korn, 2017) and corruption (Bojin et al.,2016) in different parts of the world. This allowed Harvard to already have a corporate structure model that could be replicated into agricultural investments, in a low-risk country with potential high returns such as Brazil.

Today Harvard holds about 294,000 hectares of land in Brazil, through three different corporate structures involving three different local operators, Insolo, Caracol and GBE, which respectively account for 116,631 ha, 140,000 ha and 37,000 ha. In Figure 5.8 it is possible to observe the different corporate branches that Harvard has built to orchestrate its farmland deals. The first chain on the left shows that Insolo Agroindustrial S/A is owned (95.9%) by way of Harvard's fund management company Phemus Corp and a set of different subsidiaries regisered in Dalaware and Brazil. Same applies to its ownership over Caracol Agropecuaria, 100% owned by Harvard through its fund management company Blue Marble Holdings and a set of Delaware-registered subsidiaries (GRAIN, 2018). Both Insolo and Caracol (Prager and Milhorance, 2018) have soybean plantations. Also, Harvard channels money into a sugarcane company, Gordian Bioenergy, through a Cayman Islands company

(GRAIN, 2018).

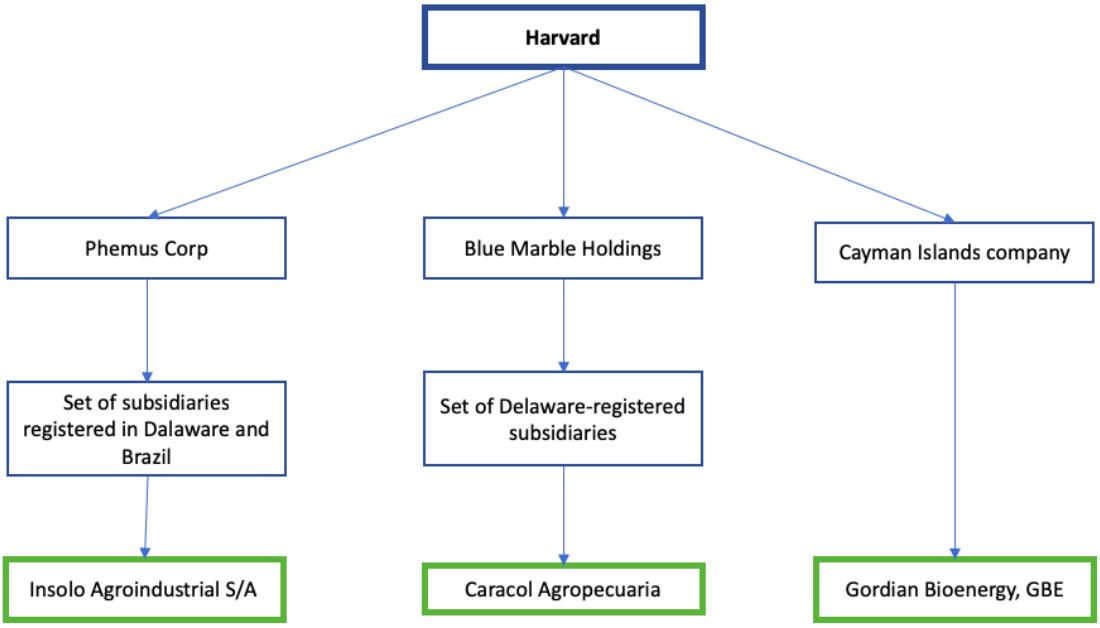

Figure 5.8: Harvard's corporate structure in Brazil and its link to three local operators: Caracol, Insolo and BGE (GRAIN, 2018)

5.2.3.1 Harvard's link to land grabbing and deforestation

Several of Harvard's farmland acquisitions have been severely criticized because of lack of prior due diligence processes, and have been linked to land conflicts and "notary irregularities" (Prager and Milhorance, 2018). One example is the Campo Largo Farm, a 140,000 hectare area in the state of Bahia, in the Cerrado biome. According to an investigation conducted by Mongabay (Prager and Milhorance, 2018), this area was public land (*"terra devolutas"*) in 1990s, legally transferred to small-scale family farms growing there different types of crops for their own consumption. These family reported the violence and the threats received to force them leaving their land, which has subsequently being passed from one owner to another, finally reaching Caracol Agropecuaria, a Harvard-backed company. Another case of inquiry has concerned Fazenda Ipê, in the state of Piauì. Here, the Insolo group acquired 160,000 ha of land covered by six different farms through serveral Brazilian subsidiaries. In 2018, one of these subsidiaries, Sorotivo Agroindustrial Ltda, has been condemned by the Agrarian Court Judge of Piauì for grilagem (Poder Judiciário Do Estado Do Piauí, 2018) in 27,000 ha of land included in Fazenda Ipê. According to Chain Reaction Research (Steinweg, 2018), the deforestation associated to Harvard's subsidiaries in Matopiba, has been of about 53,117 ha, out of about 294,000 ha of land holdings in this area.

6

Analysis

In this chapter the data gathered in the previous part of the report will be analyzed and discussed. It is important to note that all the reflections reported below are based on the information that could be retrieved within the time limits dictated by the drafting of this thesis project. The actors involved in this product chain are many, and it is therefore possible that further researches may find other relevant actors that may play an important role, connected to the ones identified in this project.

6.1 Financial actors along the chain

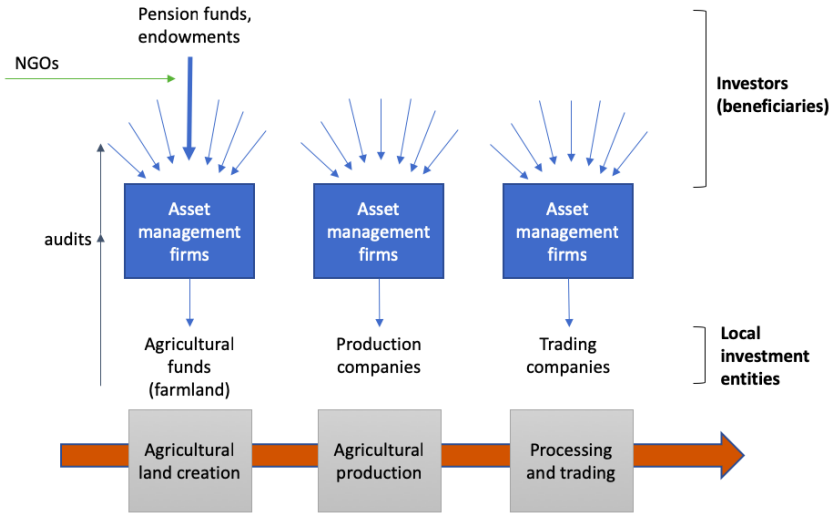

Figure 6.1: Illustrative framework of the actor system along the first three steps of the product chain.

Within the step of agricultural land creation, two types of institutional investors emerged as having significant influence on this process. These two types of institutional investors are primarily pension funds and endowment funds. In fact, as showed by (Steinweg et al., 2018), pension funds and endowments such as TIAA and Harvard have extensive land holdings in Brazil (they are respectively the first and the second biggest foreign investors in the country) and it has been possible to register very high levels of deforestation linked to their possessions over the years. Involved in farmland investments in Brazil, in only two agricultural funds (TCGA

I and II) there are pension funds based in seven different countries: US, Sweden, Canada, Germany, Korea, UK, the Netherlands. These type of agricultural funds are managed by investment management companies, but as beneficiaries pension funds have a significant influence on how these funds are administered. When it comes to endowments, Harvard university endowment certainly stands out among those most problematic from the point of view of the agricultural land creation from areas with conflicts and land grabbing, recently deforested or very polluted. In the cases of TIAA's and Harvard's corporate structures, both, as they have developed over time, recall the definition of Global Wealth Chains given by (Seabrooke and Wigan, 2014), as they "thrive on rendering movements through the chain opaque", through a complex system of subsidiaries which has helped them increasing the scale of their investments on Brazilian land.

What emerges when looking at the production step, is that international asset managers and commercial banks are the most common types of financing for agricultural activities. However, in this step there are in general a mix of different types of financial actors from many different countries. Among some of the biggest producers - O Telhar, SLC, Xingu SA, BrasilAgro, Agrex and Terrasanta - it is possible to find hedge funds such as Altima Partners from UK, private equity firms such as Capital group from US and Valiance from UK, real estate companies such as the Argentinian Cresud, but also Asian investors, as the Japanese Mitsubishi and Mitsui and Co. The latter, have recently formed ventures of many different production companies, to make sure they get large quantities of soybeans to export to Asia, where they are then processed. Also, within production, the Brazilian Development Bank (BNDES) plays a big role in disbursing rural credit to farmers, enhancing production.

When it comes to the processing and trading step, looking at shareholders and bondholders of big traders such as ADM or Bunge - the ones publicly listed and for which more information are available and responsible for almost a quarter of all soybean exports - most of them are from US. In particular, the "Big Three" (Vanguard, State Street and BlackRock, all US-based investment management firms) have a considerable influence in the companies, holding together much of the shares for both firms. Looking at the information available for Cargill, which by itself is responsible for 13% of the soy exports, most of the financial institutions holding its bonds are also from US. Asian investors are also emerging as important players, gaining more and more power in the last years. However, the Asian investment branches in Brazil does not seem to develop integrating themselves to the "traditional" system, meaning investing in the big traders that have been operating in Brazil for decades, as American investors have done and are still doing. What Asian investor are doing instead is to create a parallel system investing in Chinese traders such as COFCO, which acquire foreign companies, producers or other traders, to ensure consistent product flows in Asian countries that are more directly controlled by them. In this way, China - more than Japan - can count on two different big soybean flows: one flow from its Chinese investment branches, directly managed by them, and another consistent flow from all other traders which find in China as one of their biggest importers. Overall, what emerges from this picture, is that in the

production step of the product chain, investment management firms play the biggest role on the product flow, especially US-based firms, with a parallel and increasing influence played by Asian investors. It is important to note that certainly also in this step there will be pension funds or other institutional investors related to the Big Three or other asset managers, but the information retrieved during this thesis project has not shown that they have a particular role to play in this phase, as at the beginning of the chain.

In summary, looking at these first three important steps of the product chain (Figure 6.1, they differ from each other for what investors may be interested in: agricultural funds - and therefore farmland and agricultural production - in the first step, production companies in the second, and mainly large soybean traders companies in the third step. Asset management firms certainly play an important role in all the steps, as intermediaries between all other investors and the entities to invest in and make profit on. In fact, asset managers' job is to manage investments on behalf of their customers. Going back to their international clients, those who have emerged as particularly influential on one of the processes we looked at, are pension funds and endowments. And since this process is agricultural land creation, a fundamental point where to intervene to reduce deforestation linked to agricultural production, the type of interactions occurring here between different actors can play an important role.

Institutional investors, especially pension funds and their asset managers, are fiduciary investors which have the responsibility of maximizing profits on behalf of their beneficiaries (citizens when referring to pension funds, pension funds themselves when talking about their asset managers). Land is a tangible asset, seen by investors as a stable asset to have in their portfolio, ensuring a stable income flow and steady returns, at low risks (Gro, 2016). Hence, farmland for institutional investors has become a very important asset especially after the global financial crisis. Land, in fact, has also the benefit of being profitable in different ways: through agricultural production, or through capital appreciation of land or timber (Gro, 2016). As more and more institutional investors from different countries have recognized these benefits, and as meat consumption has continued to increase requiring more protein-rich animal feed as soybean, the need to have more agricultural land available to cultivate has increased. Moreover, Brazil has been targeted by institutional investors as one of those countries with very low land prices (Grain, 2015). If we consider these aspects, it is not surprising to find institutional investors such as pension funds and endowment funds as particularly relevant in this specific first step of soybean product chain, holding very large shares in agricultural funds, more than in other types of investments along the chain.

6.1.1 Interactions

The types of interactions between different actors on a vertical level (investors, asset managers) guide how investments are carried out on a more local level on the chain. In Figure 6.1 are represented the main entities recognized of more relevant

interest for investments in each step (farmland, production companies, processing and trading companies). The interactions between financial actors and these entities will be analyzed looking at two different levels for the first step of agricultural land creation, where more information have been retrieved for the scope of this project: the highest level of interaction is between pension funds (investors, or clients) and their asset managers; the lowest level is between asset managers and farmland. There are also ways of interactions between investment entities and remote actors, that will be analyzed only for the first step of the chain. For the other two steps of production and trading, the interaction will be analyzed only on the lower level, between asset management firms and investment entities.

6.1.1.1 Agricultural land creation: from pension funds to farmland

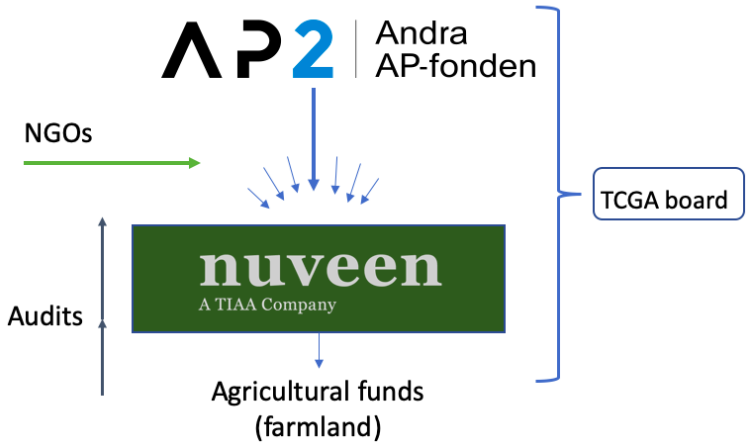

Figure 6.2: Interactions from pension funds to farmland

To understand the interactions within the first step (pension funds, asset managers and farmland investments), interviews were carried out with an asset manager (Nuveen) and one of his most important beneficiaries (the Second National Swedish Pension Fund, AP2), chosen because investing in one of the biggest agricultural funds in Brazil, holding more than 300,000 hectares. What emerged from the interviews, showed in Figure 6.2, is that Nuveen, the asset manager, has direct contacts and dialogue with all beneficiaries who invest in the agricultural funds (mainly pension funds). According to Nuveen, the relationship with the latter does not depend so much on the share they hold in the funds, as Nuveen tries to establish a strong relationship with all its beneficiaries without distinction. What changes, however, is the type of dialogue carried out with each of them, as each investor has different interests and priorities on which they want Nuveen to focus on. This means that for each new policy proposed by one of the investors on the fund, it has to be agreed by all other investors. This can cause problems in cases where, for example, environmental and social issues or policies are at stake, if not all find it beneficial to improve how investments are managed in this sense, or if that is not found profitable for everyone. Fortunately, the policy of deforestation has found all investors unanimous, and to date Nuveen is the only foreign investor in Brazil to have one in place.

If it is assumed that the other asset managers who manage agricultural funds also have the same or similar type of relationship with their beneficiaries, this conflict of interest between them could be one of the causes that has not yet led other investors to drawing similar policies. However, regulatory, reputational and operational risks might unify investors' views on these issues. In fact, these type of risks is what has mainly led the National Swedish pension fund (AP2) to communicate their concerns to their asset manager Nuveen, after reading NGOs reports on farms they were investing in linked to deforestation and land conflicts in 2015. After reading the findings of the reports, AP2 asked TCGA to follow stricter procedures to verify land titles, in respect of local laws and indigenous community rights. This episode also explains the big role played by NGOs in highlighting these problems, which can, as shown by this case, enhance constructive interactions between different investors at different levels. The exposure of environmental and social problems by NGOs has also been recognized as a positive input by Nuveen's Sustainability Director Allison Spector. Hence, the empirical case of Nuveen's agricultural funds TCGA I and II, indicate that the interactions between the two levels of financial actors (asset managers and beneficiaries) are influenced by beneficiaries' preferences, financial risks and, in part, also by NGOs' or other entities' and organizations' public exposure of specific investment issues.

If we get closer to the product flow and try to analyze the interaction between financial actors and more local actors in the agricultural land creation step, the relationships that we find at this lower level are very tight, but at the same time, the closer we get to the product flow (hence to farmers and local communities), the less investors in the agricultural funds seem to have much direct control, which is in the hands of their asset managers. If we consider the case of Nuveen, as showed in Figure 5.4, most of the Brazilian companies operating on land are 100% subsidiaries of Nuveen, a foreign investor managing agricultural funds, in which participate other many foreign pension funds. These 100% subsidiaries are responsible for acquiring land (such as Radar) or responsible for the relationship with lessees or tenants, and operational management of farmland (such as Westchester). Being 100% subsidiaries of Nuveen (or TIAA, which is ultimately the creator of the agricultural funds), means that those companies are 100% owned by Nuveen and TIAA, hence they are in control of how land acquisitions and relationships with tenants are carried on. Land acquisition, as showed in Chapter 5, has been one of the main aspects linking the name of TIAA to land grabbing, and same has happened with Harvard's name. In the case of Nuveen, as declared by its Sustainability Director, they have been trying to continuously improve the due diligence process since their acquisition as TIAA'a managers in 2014, and have always tried to find better ways to check land rights related to their acquisitions, also pushed by some specific investors, such as the Swedish AP2. In this case also, NGOs' work has probably pushed the process of improvements in this sense, to avoid or minimize reputational risks for investors, as well as other risks.

A way for Nuveen, as well as other asset managers in this step of the chain, to have information about production, environmental and social conditions in the farms in

Brazil, is to conduct audits. Nuveen, for example, uses an external company that physically goes to the farms, collect the data, talk to the tenants and to community members to understand labor conditions, wadges, etc. This company feeds the data back to Nuveen that in turns communicate the findings to its investors. According to the results, investors can see if their investments are conducted according to their principles or not, can communicate to their asset managers their concerns or discuss improvements. Hence, audits allow a dialogue between local and remote actors. However, information about audits have been found only from 2015 on, one year after Nuveen has become TIAA asset manager. The AP2 fund and the other investors of TCGA I, the first agricultural fund, started investing here since 2012. Hence, there are indications that a more aware interaction between AP2 (and the other investors in the fund) and the farms has improved from 2015 on. In fact, thanks to the findings of the 2015 audits which found problems in many farms, AP2 has decided to change the fund policy around site visits and to have more in depth ones (AP2, 2017). The results of the next audits will be received by AP2 in June 2019. According to Nuveen's Sustainability Director, audits are performed checking on communities that live either on the land of their possessions or in proximity of their possessions, to ensure that their economic activity is being supportive and are not affecting the ecosystems and the environmental resources entitled to local communities. However, this is still in contrast with the NGOs' site-findings on local communities (FIAN, 2018; Grain, Harvard, 2018), which complained about the heavy use of pesticides and lack of water.

The interactions between remote actors and farmland have improved over the years for the case observed more specifically for this study, between the Second Swedish pension fund and the Brazilian farms. Audits, at least for conditions within the farms, have been a useful tool to improve connections and dialogue between remote and local actors. However, the contrast between the complaints from local communities and Nuveen's self-declared aim to support local development, shows that there is still work to be done in this sense. As long as local communities surrounding TCGA farms are being affected by their agricultural activities, environmental and social sustainability has a long way to go. In fact, focusing on the concept of value, as long as local communities are still affected, the value that is created from that farmland comes back to the financialization process itself, feeding the wealth chain, but not the local Brazilian community.

Other remote financial actors operating in this step of the chain also need to have a closer relations with their investment entities on land. The stable returns that remote investors get back, are created in physical context where environmental and social factors are determining factors. As showed for the AP2 case, a stronger awareness of what is going on in local areas where the investments are located, can avoid to incur in future financial risks (operational, regulatory or reputational) linked to environmental or social problems.

6.1.1.2 Production, trading and processing

The interactions occurring between asset managers and investment entities in the other two steps of production, processing and trading, are similar to each other. In both cases asset managers have small (usually less than 12%) ownership share in each of the investment entities (production companies and trading companies). Asset managers have this type of approach here to diversify their portfolios lowering risks. However, with such small percentages of ownership in each companies they have less stake in each of them, compared for example to the share of pension funds in agricultural funds (which arrives at 25-40%). The influence that each investor can exert on each company is much smaller. The way asset managers can show their preferences in each of the companies' management strategies, is voting during proxy seasons, with direct engagement with the companies, or through divestment (if the company's is not respecting its investor principles or interests).

The different ways of interactions along the chain are dictated by the different shares of ownership that investors have in the investment entities. What has been observed from the analysis of two big agricultural funds is that here shares of ownership by investors can be very large (the AP2 has the 23% of ownership on TCGA I and 25% on TCGA II), while shares of ownership in production or trading companies don't exceed 12%. The result is that in agricultural funds investor can have a bigger influence on how to drive the investments, while in other cases the interactions between more remote actors and local entities might be more difficult, hence less control and influence can be exert here, and less sense of responsibility is felt by most of the investors.

6.1.2 Ways of approaching sustainability

Linked to the type of interactions between actors is also their way of approaching to sustainability. What has been observed by Steinweg et al. (2018), is that among foreign investors operating in Brazil, only one has a zero-deforestation policy in place, Nuveen. In this sense, and also looking at the low scores given to some of these investors' ESG policies by Levicharova et al. (2018), among investors leading agricultural land creation, mainly farmland investors, strong ESG policies don't seem to have spread yet. Weak ESG policies or absence of zero-deforestation commitments from investors indicates that there will be less requirements of this kind to their subsidiaries, which are responsible for land acquisition or production.

When it comes to production, Levicharova et al. (2018), showed that Brazilian soy producers ESG policies are also weak, lacking of environmental commitments and mainly focusing on governance and disclosure, human and labor rights. When it comes to processing and trading, 49% of companies have committed to make their supply chains deforestation free. Investors in this step, however, mainly US asset managers, have on average weak forest policies (ADM, Steinweg et al., 2018). The extent to which production and trading companies are committed to more sustainable practices has repercussions on the relationship with their investors and clients. In fact, if investors have strong ESG policies already, they will require their

subsidiaries to have stronger ESG policies as well. This affects especially soy production companies with weak ESG policies that might risk divestment by some of their investors, and might also risks to loose customers among traders.

6.1.2.1 Main differences observed along the chain

In the first step, where agricultural funds are the main investment entities recognized, it has been observed very high shares of ownership by investors and in particular by pension funds from different countries. This large shares are not characteristics of the other investment entities (production and trading companies, Figure 6.3). These differences might affect approaches to sustainability. In fact, in the first step, investors who have strong ESG policies or are particularly committed to environmental and social issues, can have much more power on their farmland assets in making more sustainable choices, compared to the influence that can exert investors with similar principles on the other main investment entities along the chain. The approach on the first step, in agricultural funds, can be seen as much more direct and influent compared to the possible approaches in the other investment entities.

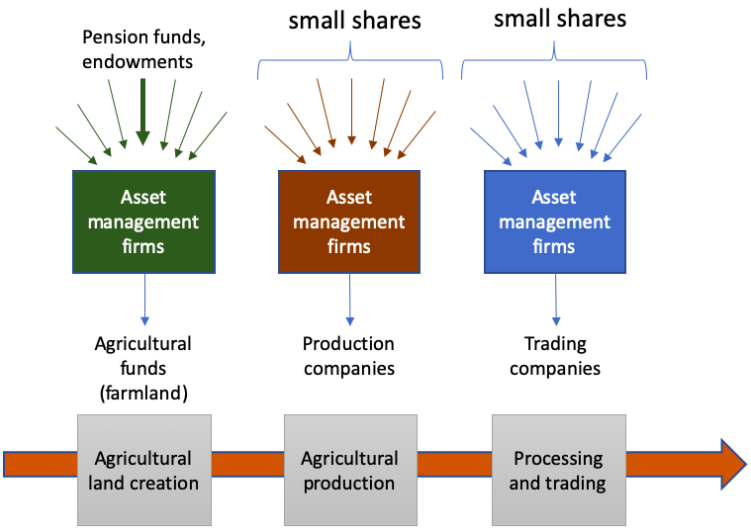

Figure 6.3: Main differences along the chain

6.1.2.2 Wealth and sustainability. For who?

As mentioned before focusing on interactions, there is still a strong contradiction between Nuveen's (on the behalf of its clients investing in the agricultural fund) intent to enhance local development and wealth, with the actual situation declared by local communities.

Talking specifically about Nuveen, there's undoubtedly been improvements in its sustainability approach, and TIAA's and other pension funds' agricultural investment have been more responsibly administrated since Nuveen's acquisition as agricultural funds' new asset manager. As stated by the Sustainability Director, since

Nuveen started managing farmland investments, they have tried to focus on environmental and social risks mitigation, sophisticating due diligence processes prior to land acquisition and drafting a zero-deforestation policy, which also helps reducing land grabbing. As it was only drafted in August 2018, concrete progresses in terms of reducing deforestation in their properties or reduction of land grabbing episodes will be observed in the coming years. What is significant to note, however, is that as an institutional investor, "*there are a number of constraints around the types of activities that we can do in the name of sustainability, if they don't help us maintain return for investors*", as stated by Allison Spector. Nevertheless, there has been recently a shift in how Nuveen and its investors have started approaching sustainability, which is not only thinking about it and ESG policies as only risks, but as opportunities. They have realized that returns have increased when they have started to focus on sustainable land management and environmental improvements.

If we reflect on these statements, it is perhaps possible to find some explanation for the problems encountered by interviewing local communities, who claim to be damaged by agricultural activities carried out in the large farms of Nuveen (such as those of Harvard, which are often very close). Some types of strategies used by Nuveen for a more sustainable use of land, such increasing water efficiency, increasing soil health, inevitably lead to an increase of returns. The same cannot be said about safeguarding the well-being of neighbouring communities, which in reality have always been the ones to ensure a true sustainable use of the land. Sustainability and proactiveness also include the well-being of those communities, which at the moment are still affected by the presence of these large investors. To improve institutional investors' sustainable approach, there is apparently a great need to look beyond the boundaries of individual farms. The work of the NGOs that document these hardships, also in this case, can be really fundamental to trigger the action of financial actors as well.

The same argument applies when referring to the National Swedish pension fund (AP2). In particular, their mission, as well as the mission of the other three pension funds, is defined by the Swedish parliament for which "*the AP funds must manage their funds in an exemplary way through responsible investments and responsible ownership. When managing funds, special emphasis must be given to how sustainable development can be promoted without compromising on the overall objective regarding return and risk*". When it comes to responsible investments and ownership, the AP2 follows the UN-backed Principles for Responsible Investment (PRI) Farmland Guidelines, which are the ones followed by its asset manager Nuveen. Key performance indicators (KPIs) are used to track progresses in their possessions regarding soil health, use of water, respect of labor and human rights (for tenants, operators and crop managers), ownership rights. Also, Nuveen and AP2 communication strategy focuses a lot on their contribution to the SDGs, in particular SDG 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture), SDG 6 (ensure access to water and sanitation for all), SDG 15 (Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss).

In practice, the AP2, through Nuveen, aims to have responsible investments in large-scale farmland assets, which don't allow for organic agriculture here in Brazil (although AP2 has other investments in organic farming, such as dairy farms in US). Moreover, KPIs considered don't really quantitatively capture how their large-scale monoculture affect biodiversity, or how much emissions are produced by their practices, or how local development and well-being is promoted. When comparing with the NGOs reports, the fact that agriculture is large-scale and non-organic is what is most affecting local populations surrounding their farms. In this respect, during the interviews both Nuveen's and AP2's representatives stated that they aim to improve measuring how carbon content in the soil changes according to agricultural practices and, more in general, to go beyond KPIs to have impact indicators or impact metrics to really capture the impacts in their possession in Brazil and their other investment countries.

Considering both the climate emergency affecting our planet, but also the condition of local populations denounced by NGOs, a quantification of impacts is very much needed in Brazil - and also in other investment countries - and social inclusion and protection of local communities by those impacts should also be part of responsible investment principles. The zero-deforestation policy, which discourage land grabbing and can have positive impacts on the climate, also needs a quantification of the impacts over time, crucial to really understand progresses.

The ultimate question Nuveen, AP2, and all the other investors who are particularly concerned about environmental and social issues, should try to answer, is if large-scale farmland assets, where organic standards can't be applied, can really allow for responsible, sustainable investments or not. Considering the state of our planet today, we urgently need to identify where most impacts are in our practices and find more sustainable alternatives. Also in this case, only quantification of environmental impacts and controls out of farms' boundaries can allow for different choices to be made, and reflect on possible solutions.

6.1.2.3 A new meaning of fiduciary duty is needed

Institutional investors respond do their beneficiaries, they manage money and maximize returns for them. This is the framework used by all the financial actors analyzed in this project, where financial benefits are put as a priority. Clearing land for agricultural purposes is a process that can particularly lead to adverse incentives, and can create limitations of what asset managers can do in the name of sustainability. In fact, for some of their beneficiaries clearing land can be the choice that might benefit returns, especially in a scenario where protein-rich agricultural products, such as soybean, are increasingly needed to sustain a growing population consuming more and more meat.

However, in order to be really defined sustainable, investments need to help societies and individuals to mitigate and adapt to climate change. They need to ensure not only environmental sustainability, but also social sustainability, ensuring

equity and justice in the areas where investments are placed. Today this has not yet occurred in countries like Brazil because of the conventional framework still used by asset managers and their investors, where the financial benefits always come first, and depending on them everything else follows. In the new framework of sustainable investing, able to respond to global challenges, fiduciary duty must ensure not only financial benefits, but also social and environmental ones, putting all the three aspects on the exact same level (Krosinsky and Robins, 2012).

6.2 Zooming on agricultural funds' investments

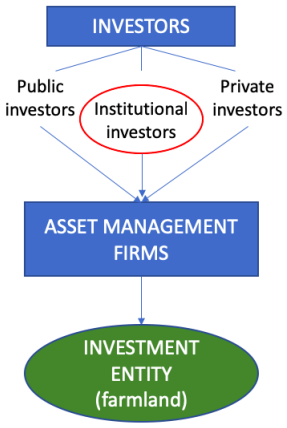

Figure 6.4: Simplified scheme of farmland investment structures. Institutional investors are marked in red because of their substantial ownership shares in agricultural funds. It is important to note that according to the investment entity the influence of other types of investors vary, and other types of investors may become more relevant. Source: Ouma, 2016

As showed in Figure 5.4 and 5.8, the corporate structure built around farmland investments involves between 2 and 4 levels of ownership, as shown in Figure 5.4. In Figure 6.4 a more schematic and generic corporate structure is represented, which can be applied to the empirical cases studied in this project (TIAA/Nuveen's and Harvards'), but also to other investors in farmland assets.

Institutional investors such as pension funds have showed a great interest in farmland in the past ten years (Network for social justice and human rights, 2018). For them, investing in farmland means putting capital into agricultural funds administered by asset managers. As evidenced by the example of agricultural funds administered by Nuveen for TIAA, in between the agricultural funds and the concrete agricultural farms on land, there are many various local subsidiaries (in Figure 5.4 these local subsidiaries are represented by the red boxes). These Brazilian companies are responsible for acquiring land, selling it, leasing it or operate it. Everything that is done by these companies (such as Westchester, Radar or Tellus, that are all 80% or 100% owned by TIAA/Nuveen) has to be managed and checked by the asset manager Nuveen. Hence, farmland is acquired through local companies, leased and then

operated by local tenants to generate constant income streams, through cultivation of raw (such as soybean, corn, cotton, rice) or permanent crops (fruit trees) in very large agricultural possessions (monocultures). Some of the most remote investors, such as AP2 that has about 25% of ownership of two agricultural funds, do visit to the farms they invest in, to check compliance with regulations and general conditions. Hence, this step in the chain allows direct control from some of the most remote investors, given the high percentage of ownership of many of them. Despite the intricate ways of acquiring land through the complex corporate structure in Figure 5.4, even the most distant actors have several, fairly direct, ways of intervening in the way investments are managed.

However, being financial profits at the base of fiduciary duty, the investment scheme illustrated in Figure 6.4 is a network of actors where the flow of capital constitutes a closed loop. The capital is injected in farmland, and from farmland it goes back to investors, leaving few space for environmental or social inclusion. A way to open this loop and make it more sustainable is to expand the network of actors establishing new social and financial relations with different local actors, also on a smaller scale. In the case of Brazil, financialization of farmland has not has not proven to be socially inclusive meaning that there is still a striking opposition between the financial network how is it illustrated in Figure 6.4, and the local population (GRAIN 2018; GRAIN 2015; Fian International 2018; Prager and Milhorance, 2018). One of the arguments in the dedicated literature has been that “hungry capital” (Russi, 2013) contributes to rising land values, threatening the ability of smaller farmers to keep their land or acquire new one. Also, such corporatization of the food system threatens food security among the affected rural communities, whose land can be often sequestrated by grileiros – in the case of Brazil – then sold to big corporations, and subsequently managed with great use of chemicals.

Zero-deforestation policies are a first step to discourage land grabbing and reduce illegal deforestation. However, if deforestation on private land were still possible according to the Forest Code, there would be no other means to stop it, because it would be perfectly legal. The Brazilian Forest Act revision is also further threatening legal reserve requirements, allowing 50% of reduction of protected areas if more than 65% of a state’s territory is already protected public land (which includes indigenous reserves and public conservation units) (Freitas et al., 2018). Most of zero-deforestation commitments by investors or companies still lack clear and explicit references to rejecting also legal deforestation (such as Nuveen’s, ADM’s, Cargill’s and Bunge’s committments).

As Nuveen’s Sustainability Director sais about their zero-deforestation policy: "*If an investor had the intention to make more profits out of a weaken of environmental regulations, we would need to respond to our investors.*". Zero-deforestation policies are surely a first step, but some other measures are needed to really reduce investors’ impact on land. Also, the heavy use of chemicals remain a big problem affecting neighbouring populations.

However, if we reflect on how these "global wealth chains" can finally stop the deforestation associated with their farmland assets and improve the relationship they have with their hosting countries (especially developing countries), a number of measures might be possible. There's a need to assess more quantitatively and specifically their impacts on land and on climate; this can be done through stronger regulations on investors, asking them to provide better quality environmental assessments of their operations. Also, stronger regulations based on emissions and other impacts (biodiversity, human toxicity, water pollution) extending the boundaries also to the surroundings of the farms, might discourage investors from legal deforestation and use of chemicals. In general, disincentives to clear the land (also in a legal way) must be urgently created. Another way of action is the redefinition of fiduciary duty and the inclusion of environmental and social profits, which might enable the network of actors to be more socially inclusive and a leverage point for a shift to smaller-scale agriculture.

6.3 The methodological approaches

This project has looked at the soybean product chain with a life cycle perspective, but instead of focusing on the processes and their impacts, there has been an attempt to reconstruct the network of actors who manage these processes and that are the cause of the impacts accounted by LCA studies. LCAs' ultimate aim is to recommend different types of interventions at different steps of product chains in order to minimize environmental impacts where they are most critical. Looking at the actors, at their direct or more indirect influence on each process along the product chain, some of the most significant receptors of LCAs' recommendations are also identified. Furthermore, the method used in this project has not looked at just one type of actors, but has looked at different ones at different levels and "distance" from the product flow, showing that also remote financial actors, from different countries, can influence local conditions and must be taking into account when addressing environmental and social impacts. In fact, the preferences of a couple of foreign pension funds led to the drafting of the first zero-deforestation commitment for one of the biggest and most deforestation-driving foreign investors in Brazil, TIAA/Nuveen. Hence, some of them can practically intervene on a very local scale if needed.

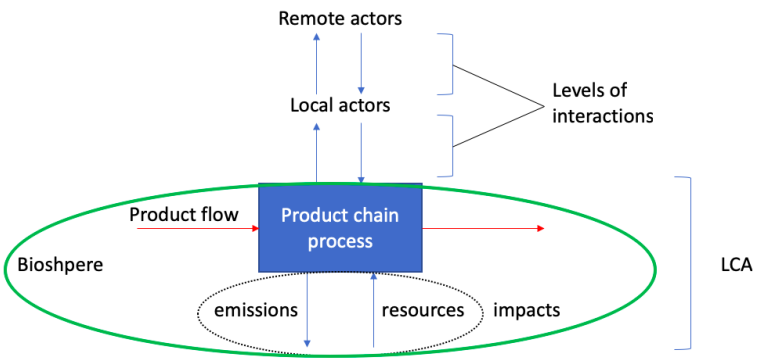

Figure 6.5: One step process, from biosphere to remote actors

This study has shown that not only the identification of actors responsible for impacts, but also the understanding of the relationship existing (or not exsisting) between them is important. It's the "intricate interplay" (Galaz et al., 2015) of network interactions that in Brazil often determines the fate of vast areas of territory: the need for stable, consistent returns for investors channels money into large-scale farmland assets, disadvantaging small scale farmers, contributing to inequality and poverty, which in turn are major causes of deforestation (as evidenced by the deforestation driven by landless migrants and sem terras on the borders between of the Parà state). Deforestation is thus driven by these interactions, not by single actors. By looking at the relationships at different levels of interaction (Figure 6.5) between the various actors, how they work, which principles regulate them, and what impacts these imply, it is possible to understand how and at which level to improve them to minimize the impacts. In this sense, the study of the so-called "global wealth chains" (Seabrooke and Wigan, 2014) and their local operations (in Brazil, for our specific case), has allowed to contextualize the "operative dimensions of circulation" (Ouma, 2015), meaning practices that shape and generate the circulation of capital and resources. LCA studies on technical processes may find causes of the impacts assessed also at higher levels of interactions, such one the ones where global wealth chains operate.

LCAs look at environmental impact along different steps of the chain. PCOs that reconstruct the network of actors along the product chain can then indicate for each step the potential responsible actors for the impacts. This thesis project, in fact, has recognized the influence of different actors in different steps. Understanding the differences and the weight that some types of actors have compared to others, can help addressing specific impacts along the chain to their possible major contributors, identifying strategies for improvements without missing out important transverse relations that might occur along the chain.

7

Discussion

This project has focused its attention on types of actors, financial ones, that have been not traditionally included in product chain studies, or directly linked to social-ecological changes (Galaz et al., 2015). Their role has been analysed in the context of Brazilian soybean production and trading in Brazil, given the importance of soybean in a variety of global supply chains and its impact on Brazilian landscapes, important not only for the country that hosts them, but for global climate stability (Steffen et al., 2018). The current climate emergency and the different political and economic pressures that threaten the well-being of these biomes, require that all possible factors and actors interacting with them must be taken into account in order to find coordinate solutions.

With a market based analysis, Galaz et al. (2018) have identified the main financial actors linked to some of the biggest soy trading companies (and also beef companies), which are linked to high deforestation risks (West et al., 2018). Given their large market share and the extension of their supply chains, big soy traders necessarily emerge among the biggest players when referring to Brazilian soybean. This study looks specifically at different steps of the product chain and has not started from marked based information, but rather on the contribution of different actors on deforestation processes. The analysis has positioned the contribution of big traders and their investors (mainly US-asset managers backed by a varied range of as many investors), in a precise step of the product chain. Analyzing the previous steps of production and, above all, agricultural land creation, US-asset managers have certainly emerged as influential also in this case, but as a force acting on a different, much more tangible entity of investment, farmland. In addition, while for the trading step it has not been possible to recognize a specific type of investor/actor particularly influential on U.S. asset managers, in the case of direct investments in farmland pension funds and other similar institutional investors, were observed to be considerably powerful. This type of difference has repercussions in terms of greater responsibility and influence on what happens locally.

The analysis of this type of institutional investors has opened a reflection on the role of fiduciary duty in enhancing deforestation or other social problems on a local level. As explained by Krosinsky and Robins (2012), there is a profound need to shape a new meaning of fiduciary duty, opening it to new types of benefits in addition to the financial ones. The empirical study on Nuveen and the Second National Swedish pension fund (AP2) has showed that although some steps forward have been made toward the path of responsible and sustainable investing, fiduciary duty is still

prioritizing financial benefits over social and environmental ones, hence missing an important opportunity of guiding climate change adaptation and mitigation, for the environment as well as for societies and individuals.
In the Brazilian context, this shift will be showed after zero-deforestation commitments by both companies and their investors will explicitly go beyond legal requirements dictated by the Forest Code, whose weaknesses have been recognized by Freitas et al. (2018). In all the zero-deforestation commitments of the actors included in this thesis project, this particular specification was never met, tackling only illegal deforestation.

The soybean product chain branches into other many supply chains globally, where the interests of many actors are played interacting with it and with each other in a different way. Up to now, these interactions have led to a visible and tangible emergency on the Brazilian territory, tormented by deforestation to make room for monocultures of soybeans. This process has brought with it conflicts, poverty, injustice and extreme global environmental consequences. This study has looked at the network of actors and at their interactions because the dynamics occurring among the network, not only at a single actor level, have played a determining role in causing such impacts. The importance given at actors-relations and the stress put on the possibilities of sustainable transitions working at different interaction-levels has been recognized as a vision characteristic to the social-science ontology of relationism (Geels, 2010). According to this vision, what can happen is that ″a game process, which comes about entirely as a result of the interweaving of the individual moves of many players, takes a course which none of the individual players has planned, determined, or anticipated" (Elias, 1978). In the case of soybean, the system of actors and interests around its product flow is so complex to result in environmental and social impacts of unexpected scales or difficult to manage. A picture of the main interaction's dynamics can help single actors, policy makers, individuals, understanding their role and hence coordinating their actions within the network with more awareness.

8

Conclusion

In this thesis project only one product chain has been considered, soybean's, yet this product only has been linked to enormous environmental and social impacts. The challenges related to the entire food production system are therefore huge and require coordinated efforts and solutions to enable the expected 10 billion people to thrive on this planet, managing the resources and the land available in a sustainable manner. Brazilian land is particularly important for the ecosystem services and biodiversity offered by the biomes it hosts, and deforestation related to food production must be stopped before going beyond critical thresholds and completely altering the environmental balances that have sustained us until now. Hence, no actor who has a stake in systems such as food production systems which such tangible impacts on the environment can and should be considered less important or with less responsibility if particularly remote.

This thesis has in fact shown how financial actors, often based in other countries, act concretely in the places where their major investment interests reside, and that they have the power to influence positively or negatively what happens at the local level, through different ways of engagement and interaction. The type of engagements that they can have between each other and with local entities can look similar along the different steps of food product chains, but really differ according to ownership shares and consequently to the sense of responsibility that these actors show in respect of the environmental and social impacts of their investments. In some steps, these interactions are minimal and only exist for investors to diversify their portfolio and for local actors to obtain capital. In other steps, where ownership shares are bigger, investors want to show a greater sense of responsibility and manage more directly local investments. In order to build more sustainable product chains, all these remote actors must recognize their responsibility for the impacts of their investments, engaging more with local actors regardless of their ownership shares. Moreover, to really have responsible investments, environmental and social benefits need to be equally considered in addition to financial ones.

The method used in this thesis project has also shown that LCA and PCO studies can complement each other giving new opportunities of minimization of environmental and social impacts. LCA alone, in fact, are not able to consider the "human factor", which is actually the one responsible for allowing the product to flow globally and to impact negatively or positively the environment and society. Hence, looking at the "human factor" in the actor-network and at the interactions which regulates it, it is possible to find the causes of some of the environmental and social impacts

highlighted by LCAs. Once identified, strategies for changing those interactions into some that can give more sustainable outcomes can be researched and applied.

Finally, this project also showed the dependence of each actor on the actions of the other actors in the network, in an almost hierarchical way. In this sense, keeping tracing back actors we reach citizens and individuals, beneficiaries of pension funds as well as consumers of products with high environmental impact. More public awareness of the direct link that also our pension savings, not just the food we eat, can have with deforestation in other parts of the world, might also trigger new interactions with actors individuals haven't considered so relevant before.

8.0.1 Further research

Given the need for an alignment between financial, environmental, and social benefits, further research should investigate the types of regulations and policies to put on investors in order to achieve such change. Specifically, these types of regulations and policies should focus on making land clearing no longer a profitable option for investors and their companies. However, in order to have regulations on climate and carbon for investors, they should, in turn, start to quantify the impacts related to their investments. In addition, regulations should also have the effect of transforming small scale, organic and socially inclusive agriculture in a more profitable option compared to monocultures. Research is needed in finding out if and how that would be possible. Furthermore, it has been observed that investors in production and trading companies use their investments only to diversify their portfolios and lowering risks, but due to the small shares of ownership that they have are not really accountable for how these investments are driven. Hence, further research is needed on policies and regulations that can increase their responsibility regardless of their shares.

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