

# A Solution to Crises or a Mechanism of Capitalist Expansion?

## Environmental Injustices and the Flexing of the Soy Complex in Brazil

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### Abstract

It seems as though every generation has been faced with crises that are presented as more dire than the last. The current elaborations of crises focuses on peak oil, climate change and food production as imminent threats to the modes of production and consumption encompassed in the capitalist world system. The rise of flex crops – the industrial cultivation of select crops with corresponding technologies to process them into multiple and flexible products such as biofuels, non-food industrial material and food - has been observed as a response to the widespread delineation of crises in the late 2000s. Generally positioned within an Ecological Modernization theoretical framework as a component of a sustainable future biomass based economy, flex crops have been forwarded as a means to providing alternative fuels, increasing food production and providing renewable raw biomass materials for industries. This thesis seeks to provide an alternative understanding of the development of flex crops, specifically soybeans in Brazil, within the historical development of the world-economy and cyclical crises of over-accumulation. Within Brazil, the encouragement of a flexed soy complex can be seen as an integral aspect of developmental projects in the hinterlands, as well as a vision of the continued economic prosperity of the country. However, while the flexing of soybeans is posited as a sustainable process, the production of soybeans have had severe environmental and social consequences in areas of cultivation. This thesis examines both the theoretical and structural causes of the rise of flex crops as well as the ways in which the flexed soy complex contributes to instances of environmental injustices in Brazil, as the Brazilian environmental justice movement defines injustices. I contend that if a flexed soy complex is to be thought of as a genuinely ecologically sustainable industry, it should not contribute to environmental injustices in Brazil and that the phenomenon is a mechanism of capitalist expansion rather than a solution to crises.

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*“...the crisis of the earth is not a crisis of nature but a crisis of society. The chief causes of the environmental destruction that faces us today are...social and historical, rooted in the productive relations, technological imperatives, and historically conditioned demographic trends that characterize the dominant social system....the need to transform the major social bases of environmental degradation, and not simply tinker with its minor technical bases” (Foster 1999, 12).*

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## List of Acronyms

ABD	Accumulation by Dispossession
EJ	Environmental Justice Movement
ELD	Environmental Load-Displacement
EM	Ecological Modernization
EU	European Union
EUE	Ecologically Unequal Exchange
GM	Genetically Modified
ha	Hectare
MNCs	Multinational Corporations
MST	Brazil's Landless Workers Movement (Movimento dos Trabalhadores Rurais Sem Terra)
PA	Primitive Accumulation
RBJA	Environmental Justice Network in Brazil
TNCs	Transnational Corporations
US	The United States of America
WS	World-Systems Theory

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# 1 Introduction

Agricultural production is as inextricable from the cultural life and existence of humans as it is from the ecological systems it is grounded in. Even a cursory inspection into the history of known civilizations will show that their rise and fall are intricately tied with environmental degradation from exploitative and non-regenerative agricultural practices. In approaching this thesis, I was interested in examining whether or not the contemporary deepening reliance on biotechnology in agricultural production paired with expanding financial markets and investments represent a viable way forward in light of the contemporary crises of climate change, fuel dependency and food production.<sup>1</sup> While we will never know how the world would have been configured if capitalism had not developed, the crises today can be understood as a direct result of the transformative and extractive dynamics of the system that did evolve. The evolving global agro-industrial food complex has increasingly positioned soybeans as a flex crop<sup>2</sup> providing the perfect phenomenon to explore this topic.

In light of the contemporary convergence of crises of food production, peak oil and climate change/ecological destruction,<sup>3</sup> flex crops have been positioned within an Ecological Modernization (EM) framework as a way to reverse the environmental effects of agro-industrialization, increase agricultural surpluses and an alternative source of fuel. Soybeans, considered a key flex crop, have risen to prominence as a commodity crop in the past several decades. The global soybean industry grew at a rate faster than any other commodity during the 20<sup>th</sup> century over a five year period and provides an important source of vegetarian protein, animal

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<sup>1</sup> There has been a general consensus that beyond the cyclical crises of the capitalist world system, the consequences of industrialization have manifested themselves into "...ecological crises...: overpopulation, destruction of the ozone layer, global warming, extinction of species, loss of genetic diversity, acid rain, nuclear contamination, tropical deforestation, the elimination of climax forests, wetland destruction..." (Foster 1999, 11-33).

<sup>2</sup> Flex crops are commodity crops such as maize and soybeans that have multiple and flexible uses within an agro-industrial complex. Under this conceptualization, with the appropriate infrastructure and technology, a crop can provide energy (biofuels), food for humans, animal feed, and components in non-food industrial products.

<sup>3</sup> These crises are referred to by different authors in different ways. Generally, however, the food crisis is related to sharp increases in global staple crop prices and the belief that increasing populations require an increase in production of commodity staple crops within the agro-industrial complex. The environmental crisis can be understood as the ecological degradation that industrial activities and urbanization have resulted in, including - but not limited to - climate change. Footnote 1 details ecological crises in further depth. The energy crisis, or sometimes referred to as peak oil, refers to the finite amount of fossil fuels that exist and the need to prioritize alternative and regenerative sources of fuel. All of these crises intersect and contribute to one another and are largely the result of cycles of crises of accumulation as well as the consequences of industrialization within a capitalist world-economy and modes of production.

fodder, biofuel, cooking oil and various other non-food commercial uses (Austin 2010, 512). The increased production and consumption of soybeans have been primarily initiated by an increase in commercial meat demands, largely in Europe and Asia. While the majority of soybean cultivation occurs in the United States of America (US), Brazil and Argentina, those consuming it are primarily in Europe, China, Japan and South Korea (ibid, 513).

Brazil is a country wracked with deep inequalities, ethnic/racial and socio-economic conflicts and environmental degradation as a result of colonial policies as well as agro-industrialization and other extractivist activities. The expansion of the flexed soy complex in Brazil, the second largest producer in the world, has led to a deepening of these inequalities, and vast ecological destruction in biomes such as the Amazon and Cerrado. Furthermore, it has facilitated the expansion of capitalist markets violently transforming socio-economic and political norms of many of the most marginalized peoples in Brazil (Herculano & Pacheco 2008, 249). Despite the known consequences agro-industrialization, agribusiness and biotech firms as well as governmental institutions have increasingly framed soybeans as a flex crop as part of a national strategy to revolutionize Brazil's economy.

### *1.1 Research Questions*

My first question seeks to situate the rise of flex crops into a historical and theoretical framework:

- 1) Although typically rationalized through an Ecological Modernization theoretical framework, how can the development of a flexed soy complex be understood within a World-Systems perspective of capitalist over-accumulation and crises?*

I then investigate how the mechanisms of capitalist expansion that facilitate continuous growth and accumulation, despite cyclical crises, have manifested themselves in areas of soybean cultivation in Brazil. In order to understand these effects as specific to the particular context of Brazilian agro-industrialization that has resulted in social exclusion and environmental degradation, I pose my second question:

2) *To what extent does the expansion of a flexed soy complex contribute to environmental injustices in areas of production in Brazil?*

While the use of commodity crops in multiple and flexible ways is not necessarily new, the manifestation of a coherent rhetoric regarding the specific parameters of a flexed crop complex did not mature until the late 2000s. Relevant literature either champions the flexing of crops as a sustainable solution to contemporary crises or condemns it as a mechanism to generate profit at the expense of food security. However, research into the environmental and social effects of the intensification of soybean cultivation and expansion of relevant infrastructure necessitated by a flexed soy complex seem to be largely missing. In establishing a theoretical understanding of the function of flex crops in the world-economy and then analyzing the ways in which the flexed soy complex affects EJ in Brazil, I seek to connect how global capitalist trends and logic manifest themselves in a localized context. I use World-Systems theory (WS) and Accumulation by Dispossession (ABD) as analytical frameworks to inform a critical literature review and a qualitative case study of the flexed soy complex in Brazil. I advocate pursuing ecological sustainability as understood within an EJ framework, rather than the sustainability model promoted by an EM conception of crises and solutions. Subsequent to situating the flexing of crops within a WS framework, I use environmental injustice indicators to analyze whether or not the flexing of soybeans has led to, and will continue lead to, ecological sustainability within Brazil. While concentrating on soybeans specifically, the intent of this thesis is to contribute to a larger critique of the logic regarding the intensification of flex crop production in order to address the contemporary crises and to what degree doing so can contribute to or undermine EJ.

## **2 Background**

### *2.1 Contemporary Crises and Flex Crops*

Since the 2007/08 global food price spikes and financial meltdown, the convergence of multiple crises have become an influential factor in many inter- and intra-governmental policies. While crises are not exclusive to the contemporary world context, the current manifestations are



unique in the breadth of their affects and the impending threat of widespread ecological collapse (Ghosh 2010, 77). As it is beyond this text to examine the arguments over the exact causes and consequences, I use the following quote from McMichael as the framing for my understanding of the crises within the specific purview of agricultural production and the global food system:

...the crisis stems from a long-term cycle of fossil-fuel dependence of industrial capitalism, combined with the inflation-producing effects of current biofuel offsets and financial speculation, and the concentration and centralization of agribusiness capital stemming from the enabling conjunctural policies of the corporate food regime. Rising costs, related to peak oil and fuel crop substitutes, combine with monopoly pricing by agribusiness to inflate food prices, globally transmitted under the liberalized terms of finance and trade associated with neoliberal policies. (2009, 281)

This understanding highlights some of the specific contemporary structural processes that have led to the crises elaborated upon in the introduction. Within the larger context of periodic crises inherent to the capitalist world-economy, explored in section 4.2, the response of financial, corporate and governmental institutions has been a general expansion of industrialization and financialization<sup>4</sup>, especially regarding agricultural production. Agribusinesses have increasingly framed flex crops as a sustainable solution to the crises that opens up new investment and speculation opportunities, increases food production, is a renewable source of energy and more (Oliveira & Schneider 2016, 169). This positioning, however, ignores the environmental and social impacts of agro-industrialization and focuses on economic growth and development prospects to the detriment of environmental and social justices in areas of cultivation and production (Oliveira 2016, 362).

To be considered a flex crop, the crop in question must have multiple uses that can be flexibly interchanged with relative technical ease. (Borras et al. 2016, 98). Flexing takes place during the processing phase of the soy complex (Gillon 2016, 123). The actual production phase of the soy complex requires an expanded reliance on mechanization and biotechnology to provide uniform and reliable harvests. In order to transport and process the beans, a vast network of transportation networks and factories and ports have been, and continue to be, built (Oliveira &

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<sup>4</sup> Financialization, within this context, describes the increasing role of investors and financial institutions in dominating the operations of sectors, such as agriculture. The decisions of farmers that cultivate soybeans on farms that are incorporated into the agro-industrial complex are thus made by actors based on financial and profit motives rather than situational realities (Fuchs, Meyer-Eppler & Hamenstadt 2013, 221-222).

Hecht 2016, 267). Thus, in examining the current impacts of the soy complex in Brazil, we can deduce that the socio-ecological consequences will only be intensified with the further orientation of governmental policies, research and capital towards flex crop infrastructure.

In the past several years there has been an upsurge in biotechnical research searching for new products that can be derived from flex crops as well as ways to ensure uniformity and high yields in the cultivation phase. As crops, such as soybeans, are increasingly transformed into inputs for processed foods, animal feed and biofuels, land use is diverted away from food production and new agro-industrial relationships and activities are formed at domestic and global levels (Gillon 2016, 120). Current examples of the most prominent flex crops are: soybean, maize, sugarcane and oil palm while crops such as sunflower, cassava, coconut, sugar beets and rapeseed are gaining popularity (Borras et al. 2016, 94). Narratives have been put forth by landed, corporate and governmental actors that position flex crops as part of a envisioned future biomass based economy that will rectify the current crises by providing renewable energy, increase food production and encourage green industrialization to halt climate change (ibid, 100). According to Isakson,

The diversified uses of flex crops are believed to substitute for a diversified product portfolio: price shocks are muffled by redirecting large quantities of versatile crops to where they are in greatest demand. Given their versatility, including their perceived ability to provide 'green energy', flex crops are often touted as a solution to the contemporary food, fuel and climate crises. Such logic suggests that the cultivation of flex crops is not only a means for financial actors to mitigate risk, but that it also contributes to social welfare. (2014, 768)

The expansion of flex crops under the agro-industrial model requires a new set of relationships between agricultural production, industrial processing sectors and capital as agricultural products and uses become more and more commoditized within a system of financialization (Gillon 2016, 120). Between 2006 and 2011, speculative investments in agricultural commodities increased from 65 billion to 126 billion dollars following a change in the regulations of key financial markets (Clapp 2014, 4). Until recently agricultural production itself was considered a risky investment due to relatively low profits and the dependency on unpredictable weather patterns on production (Isakson 2014, 756). However, in the last 30-40 years downstream industries have become more consolidated and intertwined in actual production as farm sizes have generally increased and agricultural commodities have become more profitable (Magdoff 2013, 5). According to the above

quote by Isakson, flex crops are positioned as a means to relieve economic crises, climate change, and of particular note, contribute to social welfare. In subsequent chapters I examine to what degree flex crops fulfill these promises through a WS perspective and an analysis into how the flexed soy complex contributes to environmental injustices within Brazil.

Flexibility in the uses of commodity crops is not necessarily a new idea, yet it has risen to prominence in the context of volatile world markets, ecological concerns and food scarcity threats within the expansion of an agro-industrial complex<sup>5</sup> (Gillon 2016, 119). Proponents claim that increasing the industrial non-food products of crops such as energy (biofuel) will reduce greenhouse gas emissions and is friendlier to the environment than current industrial production processes (Oliveira & Schneider 2016, 168). Beyond the benefits espoused by biotechnology firms and politicians, flex crops represent a significant break of agricultural production from the biological basis and connectivity to ecological systems as well as the ways in which profit is derived from such activities (ibid, 187). Flexing can thus be understood not as an intentional policy per-se, but as a process that has evolved out of an increased demand, biotechnical processing innovations as well as a way to ensure profits in light of volatile markets and general crises.

## 2.2 *Brazil and the Flexing of Soybeans*

As of 2014, domestic agribusinesses accounted for around 20% of Brazil's GDP making it one of the most influential sectors in the Brazilian economy (Oliveira 2016, 348). This is largely the result of historical agricultural developments in Brazil that have primarily focused on producing commodities for export. After the 1964 coup in Brazil, the military government instituted development plans that encouraged large-scale export oriented industrial agriculture as a means to obtain foreign currency to fund other industrialization programs (Wolford 2008a, 645). As Brazil amassed international debt during the subsequent decades, agricultural commodity exports provided a large percentage of capital used to pay back those debts. While paying off international debts is no longer a top concern of the government, the policy of encouraging export-oriented commodity agriculture as a means to accumulate foreign currency is still preminent (ibid,

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<sup>5</sup> The agro-industrial complex is explained in section 3.1.

133). Consequently, the expansion of the soy complex has been encouraged as a strategy for development as well to expand the modern Brazilian nation-state (Fisher 2007, 350; Oliveira & Hecht 2016, 268).

In the 1970s, soybean varieties that could grow in tropical areas such as the Cerrado and forest areas were developed leading to an expansion or agro-industrialization into those areas (Weinhold, Killick & Resi 2013, 133). Subsequently, the cultivation of soybeans in Brazil increased by 400% between 1975 and 2000, a rate of growth unrivaled by any other globally traded commodity during the 20<sup>th</sup> century (Caceras 2015, 642). Currently, Brazil contributes to around 40% of global soybean supply (Oliveira 2016, 348). In addition to a massive expansion in the area under soybean cultivation, there has been a parallel intensification of land use through technological innovations, infrastructure projects and a verticalization<sup>6</sup> of productions chains resulting in a significant increase in yields (Castanheira et al. 2014, 682). For the coming growing season, 2016/2017, it is estimated that soybeans will be grown on 50% of all cultivated area with a total harvest of 103 million metric tons. Of the harvest, 57 million metric tons are expected to be exported, mainly to China (Rubio 2016, 1-2). In 2013, soybeans and its products (meal, oil and derivatives) were 12.9% of all of Brazil's exports – second only to iron which was 13.5% (Oliveira 2016, 347). According to an annual report on oilseeds in Brazil, soybeans are forecasted to remain the primary oilseed in Brazil for the 2016/2017 crop year with a strong demand from the domestic animal sector, export markets, and new biodiesel blending mandates (Rubio 2016, 5).

When a soybean is crushed, it produces 79% meal, 18.5% oil and 2.5% waste. Of the meal portion, 98% is used as livestock feed while 2% gets turned into soy flour and protein. Globally, 95% of the oil is used in cooking and the remaining 5% is refined into biofuel and other non-food products (Oliveira & Schneider 2016, 168). Brazil came close to over-producing soybeans in the 2000s leading to a search for new markets. As a result of research into flexible products and derivatives, soybeans began being processed into biofuels and nutritional inputs for processed foods (ibid, 183). Brazil is currently the second largest biodiesel producer, after the US (Rubio

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<sup>6</sup> Verticalization is a strategy of integrating all of the phases of harvesting, storing, transporting and processing. This facilitates the monopoly of corporations to control chains of production, processing and distribution while reducing costs, minimizing risks and manipulate price setting mechanisms (Oliveira & Schneider 2016, 170).

2016, 11), and while soy-based biodiesel represents a smaller percentage than ethanol and sugarcane, as of 2013, it was the third largest domestic market after oil and feed (Oliveira & Schneider 2016, 184). There has also been a push for soybean products to be consumed within Brazil as food. While soybeans are not part of the Brazilian culinary tradition and there are strong stigmas attached with eating soybean products, the food processing industry has increasingly incorporated soybean derivatives into products and there have been attempts to create niche soybean markets (ibid, 187). The increase in research and development into the multiple and flexible products that can be derived from soybeans signifies the existence of a flexed soy complex in Brazil.

In recent years, Brazil has committed to several initiatives to reduce the negative environmental impacts of its industries. It has declared its intent to reduce CO<sub>2</sub> emissions by 2020 and has encouraged the processing and use of biofuels (Saad 2015, 4). In general, a trend towards market-oriented and technological solutions and strategies have been adopted by governing institutions to achieve sustainability goals (Jepson, Brannstrom & Souza 2005, 296). However, agro-industrialization overwhelmingly tends to result in environmental and socially disruptive consequences that threaten stability and availability of resources. As such, governmental and corporate initiatives championing market correction and green technological solutions represents a continued, or even a revamped, focus on industrialization as a means to achieving economic growth rather than a paradigm shift in approaching sustainability (Saad 2015, 7). The promotion of a flexed soy complex is predicated upon future technological advances that will clean up industrial agricultural production, rather than current technologies. Thus, promoting a flexed soy complex as one means to achieving sustainability goals will only serve to deepen the already profound social and environmental impacts of agro-industrialization.

While this thesis focuses on large-scale soybean production, the interrelations between the different industrial agricultural and ranching sectors are complex and work together to produce the environmental and social impacts that are discussed. Today, many agribusinesses in Brazil are expanding production and investments into Paraguay and Bolivia (Gaspari & Waroux 2015, 295; Oliveira 2016, 348). According to a study by Gaspari & Waroux, of the 13 major soybean

producers in Brazil, 30.8% are involved in production throughout South America and 30.8% are invested in the domestic cattle sector (2015, 293). This represents a coupling of production frontiers and sectors within the agro-industrial complex in Brazil as actors become increasingly invested in different sectors (ibid, 291). Additionally, as the food processing, biofuel and other sectors become increasingly intertwined in the flexed soy complex, the power relations and dynamics between domestic and international actors will become even more complex. The focus on soybean production should be seen as only one part, albeit an integral one, of the agro-industrial complex ruled by state developmental policies and agribusiness interests that have resulted in the socio-ecological impacts and possible environmental injustices affecting the regions of production.

### **3 Terminology**

#### *3.1 Agro-Industrial and Flexed Soy Complexes*

This thesis uses *agro-industrial complex* to frame the complex set of evolving relationships and interactions between states, transnational corporations (TNCs), multinational corporations (MNCs), investors, producers, processors and consumers. Within this complex, food/crops are commodities largely to be transformed into industrial inputs for processed foods. This complex comprises of not only the production phase of agricultural output, but the inputs necessary in modern farming – agro-chemicals, machinery, plant varieties – as well as transportation, processing, storing, packaging infrastructure and marketing strategies not to mention the inputs of financial capital through investments and speculation. Thus, this conceptualization of an agro-industrial complex takes into account all of the various operations that the domestic and international food systems entail.

The soy complex is deeply intertwined in a global agro-industrial complex. Many of the features of the agro-industrial complex are reflected in the cultivation and processing of soybeans that entails a complex convergence of technologies, financial markets, institutions, social relations and practices as well as a global network of infrastructural components that channel commodity and capital flows around the world (Oliveira & Hecht 2016, 252). Taking into consideration the

incorporation of infrastructure that facilitates the flexing of soybeans in Brazil, the different relationships between interests and cultivation, processing and transportation infrastructures is referred to as a *flexed soy complex* throughout this thesis. The flexed soy complex is a material reality in certain areas of Brazil where farms and transportation and processing infrastructure exist, as well as a conceptual concept that exists as a potential investment and speculation opportunity. While this text focuses on the domestic consequences of the flexed soy complex in Brazil, it situates the dynamics of the flexed soy complex as being based in the global agro-industrial complex that directs flows of capital and processed commodities throughout the world. Additionally, due to limited space, secondary research material as well as the complicated nature of the flexed soy complex, I focus solely on the cultivation and transportation infrastructural components and practices of the complex in Brazil. Further research into the impacts of the research, processing, global transportation as well as marketing infrastructures is needed in order to gain a more complete understanding of the dynamics and consequences of the global flexed soy complex.

### 3.2 *Core and Periphery*

Following a Marxist tradition, WS theorists typically use the theoretical categories of core, semi-periphery and periphery meant to refer to centers of production and extraction (Chase-Dunn 1989, 214). In WS, there is a heavy focus on the unequal and exploitative relationships and interactions between core and peripheral centers (Wallerstein 2004, 28). While these categories are largely applied to states as a means to generalize their position in the world-economy, I use these categories to discuss the relationships between centers irrespective of national boundaries as proposed by Chase-Dunn (1989, 214). Core activities typically consist of capital, rather than labor, intensive activities that rely on advanced technologies and raw inputs extracted in peripheral areas. Peripheral centers largely supply raw materials through socially and environmentally harmful extractivist or industrial sectors, such as industrial agriculture (Shannon 1992, 28). However, mechanized agricultural production requires high levels of capital and as agro-industrialization intensifies in peripheral areas, the categories of core and periphery to describe the interactions between actors becomes increasingly convoluted. I acknowledge these complexities and for the purposes of this thesis, I use the concepts of core and periphery to describe areas of soybean

cultivation and processing where the local environment and communities are burdened with the consequences while the products are largely consumed elsewhere. Brazil is typically referred to as an emerging economy or a semi-peripheral state with a mixture of core and peripheral production activities. However, I recognize that core and peripheral activities and trade occur within countries as well as between and the processes of *ecological unequal exchange* (EUE) and *environmental load-displacement* (ELD) routinely take place between rural and urban areas, sites of cultivation/production, processing and consumption. As most of the text research in this thesis looks agricultural activities in rural, peripheral areas I am largely able to avoid classifying nation-states as core or periphery.

## 4 Research Design

### 4.1 Methods

#### 4.1.1 Qualitative Case Design

Working within a critical realist ontological and epistemological framework, I contend that many of the generative mechanisms within the WS are not always directly observable, depending on scale, although their theoretical delineation provides feasible explanations of particular patterns of phenomena (Bryman 2012, 29). Bach proposes that a methodological approach to WS theory entails the analysis of spatial and temporal processes that are constantly reforming and cannot be properly represented by standards of measurement or physical quantities (1982, 179). This recognition of the spatio-temporal fluidity of real systems processes makes it difficult to use standard methods of research (Chase-Dunn 1982, 183). Furthermore, due to several restrictions to my research, primarily my lack of first hand field research, it was difficult to pinpoint an appropriate method to analyze the central questions of this thesis.

I eventuated in a qualitative case study on Brazil with data gathered from second hand sources such as previously undertaken research in relevant literature, as well as policy, news and NGO reports. In employing a qualitative research strategy I attempt to present a more complex



account of the various components of the development of flex crops that a heavy reliance on figures and statistical data could potentially obscure. I feel as though the complexities of the interplay between financial actors, infrastructural developments, social relations, political actors, international politics, environmental concerns and more all at work within the cultivation, processing and trading of soybeans would be lost in a quantitative method. A qualitative strategy provides a more holistic contextualization of the topic that will at least hint at the depth of the various dynamics at play. Thus, while I will use various numerical figures, they do not form the backbone of my discussion, and I use them keeping in mind the socially constructed parameters of their quantification.

#### 4.1.2 Case Study: Brazil

I use a *representative revelatory* case study approach to analyzing the environmental injustices of soybean cultivation in Brazil. It is *representative* in that while it focuses on soybeans in Brazil, I believe that further research into other flex crops around the world will show similar results and *revelatory* in that the theoretical and methodological approach described above is meant to seek out alternative means to understanding the rise of flex crops that may be obscured through other viewpoints (Bryman 2012, 70). Brazil is a large and widely varied country and ideally I would have liked to focus on one producing region. Even with a specific topic such as the cultivation of soybeans, there are broad differences in the development and impacts of the soy complex depending on the region and between socio-economic classes and racial identities. As a majority of the research conducted in Brazil on soybeans is in the state of Mato Grosso, most of my text research was unintentionally directed there. For my data collection I researched the various environmental and social impacts of soybean cultivation. I looked at both qualitative and quantitative research papers, NGO and governmental reports as well as policy documents. In addition to amassing data for my discussion, I examined the historical and theoretical context of the development of flex crops in order to provide a historically grounded theoretical discussion of flex crop production in Brazil as a larger project in the global economy.

##### 4.1.2.1 Environmental Injustices Analysis

In my analysis, I use the data obtained through my literature review and my three environmental injustice indicators to understand the contributions that large-scale soybean cultivation has on EJ in Brazil. I examined the themes of quotes from two texts on the Brazilian EJ movement to establish three indicators that contribute to environmental injustices - *environmental degradation, deepening of socio-economic divisions, and concentration of land*. The first text is a translation of part of the 2001 Environmental Justice Network in Brazil's (RBJA) Declaration of Principles of Environmental Justice translated in an article by Tania Pacheco; the second is an article by Henri Acselrad entitled "Grassroots Reframing of Environmental Struggles in Brazil" and summarizes the various struggles for EJ in Brazil.

We understand environmental injustice to be the mechanism by which unequal societies, from the economic and social point of view, direct the greatest burden of environmental damage caused by development towards poor populations, discriminated groups, traditional ethnic communities, working class neighbourhoods, and marginalised and vulnerable populations. – Declaration of Principles of Environmental Justice (Pacheco 2008, 721)

...[the] defense of rights to culturally specific environments, such as those of traditional communities at the front-line of expanding capitalist and market activities; struggles in defense of rights to equitable environmental protection against market-led socio-territorial segregation and environmental inequality; struggles in defense of rights to equitable access to environmental resources and against the concentration of fertile land, water resources and safe ground in the hands of powerful market interests; and also struggles in defense of the rights of future populations. (Acselrad 2008, 93)

Through the excerpt from the RBJA I establish that instances of environmental injustices should be the focus of my analysis as they reveal the consequences of a flexed soy complex. The excerpt focuses on the deepening of socio-economic divisions as the displacement of environmental burdens are placed on the most marginalized. The other two indicators I extracted from the second excerpt by Acselrad. Land concentration – including the displacement of people from the land - as well as environmental degradation are two themes that intersect with the deepening of socio-economic divisions that formulate the basis of the EJ movement's struggles. Based on supplementary research into the social and environmental movements, I believe that these two excerpts are representative of how environmental injustices are framed within the Brazilian context. Thus these two quotes provide me with parameters to discuss the effects that large-scale

soybean cultivation has had in areas of cultivation from an EJ perspective. Embedded in Acselrad's formulation is the role of capitalist market expansion in effecting environmental injustices that are an integral component in the struggles of the EJ movement in Brazil. I seek to understand whether or not flex cropping can be theoretically compatible with the EJ movement by first examining how flex crops can be understood within a WS framework of capitalist expansion and accumulation.

Flexing is an on-going process that entails the construction of new infrastructure, socio-economic and political relationships and biotechnical inventions. The soy complex in Brazil has been undergoing an orientation towards flexing as a primary mode of production within the agribusiness industry, but by no means has it fully manifested itself throughout the whole country. However, based on the methods of cultivation and processing exhibited in the soy complex, I assume that all soybean cultivation occurs within a complex that is geared towards multiple and flexible products. Thus, a further comprehensive and intentional materialization of a flexed soy complex will only intensify and expand the current practices of large-scale soybean production. As such, it is reasonable to assume that the current contributions to environmental injustices will also appear in a fully flexed soy complex.

#### 4.1.2.2 Limitations

There are several limitations that I have faced in conducting my text research. The greatest two being that I am reliant on secondary materials as I did not conduct field work, and that I do not speak Portuguese and so have been unable to access potentially relevant material. This was specifically noticeable in my construction of the main features of EJ within Brazil where I had to rely on a research paper on the movement and a translated excerpt to formulate my three indicators that I will use to structure my analysis. Qualitative methods typically entail some measure of *interpretivism* during the collection and analysis of data. As I am gathering information that has already been collected and analyzed, I run the risk of misinterpreting the data myself or using data that has been interpreted under a different epistemological paradigm than my own (Bryman 2013, 28). There are further concerns that case study research discussions cannot be necessarily transferred into general statements regarding the overall phenomenon (Bryman 2012, 71). With regards to this text, a discussion on the cultivation of soybeans as a flex crop in Brazil and whether

or not it contributes to environmental injustices is most likely not directly generalizable to other crops and situations around the world. However, working within a WS perspective, certain trends and patterns can be surmised and brought up for further research in discussions on other crops and contexts.

## 4.2 *Theoretical Framework*

*“The capitalist system establishes the idea of domination that turns everything into a commodity: water, soil, human beings, ancestral cultures, biodiversity itself. Everything becomes merchandise within this social structure. In thinking about justice from an environmental point of view, it is necessary to re-signify what peasants did historically. Peasants are nature guardians around the world. Under the capitalism structure, Mother Earth becomes a source of raw material and human beings have been turned into means of productions and consumers of what is produced”- Cleber Folgado (Sineiro & Berger 2012, 114).*

### 4.2.1 Critical Realism

For the purposes of this thesis, I follow a *critical realist* approach in establishing that there is a world that exists independently of our knowledge of it (Sayer 2000, 2). Critical realism also provides a basis for the epistemological aims of the subsequent analyses. While there is a tangible world that exists, attempts to understand and know this reality are socially situated and provisional in nature. Retroductive reasoning<sup>7</sup> allows for the identification of causal mechanisms that are responsible for the patterns of observable regularities. Although not always directly observable, generative mechanisms- including the entities and processes of various phenomena - can be established within their particular contexts. In pinpointing such mechanisms, alternatives may also be delineated that can potentially transform the status quo (Bryman 2012, 29). This thesis seeks to provide a retroductive argument analyzing the situating of flex crops as a sustainable and transformative solution to crises. While the complexities of the world are overwhelming at times, the critical realist assumption that generative and causal mechanisms can be identified in order to

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<sup>7</sup> Retroductive reasoning, or arguments, are constructed through the positioning of an explanation to account for a set of observable facts. “[It] entails making an inference about the causal mechanism that lies behind and is responsible for regularities that are observed in the social world” (Bryman 2012, 29).

establish an explanatory and consequential pattern out of the chaos is critical in my attempt to understand the various phenomena in this thesis.

#### 4.2.2 Ecological Modernization Theory and Flex Crops

This thesis situates the promotion of flex crops within the theoretical approach of EM. EM theorists acknowledge that modernization and industrialization have led to the environmental crises. However, these negative externalities can be corrected through the cleaning up of industries through technological innovations and the monetary valuation of ecosystem services to compensate for any continuation of environmental impacts (Buttel 2000, 61). Furthermore, EM theorists generally claim that socio-economic and political institutions, domestic and international, can incorporate environmentally conscious policies and technologies making any deeper structural changes superfluous (Jepson, Brannstrom & Souza 2005, 296-97). While there are debates between EM theorists on the exact solutions, in general, the theory establishes a framework that calls for the greening of industries rather than threatens the current system of capitalism. It is largely presented as a transformative alternative to current modes of production and has been widely adopted forming the basis for many governments' and industries' sustainability initiatives (Buttel 2000, 63).

Those governing Brazil have historically favored a development plan that relied heavily on large-scale agricultural production and the extractivism of raw materials for export. Within the past decade, there have been several indications that governmental and corporate leaders within Brazil are orientating the country's economy towards a *bioeconomy* within a framework of EM. A *bioeconomy* has been positioned as an alternative to fossil fuel intensive industries and production processes that will be based on renewable biomass as the source of energy and raw materials. The promise of a global *bioeconomy* is the ability for biotechnological solutions to avoid or overcome various environmental or social disasters (Goven 2015, 304) and its recent popularity can be understood as "...a prime example of a response to multiple crises and part of what gives shape to contemporary crop flexing" (Gillon 2016, 129). In 2014, the Brazilian Industrial Biotechnology Association (ABBI) was formed by MNC and Brazilian leaders to encourage the orientation of industries towards a more bio based economy in Brazil (Bernardo Silva 2016, 11).

According to an interview with Bernardo Silva, the president of ABBI, "...the bioeconomy can and should be the path for the re-industrialization of Brazil, fostering much needed innovations and development of products and processes that will fast-track the establishment of this new norm in a global scale" (Bonaccorso 2015).

Flex crops can be understood as a development towards a future *bioeconomy* influenced by an EM understanding of crises and solutions. Flexing entails biotechnological innovations regarding production, processing and uses that will, purportedly, decrease environmental impacts of fossil fuel usage, increase the nutritional quality of food, and increase food production all the while encouraging growth and investments. As such, the flexing of crops as part of the development of economies based on renewable biomass fit perfectly into the framework of EM. Proponents of EM in academia as well as governmental and corporate actors have mainly emphasized efficiency and control over degrading activities while ignoring the larger impacts of extractivism and consumption patterns (Buttel 2000, 64). Bonds & Downey assert that EM theory is predicated upon the assumption that the adoption of green technologies will benefit the world universally (2012, 168). However, this assumption presuppose equal access for all and ignores the costs of producing these technologies. Flex crops, and in this case, the flexed soy complex, can be understood within this system of green technologies as the commoditized products are positioned as sustainable and a means to overcoming crises. The next several sections seek to situated flex crops as a response, rather than solution, to crises and as a process that will only contribute to continued crises.

#### 4.2.3 World-Systems Theory and Ecologically Unequal Exchange

I contend that flex crops ought to be situated within the historical trajectory of trends in the world-economy in order to garner an understanding of the phenomenon within the context of capitalist expansion and response to crises. WS provides an alternative historical understanding to the narratives of crises and solutions provided for by other schools of economics, politics and development. Accordingly, the world-economy is the site of interactions between core and periphery where extraction, production and consumption are facilitated through an inherently exploitative system of relationships. Through this system, a majority of wealth that is generated

from activities in the periphery flow to core centers (Moore 2000, 134). In light of the contemporary crises and the widely championed notions that technology will be our salvation, approaches using an EM framework have gained widespread attention by reworking older justifications for the negative consequences of EUE and ELD into a new language of sustainability.

In addition to facilitating the ascent of capitalist socio-economic and political interests over those of the working classes, exploitative activities in core states have provided an outlet for the disposal of over-accumulated capital by providing new markets for consumption and sites of investment for capital (Shannon 1992, 13). According to WS theorists, the capitalist system is predicated on an endless accumulation of capital where individuals and firms amass capital mainly in order to facilitate further accumulation (Wallerstein 2004, 24). The consumption and ecological degradation paradox of the world-economy and capitalist accumulation concentrates on the means by which core areas have structured global production in a way that expedites their continuous accumulation of capital (Hornborg 2013, 77). Marx's theory of metabolic rift focuses on the disruption of the nutrient cycling in ecosystems that results from the expansion of capitalist divisions of labor and the relationship between country and city during capitalist transitions (Moore 2000, 125). Consequent to the inevitable metabolic rift, capitalism requires constant external inputs for metabolism, rendering it unable to exist in a closed system. As a result, capitalist modes of production and socio-political relations are forced to constantly gather resources, natural and in the form of labor, from peripheral areas in order to survive (Moore 2000, 146) in an inherently exploitative system (Shannon 1992, 13). Thus, a capitalist system can only exist in a world-economy that features a general global division of labor and trade based in unequal terms (Wallerstein 2004, 23-24). Peripheral areas have been forced, or encouraged, to orient their markets and production capacities towards raw materials and agricultural exports. This has resulted in landscapes dominated by largescale landholdings and concentrated earnings creating a class of co-opted or new capitalist elites who have strong, profit-driven, incentives to encourage unequal exchanges (Austin 2010 512).

The asymmetric transfers of value between core and periphery trade relationships typify unequal exchanges that facilitate the accumulation of capital and commodities in the core at the

expense of the periphery (Hornborg 2013, 77). The capitalist world-economy is dependent on the endless accumulation of capital from external sources giving core centers the ability to consume and accumulate at a cheap price and beyond their resource base (Austin 2010, 514). Expanding upon unequal exchange and Marx's concept of metabolic rift, EUE is used to explain the disproportionate concentration of environmental degradation in peripheral areas as a consequence of core appropriation of ecological space and natural resources beyond their geographical boundaries (Austin, McKinney & Thompson 2012, 73). ELD is a phenomenon within EUE relations where the environmental and social impacts of extractivist and productionist activities are displaced to areas divorced from sites of consumption. Hornborg claims that the uneven distribution of environmental burdens is "...a social strategy that is integral to the political economy of world-systemic processes rather than the incidental effect of certain patterns of production and consumption" (2013, 48). This social strategy can be seen as a means of pacifying working classes by increasing their welfare through the displacement social and environmental costs of industrialization and unsustainable consumption patterns. The soybeans cultivated in Brazil are largely exported to other countries with the global market determining market prices and demand. This thesis does not focus on the vertical flow of soybeans and derived products and the dynamics of EUE that ensues, however, as a majority of soybeans are cultivated for export within relationships of EUE resulting in ELD, these processes are an important contributing aspect to environmental injustices within Brazil.

Conversely, EM theorists largely neglect considering how power relations and inequalities are tied to capitalist production and relations as well as environmental degradation from these activities (Bonds & Downey 2012, 170). However, the dispossession of people from land in processes of commodification and privatization has been a primary means to accumulate capital within relationships of EUE, and the consequences play an important factor in contemporary crises. According to Magdoff, "...land bought (or obtained by other means) and sold, speculated upon, and used to produce human food, animal feed, fiber, or fuel and with crops selected based on climate and soil type but also on what would bring the greatest returns...is the...basis of the dispossession of people from their lands" (2013, 1-2). As new frontiers for capitalist expansion and investments have diminished, there has been a general trend - land grabbing and the dispossession of peasant farmers notwithstanding - towards an intensification of current



agricultural land. This has been achieved through an increase in mechanized production with biotechnical innovations that increase yield and efficiency of large-scale farms (Moore 2000, 144). This next section further examines the ways in which capital is accumulated and crises of accumulation.

#### 4.2.4 Primitive Accumulation and Accumulation by Dispossession

Each successive round of capitalist expansion has featured the restructuring of agro-ecological systems as a primary means to generate new accumulation and has led to an intensification of exploitative activities (Moore 2000, 124). According to Moore,

Each reorganization is not merely organizational and technical, it is crucially a new phase of the geographical expansion of the world-economy, which is accompanied by the deepening subordination of agriculture to the law of value in regions where capitalism has long held sway...such periods of expansion were invariably moments of primitive accumulation on a world scale, which is not so much ongoing as cyclical. (2000, 141)

The accumulation of capital within the world system is facilitated through the specific forms of exploitative economic relationships found in capitalist modes of production. Within this system, those who possess the means of production possess the means to accumulation as well (Oliveira 2016, 25). Over-accumulation occurs when there are surpluses of labor, capital and manufactured, or raw, commodities. If capital, labor or commodity surpluses cannot be absorbed internally, then they must be externalized in order to avoid devaluation (Harvey 2003, 117). Harvey's concept of ABD draws on Marx's *primitive accumulation* (PA) - the initial process of divorcing the laborer from their means of production, typically through the forcible transformation of social relations (Glassman 2006, 610). ABD is a mechanism that opens up access to land and resources that idle capital can be invested into (Harvey 2003, 149). The opening up of new markets and privatizing the commons occurs as capital seeks new sites of investment, sources of cheap resources and markets to sell commodities in (Dunn 2007, 6). Within the cycles of capitalist expansion and retraction, capital is accumulated until there is an over production of goods or a surplus of capital that is not re-invested. At that point, there is a crisis, such as the 2007/08 financial and food crises, that deepens until the over-accumulated capital and commodities are disposed of in ways that generate more capital starting the cycle again. Capitalism, however, undermines its potential for

further accumulation as expansion through ABD and, in some cases PA, has culminated in profound environmental crises that intersect with societal conflicts, inequalities and injustices (Wolford 2008a, 118).

In the past several decades, methods of unburdening accumulation have become increasingly institutionalized through the deregulation of financial and commodity markets, free trade agreements and other policies implemented under the guise of neoliberalism by various international and domestic actors (Harvey 2003, 184). Specific mechanisms include: commodification and privatization (generally entailing the forcible expulsion of locals) of land, establishment of exclusive private property rights, diminishing access to the commons – in many cases the destruction of the commons – and suppressing alternative forms of production and consumption as well as means of production and divisions of labor (Dunn 2007, 8). However, the processes of ABD, predicated on unlimited economic growth potential, have been confronted with the realities of finite resources and land that have been compromised by the environmental consequences of industrial activities.

Building upon ABD, Sassen describes the processes in which the current phase of capitalism, dominated by a logic of financialization, is transforming more outdated modes of capitalistic relations through new processes of PA and ABD in order to transcend material limits (2010, 24). A key feature in cyclical patterns of accumulation and crises is this trend of financialization (Isakson 2014, 751) that is used as a mechanism to transcend constraints of material growth (Fuchs, Meyer-Eppler & Ulrich Hamenstadt 2014, 225). Until recently, agricultural production itself was considered a risky investment due to relatively low profits and the possibility for unpredictable and uncontrollable weather events to affect harvests (Magdoff 2013, 5). However, since the deregulation of commodity spot and futures markets in 2000 and the crises of the late 2000s, farmland and agribusinesses have been positioned as a new frontier for investments and speculation (Fuchs, Meyer-Eppler & Ulrich Hamenstadt 2014, 225). As the anticipated “oil wells of the twenty first century” (Borras et al. 2016, 95) and a new frontier, the agricultural sector provides an arena where the current phase of capitalism can expand into. Within this phase of capitalist expansion, financial actors play a pivotal role in the search for new markets and arenas for capital accumulation to occur (Fuchs, Meyer-Eppler & Ulrich Hamenstadt 2014).

Central to these processes is “...the expulsion of people and the destruction of traditional capitalisms to feed the needs of high finance and the needs for natural resources” (Sassen 2010, 25). Simply put, the rise of a flexed soy complex in Brazil can be understood as a means to facilitate accumulation through ABD as farmland is increasingly concentrated into agribusiness plantations. Such a complex opens up opportunities for investments and speculations in production processes and technological innovations providing an arena for unburdening over-accumulation. However, the expansion of capitalist markets and logic facilitated, in part, through flex cropping has entailed a transformation of socio-economic and political norms of the peoples in Brazil whose land and labor is being usurped and bear the burden of the environmental consequences of agro-industrialization.

This section has thus far re-situated the flexing of crops as a phenomenon that has arisen as a means to overcome over-accumulation within the current transitional phase of capitalism. I use the following quote by Moore to connect my next section on sustainability and EJ as integral components to any theoretical discussion on the cyclical crises of over-accumulation:

...a synthesis of the concepts of the metabolic rift, the world-system, and systemic cycles of accumulation offers a new vantage point from which to view the interconnections between agro-ecological restructuring, class struggles, and capital...capitalist agriculture as an ecosocial process involves not only economic and ecological transformation on a global and local scale but also equally has far-reaching implications for class structure, class struggle, and national political regimes. (2000, 145)

The assertion that capitalist agriculture has social as well as environmental consequences is in opposition to the general EM framing of crises as being purely environmental and solvable through technology and increased reliance on market logics. The contemporary crises of food, energy and environment can be situated as consequences of the drives for accumulation as well as market and production logic based on non-regenerative, extractivist and polluting practices.<sup>8</sup> The rest of this

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<sup>8</sup> Although at a global scale food continues to be produced mainly by small-scale farmers, agro-industrialization continues to expand as investments and speculation becomes less regulated and is increasingly positioned as a new frontier for investments. The crisis of food production can be largely understood as large-scale commercial farms expand displacing peasant farmers from their land or monopolize markets and food prices. The food crisis should be understood as being conceptualized within a framework of economic logic that more staple crops should be produced in an increasingly mechanized fashion. However, the real crisis is way that the expansion of capitalism is leading to new rounds of enclosures and ABD to the detriment of the environment and people. The energy crisis has also been framed within a system that relies on fuel to generate profits within capitalist modes of production and the looming end of fossil fuels as a result of their unsustainable over-consumption. New sources of fuel, such as biofuels, are posited as solutions that work to maintain levels of fuel consumption that supports industries

thesis focuses on conceptions of sustainability and EJ within Brazil and how the manifestation of a flexed soy complex as a historical development within the trajectory of capitalist expansion contributes to environmental injustices.

#### 4.2.5 Sustainability and Environmental Justice in Brazil

The 1987 Brundtland Commission Report, “Our Common Future” asserts that economic and social development must be encapsulated in terms of sustainability as defined as “...development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987, 41). The report goes on to state that “[at] a minimum, sustainable development must not endanger the natural systems that support life on Earth: the atmosphere, the waters, the soils, and the living beings” (ibid, 42). However, to achieve eventual sustainability, the report intermittently states that non-renewable resources should continue to be used, while viable alternatives are being developed, to stall the ecologically degrading practices of the poor (ibid, 42, 46). According to Foster, the Brundtland Report “...reflects a commitment to the needs of capital rather than the environment” as it proposes solutions such as accelerated growth, increased flows of capital and expanded use of natural resources specifically by developing countries (1999, 132). Furthermore, the report insinuates that ecological destruction is largely the result of the activities of the poor rather than on industrial practices and ignores the ways that industrialization induces poverty and marginalization. This definition can be understood as working within an EM framework that advocates for technological changes to harmful industrial processes to make them more sustainable (Low & Gleeson 1998, 26).

Alternatively, I subscribe to a notion of *ecological sustainability*, as it is used within conceptualizations of EJ in Latin America - especially when discussing agricultural production.

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and profit making activities within capitalistic logic. The crisis of the environment is multi-dimensional and impacted by the first two crises. Simply, all of these crises are the consequence of capitalist organization, and reorganizations of means of production and many of the solutions that are advocated for are meant to facilitate the continuation of the capitalist WS through the expansion and deepening of capitalistic relationships that will only lead to further crises. According to Oliveira, while the realities of climate change, food price volatility and future fuel shortages, the specific formulation of these crises are cultural constructs put together by certain dominant actors within a capitalist framework. The threat of scarcity that is denoted in the elaboration of a food, fuel and environment crises rather than actual scarcity have obscured the consequences of capitalism and have colored proposed solutions (2016, 322).

According to Gutbertlet, this framing of sustainability considers the ecological processes and cycles as well as the health of the basic natural resources of energy, soil, water and air as a priority to be sustained and improved for future generations (1999, 223). This notion of ecological sustainability calls for modes of production and socio-economic relationships that respect the requirement for healthy ecosystems in regenerative and cyclical agricultural where biodiversity promotes more resilient systems and have fewer disruptive health and social externalities on the people involved (Curtin 1999, 55). Through this formulation, I adhere to Gutbertlet's claim that ecological sustainability aspires

...to reach sustainable societies within a diversified cultural, social, ecological and economic environment. The process which leads to this final outcome is continuous, and is based on participation rather than exclusion. It considers the local and global needs and equitable access to resources, production and outcomes for present and future generations. (1999, 223)

As will be expanded upon in the proceeding section, the EJ movement within Brazil is one of the driving forces calling for social inclusion and the type of sustainable society as defined by Gutbertlet above. Policies and corporate green-washing informed by EM theories are in direct opposition to ecological sustainability goals. As outlined in the Brundtland Report, the intensified use of resources in ecologically harmful ways is acceptable as long as technologies are eventually developed that will reverse the harmful externalities. This position ignores the interrelatedness between environmental degradation and social injustices and the immediacy of changing environmentally damaging industrial practices. Counter to this is the EJ movement that promotes ecological sustainability goals that encompasses a comprehensive understanding of the interconnectedness of humans and nature and between environmental degradation and social injustices.

EJ movements, in Latin America, provide mechanisms, analytical and practical, for understanding systemic institutionalized violence embedded in processes of capitalist expansion in addition to building organizational capacity for resistance (Acselrad 2008, 89). The increased freedom of capital flows facilitated by economic development schemes, free trade agreements, and financialized commodity markets have increased the power of businesses. This has been to the detriment of workers and those being affected or displaced by extractive and non-regenerative

industries. Activists challenge the accumulation of wealth achieved through displacing the burden of environmental degradation onto the poor, or from core to peripheral areas (Low & Gleeson 1998, 26). What does *just* and *justice* mean is a point of contention that warrants a philosophical debate beyond the purview of this text. As the focus of this text is on Brazil, I will instead concentrate on how EJ has been constructed as a political and social movement within Brazil.

Brazil is an ethnically diverse country. The specific social constructs of race often determine an individual or community's socio-economic and political position in society (Cassel & Patal 2003, 9). Social divisions and prejudices based on ethnicity and race have been a major contributor to inequalities within the country leading to the creation of movements that address social injustices. In the 1980s issues of public health, human rights and justice began to be viewed as related to environmental issues of land use and combined to further the critique of the capitalist development model. EJ developed in response to the co-option of the environmentalist movement by corporate and governmental actors influenced by an understanding of environmental problems and solutions within an EM framework (Acsehrad 2010, 105). Activists have rejected the increasing trend for the environmental movement to focus on technological fixes, conservationism and environmental education which are perceived as attempts to conceal the underlying, structural causes and consequences of the environmental crises (Acsehrad 2010, 106). EJ has alternatively been framed in Brazil as an issue of class-based inequalities affecting the distribution of natural resources and encouraging unequal relations between core and peripheral centers, both domestic and international (Wolford 2008b, 213). By incorporating EJ into their objectives, grassroots environmentalists have been able to develop rhetoric that has situated environmental issues into their social contexts of struggles, inequality and human-nature relationships (Acsehrad 2008, 86). In contrast to many environmental groups who have oriented towards advisory positions on how to clean up industries and establish policies, EJ activists tend to be more radical, organizing grassroots actions and demanding a critical discussion into the role of the current capitalist development model in promoting environmental injustices (Acsehrad 2010, 108).

The EJ movement in Brazil that I refer to is more of an increasing incorporation of EJ principles in previously existing social organizations. Via Campesina<sup>9</sup> and Brazil's Landless Workers Movement (Movimento dos Trabalhadores Rurais Sem Terra) (MST), both leading peasant movements primarily focused on agrarian reform and food sovereignty, have incorporated critiques of agro-industrialization and how it leads to environmental injustices without establishing a distinct EJ program. Nevertheless, as awareness of the interconnectedness of environmental and social concerns have increased in Brazil, there have been several national attempts to facilitate a dialogue between various social organizations regarding EJ. One of the key examples of this was the creation of the RBJA in 2001 that was developed to: promote EJ, expose instances of environmental injustices, facilitate dialogue between different actors and compile data and information into a databank (Porto 2012, 103). It has provided an arena for trade unions, environmental and social activists and other movements or groups to share information, coordinate demands and organize actions (Herculano & Pacheco 2008, 257).

The Declaration of Principles of Environmental Justice in Brazil that came out of the Network<sup>10</sup> asserts that environmental injustices are integral to core processes of ELD that direct negative environmental and social impacts of industries onto marginalized peoples (Pacheco 2008, 721). Agro-industrial development in the Center-West, North and Northeast of Brazil has led to increased racism as migrant workers from the South and Southeast are given jobs based on race, skill and economic background while marginalized locals are either not hired or given a lower wage. Discrimination paired with the transformation of historical modes of subsistence and separation from the land as well as government funds being directed towards building infrastructure rather than social welfare projects have made it hard for marginalized locals to make a living. This has resulted in migration to urban slums or persistent displacement; both have separated the people from the land, forests and rivers that they had previously depended upon as well as disrupted their historical socio-economic and political lives (Acselrad 2008, 102)

Unsurprisingly, at the forefront of the evolving EJ movement have been the marginalized traditional, native and various ethnic communities whose way of life, cultural traditions and

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<sup>9</sup> Via Campesina is a transnational movement that focuses on the socio-environmental impacts of industrialization and capitalism (Martinez- Alier 2011, 146).

<sup>10</sup> An excerpt is provided in section 4.1.2.1

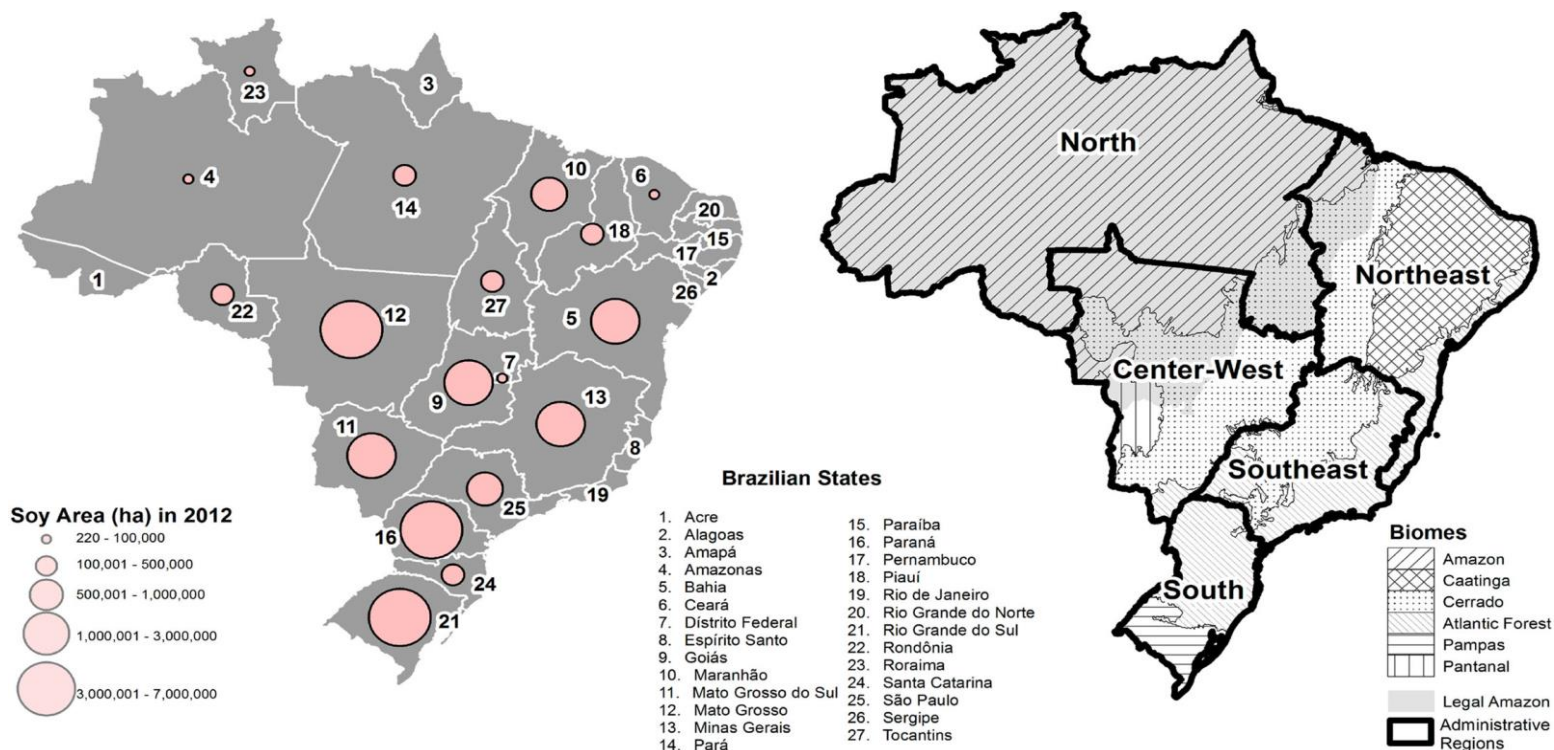
environment in rural areas are threatened by extractive and agribusiness industries as well as state development projects (Porto 2012, 101). Consequently, in Brazil, EJ issues have tended to be framed within discussions on agrarian conflicts rooted in the colonial, imperial and neoliberal means of the extraction of resources and a developmentalist approach to reorganizing rural areas as a means to both control populations as well as to transform perceived wastelands into sources of economic gain (Wolford 2008b, 214). According to an interview with Cleber Folgado,<sup>11</sup> social injustices are intertwined with environmental ones in the context of agro-industrial expansion in Brazil (Sineiro & Berger 2012, 11). Furthermore, within the EJ movement in Brazil, capitalism is viewed as the underlying cause of the burden of ELD being placed on marginalized peoples and environmental degradation will continue until these injustices end. In engaging with notions of environmental injustices and critiques of capitalist expansion, the EJ movement in Brazil has highlighted the interconnectivity between the historical development of capitalist relations and causes of the crises as well as the means by which a sustainable future can be attained (Acsehrad 2010, 115). I thus consider the EJ movement in Brazil as one that seeks to combat social and environmental injustices associated with mechanisms of PA and ABD and the current development model that encourages the expansion of capitalist relationships (ibid, 113).

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<sup>11</sup> Cleber Folgado is a representative of the Movement of Small Farmers in Brazil and the coordinator of Via Campesina's campaign against agrottoxins in Brazil (Sineiro & Berger 2012, 11).



## 5 Brazil Case Study



Map A: (left) area of soy production in each state; (right) Major biomes in Brazil (Garrett & Rausch 2016, 466).

Land consolidation as a result of large-scale agricultural production in Brazil has been a prevailing aspect since the beginning of colonialization by the Portuguese. ELD and EUE as well as social aspects of environmental injustices are thus nothing new in the Amazon and Cerrado as extractive industries such as logging, mining and cattle ranching have been a constant factor in the socio-economic and political formations of the regions. The expansion of the flexed soy complex in Brazil can be viewed as a consequence of ABD strategies by domestic and international actors and an increased orientation towards biotechnology in agricultural production within an EM framework of response to crises. Flexing has been advocated as a sustainable means to profit out of volatile commodity markets, increase food production and an alternative to fossil fuels. However, I contend that if the cultivation and processing of soybeans is to be thought of as an ecologically sustainable activity then it should not result in environmental injustices.

## 5.1 *The Cerrado*

*“The cerrado is the face of Brazil. Overcrowded cities, slums, fields razed by machines and peopled by cows, soy, fences. Idealized as the breadbasket that would alleviate our poverty, the cerrado has converted itself into a grand exporter of living things ([trans. in] Wolford 2008a, 644).*

The Brazilian cerrado is the largest and most diverse woodland/savanna in South America. It occupies 204 million hectares (ha) in the center west region, which accounts for 25% of Brazil's landed areas, and is Brazil's second major biome after the Amazon (Caceres 2015, 644). Until the 1960s, the area was largely considered a wasteland or hinterland with little potential for viable economic activity. Consequently, the area was left untouched by development plans in the early 1900s resulting in the general preservation of its biological diversity (Wolford 2008a, 642; Fearnside 2001, 24). Starting in the 1960s under the military regime, new settlements and agricultural production have been encouraged and subsidized. By the 1970s, the Cerrado became a main target for green revolution technologies and practices, namely large-scale mechanized agriculture, cattle ranching, export-oriented crop production, and agro-chemical applications. These public policies ignored the social and environmental impacts of extractive industries and mechanized large-scale agricultural production. Local populations have been, and continue to be, expelled from their lands and their communal lives disrupted (Gutberlet 1999, 227; Wolford 2008b 216).

Trade practices rooted in the economic theory of comparative advantage paired with the evolution of the global agro-industrial complex have informed governmental policies that led to the flexed soy complex in Brazil. This complex is interlaced within the world market through international finance, agribusiness interests and actors as well as distribution and processing networks (Wolford 2008b, 214). Facilitated through infrastructural development projects, international and domestic actors' interests have converged to turn the Cerrado into a 'bread basket' that threatens ecological sustainability (Wolford 2008a, 243). As of 2004, the state of Mato Grosso provided 29% of Brazil's soybeans, a number that has risen as expansion and intensification of cultivation has occurred (Fisher 2007, 345). To the detriment of the indigenous and rural communities as well as the environment, the massive expansion of soybean cultivation and

farms/plantations has transformed the Cerrado from a biologically rich and diverse savanna into an agricultural frontier. This relatively recent expansion of soybean production within an agro-industrial complex supported by domestic and international agribusiness interests has contributed to the loss of around 66% of the Cerrado's ecosystem (Oliveira & Hecht 2016, 270).

## 5.2 *Environmental Injustice Indicators*

As previously stated, I used the two excerpts<sup>12</sup> from relevant literature to identify three processes that contribute to environmental injustices as understood within the Brazilian context. These three indicators are as follows: *the concentration of land*, *the deepening of socio-economic divisions* and *environmental degradation*. Within this elaboration, *the concentration of land* refers to unequal land tenures that reflect historical colonial land ownership patterns as well as the continual processes of expulsions from land either through coercive extra-economic means or economic incentives. I also incorporate land use changes into this category. *The deepening of socio-economic divisions* are compounded by the exclusive access to land and has contributed to economic or racial divisions. Within the category *environmental degradation*, I consider soybean cultivation land use practices and the ecological impacts of such use as well as any environmental externalities of soybean cultivation. As the applications of agro-chemical and other industrial agricultural practices typically affect human health as well as the environment, I combine this into the same category. Negative externalities resulting from processing factories, ports and roads as well as the construction of infrastructure are also encompassed in the flexed soy complex and are a form of ecologically unsustainable activities and environmental injustices. For the purposes of this research, partially due to available data, I primarily focus on the impacts of the cultivation

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<sup>12</sup> A summary of the main features of EJ in Brazil are calls for "...[the] defense of rights to culturally specific environments, such as those of traditional communities at the front-line of expanding capitalist and market activities; struggles in defense of rights to equitable environmental protection against market-led socio-territorial segregation and environmental inequality; struggles in defense of rights to equitable access to environmental resources and against the concentration of fertile land, water resources and safe ground in the hands of powerful market interests; and also struggles in defense of the rights of future populations" (Acselrad 2008, 93).

"We understand environmental injustice to be the mechanism by which unequal societies, from the economic and social point of view, direct the greatest burden of environmental damage caused by development towards poor populations, discriminated groups, traditional ethnic communities, working class neighbourhoods, and marginalised and vulnerable populations" [2001 Declaration of Principles of Environmental Justice by RBJA] (Pacheco 2008, 721).

phase of soybean production as well as the consequences of transportation infrastructural development.

These indicators are general categories that are not meant to represent a static or novel construction of processes of environmental injustices in Brazil. None of these categories are recent phenomena, and while they can be seen as continuous processes contributing to environmental injustices; their occurrences can be spatio-temporally contextual and exist as constantly re-forming relations and interactions. Furthermore, these three categories are all interrelated and in contributing to environmental injustices, they signify non-ecologically sustainable processes. The flexed soy complex entails cultivation as well as transportation and processing infrastructure. As I was unable to find much data on the effects of processing factories, I include a final section looking at the impacts of transportation infrastructural development. Most of the data comes from research in the state of Mato Grosso which is the largest soybean producing state in Brazil. Mato Grosso is also considered a symbol for sustainable soybean cultivation under the logic of land-sparring, where cultivation is intensified rather than expanded - an occurrence that has been positioned as a means to solve deforestation and increase food production (Oliveira & Hecht 2016, 269). As I am bound by the existence of previously undertaken research, I do use some data from other areas to illustrate wider trends and assume that similar effects are felt in the Cerrado and Mato Grosso. I chose to focus on the Cerrado and not the Amazon to narrow my research further. Additionally, most of the research on soybean cultivation in the Amazon has focused on deforestation and I wanted to examine a wider breadth of consequences of the flexed soy complex.



to border areas where they deforest land and then sell it for a profit and repeat the process (Austin 2010, 518). This can be seen as a consequence of land concentration as smallholder farmers are increasingly pushed to expand into unfarmed areas leading to the further destruction of the Cerrado, depending on their farming methods. In the 1970s soybean production primarily occurred in the southern state of Parana. During the expansion of soybean production, an estimated 2,5 million people were displaced from their land and migrated either to urban slums or the northern state of Rondonia – on the northwest border of Mato Grosso. This resulted in unprecedented deforestation as soybean production expanded into the new state and smallholder farmers or cattle ranchers deforested areas that were then converted into soybean plantations (Fearnside 2001, 27). A report published by EJOLT found that systemic violence was used during land appropriation in Gleba Noca Olinda in the Santarem municipality of the state of Para. Soybean monocultures were found to have led to the expulsion of families and prevented them from accessing natural resources and public areas that are integral to their survival. Urbanization around cities in Para such as Santarem, Juriti and Itaituba have increased due to migratory flows encouraged by agribusiness, mining and service sectors and have intensified inter-ethnic and community conflicts as resources are concentrated in the hands of the economically powerful (2015, 1-2).

Prior to the expansion of agro-industrial soybean production and cattle grazing, the land in the Cerrado was used by indigenous and rural communities to plant a variety of crops for subsistence such as maize and beans (Fearnside 2001, 27). According to one study, the production of soybeans has not decreased the availability of staple foods nation-wide and cultivation of rice, beans and manioc have in-fact increased (Garrett & Rausch 2016, 470). Conversely, in a 2003 policy brief, Cassel & Patal claim that food security has decreased due to soybean expansion as a result of land competition. They found that, nation-wide, from 1970-1973, 90% of soybean encroachment onto already cultivated land led to the displacement of staples such as rice, beans, manioc and corn. Although recent expansion has occurred in the largely virgin lands of the Cerrado, there continues to be a competition over land use and soybean cultivation dominates over other staple food crops (3). Despite contradicting studies, which are probably the result of different spatio-temporal scales, the switch from subsistence agriculture to wage labor in light of discrimination and exclusion – that is discussed in the next section – have been generally negative. In concentrating land and thrusting subsistence livelihoods into the realm of a capitalist economy

(many of the displaced peoples have already been incorporated in capitalist modes of production to some degree or another) where capital leads to access, separating people from their ability to produce food is a basic form of environmental injustice.

Gutberlet conducted a study on rural communities in Mato Grosso in the municipality of Acorizal and found an increase in poverty and landlessness as a result of the restructuring of land use and ownership patterns within the context of a flexed soy complex. She found that there has been a general dismissal of the health and environmental benefits of the non-commercial plants endemic to the Cerrado by the government and agribusinesses involved leading to a disinterest over their disappearance. Governmental, agribusinesses actors and recent migrant farmers to the Cerrado have approached the land as being economically unproductive and the people backwards, the antithesis to modernity, ignoring indigenous land use patterns and agricultural knowledge. Historically, cassava and medicinal plants as well as a diverse set of other food crops have been cultivated and harvested in a system of regenerative and sustainable shifting-cultivation that developed to fit the particular conditions of the Cerrado. With the expansion of the flexed soy complex and cattle ranching, these practices have become marginalized and land use has changed from regenerative methods to extractive ones. This study found that governmental policies and international agricultural development projects have been informed by a framework of economic production that encourages the industrialization of agricultural production regardless of social and environmental impacts (1999, 226).

Contemporary land use logic in large-scale soybean cultivation considers plots of land smaller than 300 ha as economically unviable unless the farmers can access niche markets for special varieties (Oliveira & Hecht 2016, 266). Sorriso, an agrocitey<sup>13</sup> in the Cerrado of Mato Grosso, is a major soybean producing municipality. Most of the farmers own large tracts of land and usually several properties (Fisher 2007, 351). Oliveira & Hecht's research found that large-scale farms are normally controlled by management firms who own and lease land for multiple farms. They have been expanding their production to 10,000-30,000 ha, largely through investments from actors newly investing in agriculture such as private equity and pension funds.

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<sup>13</sup> Agrocities are cities that have developed to serve migrants and farm owners in highly industrialized agricultural. They are typically composed of luxury houses, restaurants, clubs and more with segregated areas for the lower socio-economic classes (Garrett & Rausch 2016, 472).

These new investors are seeking to diversify their portfolios in the context of volatile markets, but while they can have decision making powers, they typically have no agricultural experience and no ties to the land (2016, 266). Based on this data, land is being increasingly concentrated in the Cerrado despite demands by social movements for land redistribution and are largely controlled by investors and agribusiness actors.

### 5.2.2 (B) The Deepening of Socio-Economic Divisions

The argument for the expansion of agro-industries into the Cerrado is based in theories of economic development where increased capitalist economic activities lead to jobs and growth that increases general livelihoods. According to Weinhold, Killick & Resi, medium incomes as well as local GDPs have risen in association with expanded soybean production. However, they go on to prove that economic growth in soybean producing regions is typically accompanied with a deepening of income inequalities (2013, 142). In areas where soybean production are expanding there has been a decline in rural jobs as mechanized production activities take over the jobs of farm hands (Paulino 2014, 139). According to Cassel & Patal, mechanized soybean production is capital, not labor intensive. They found that for a 1000 ha farm, there are only, on average, three farm workers (2003, 28). Another study found a region-wide trend that for every eleven farmers soybean production displaces in Latin America, and average of one farmer is hired (Austin 2010, 520). There is a general rural exodus to urban areas as land is concentrated into large-scale soybean plantations that displace communities and fail to provide commensurate employment opportunities, most of those displaced end up in *favelas* – urban slums in Brazil (Cassel & Patal 2003, 28).

Accusations have been leveled at the agro-industrial sector in Brazil for utilizing slave labor, particularly as farm laborers. The government compiled a “dirt list” of the farms that use slaves for labor that effectively barred them from accessing subsidies and credit. On the list, less than 2%, or 10 out of 583, were involved in soybean production (Garrett & Rausch 2016, 475). However, in light of general impunity and corruption in the agro-industrial sector, this information should be taken with skepticism regarding the ability for slave use to be properly documented as should the rigor of the parameters surrounding the classification of slave labor itself. Herculano &



Pacheco describe a process of disenfranchisement and poor working conditions of indigenous and rural peoples who have been displaced by mechanized soybean cultivation. According to their study, land that they are given access to is generally contaminated by agro-chemicals. Those who have been displaced are routinely given dangerous jobs that put them in direct contact with hazardous agro-chemicals (Herculano & Pacheco 2008, 260). In almost all research studies that I read, I found a common theme of racial socio-economic discrimination on the part of employers. Local rural and indigenous populations seem to be unable to obtain all but the most menial, dangerous and low paying jobs on most soybean farms leading, in part, to a system of racial politics, and general inequalities that was noted by Fisher in Sorriso (2007, 353).

Northern states such as Mato Grosso are largely perceived to be backward hinterlands that represent a new and wild agricultural frontier. Conversely, Southern states have been the site of intensive agro-industrialization for several decades and are composed of different ethnic and socio-economic groups. Southern migrant workers are given jobs and higher wages based on the fact that they are not indigenous or rural northerners and as they typically have technical knowledge regarding soybean cultivation. The following quote obtained by Pacheco illustrates some of the discrimination that occurs:

This time it was the Maranhenses, popularly called ‘Northerners’ or ‘Northeasteners’. Considered inferior to the ‘white and competent gauchos’, it fell to them to substitute for the blacks in the ‘less noble’ jobs, such as clearing roots to prepare the land for soya. (2008, 720)

Socio-economic and racial discrimination is compounded by the flock of migrant workers who have followed the expansion of soybean production into the Cerrado from Southern states increasing job competition and racial inequalities (Garrett & Rausch 2016, 475). Racism towards historical populations from the northern Cerrado are rooted in the belief of the backwardness of the area and a perception of it being an unproductive wasteland. In a quote from an article in the *Gazeta de Santarem* in 2006, a recent migrant farmer was quoted as saying “we who are coming here are bringing development for you, you are Indians, stupid and lazy” ([trans.] Weinhold, Killick & Resi 2013, 141). This illustrates an example of racism and cultural biases that justify the

essential grabbing of land from indigenous and rural communities and the racial socio-economic disenfranchisement that results from the subsequent relationships and interactions.

Soybean cultivation requires intensive capital investments in machinery and agro-chemical inputs including seed varieties. As the land is so acidic in the Cerrado, it requires a good amount of investment in preparing it for cultivation through applications of lime and fertilizers (Fearnside 2001, 27). As a result, smallholder farmers are typically unable to participate in the flexed soy complex leading to a further income consolidation by farmers and firms who tend to be from southern states, the US or controlled by international or regional actors. Furthermore, Fisher notes a clear dominance of white males as the main proprietors of large-scale soybean farms adding a gendered aspect to the socio-economic divisions that soybean production has promoted (2007, 352). In addition to being displaced from land, many smallholder farmers have sold it and moved to urban areas. Weinhold, Killick & Resi have documented some of the reasons cited by such farmers as the lack of access to healthcare and education in rural areas (2013, 141). After selling their land, if they do not migrate to urban centers, farmers tend to move to marginal and damaged lands or find limited employment opportunities damaging their ability to make a livelihood (Garrett & Rausch 2016, 475).

In an interview published in *The Guardian* in 2016, Felipe Milanez<sup>14</sup> gave the following descriptions illustrating the ways in which the overall, cumulative effects of soybean cultivation, ranching and other extractive industries have impacted indigenous and rural communities:

...genocides, ethnocides, epistemicides, slavery, forced displacement of social groups, dispossession and the disruption of social systems. This is happening today in different parts of Brazil. From 2003 to 2014 there were 390 Indians killed in Mato Grosso do Sul, mostly Kaiowa Guarani, fundamentally in conflict with ranchers and soya plantations. The Guarani consider this genocide. (Hill 2016)

Milanez also describes what he means when he refers to an ecological holocaust in Brazil:

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<sup>14</sup> "...a political ecologist at the Federal University of Recôncavo of Bahia, activist, film-maker, former deputy editor of *National Geographic Brazil*, and the editor of the recently-published book, *Memórias Sertanistas: Cem Anos de Indigenismo no Brasil*" (Hill 2016).

I mean the destruction of environments: almost 20% of Brazil's Amazon and 45% of the Cerrado - the savannah - are deforested...Last year there were 40,000 fires in indigenous lands in just one state, Maranhão, while the Xingu Park, surrounded by soya plantations, is burning every year. (Hill 2016)

According to Herculano & Pacheco, social-economic transformations induced by the flexed soy complex have led to the destruction of “not only nature, but their own means of survival as well as their culture, traditions, connections to family and friends, and the right to practice their own religions” (2008, 260). Those who are no longer able to live a subsistence lifestyle face high costs of living, especially in remote areas. Gutberlet's study found that workers who were under contract at farms were forced to spend up to half of their income on food, medicine and tools. They lacked social security or healthcare and typically worked in insecure and dangerous conditions. Families were driven into debt by the high costs of living and suffered high instances of diseases such as malaria and tuberculosis. Although their wages were extremely low, the lack of alternative options have made employees dependent on their employers. This made them susceptible to further exploitation and exclusion that rendered them powerless and generally without rights (1999, 231). The impact of environmental degradation are closely intertwined with economic and political formations of violence and exclusion creating, and/or deepening existing, socio-economic divisions that represent instances of gross environmental injustices as a consequence of agro-industrial expansion.

### 5.2.3 (C) Environmental Degradation and Corresponding Health Impacts

One of the main environmental and health impacts of the agro-industrial production of soybeans stems from the use of agro-chemicals. According to a WWF report on soybeans from 2014, 88.8% of all soybeans produced in Brazil are genetically modified (GM) (66). GM soybean varieties were approved in 2003 for use in Brazil although they have been grown illegally since the 1990s and are integral to providing the flexed soy complex with uniform raw products (Oliveira & Hecht 2016, 254-256). While the impacts of GM cultivation are controversial, what is important to note is that its use in mono-crop systems increases the risks of pest outbreaks. Mono-crop systems fail to provide endemic species with protection and food leading to the extinction of predators that traditionally preyed on pests increasing outbreaks (Garrett & Rausch 2016, 477).

As noted in Gutberlet's study, 40 new diseases had begun to infect soybean plantations in by 1997 as a result of intensive cultivation. Farmers responded to this by rotating maize into the crop cycle and relying heavily on further agro-chemical use (1999, 230).

As of 2010, Brazil was the fourth largest buyer of fertilizers and other agro-chemicals in the world (Lathuillière et al 2014, 8). Of this quantity, the WWF reports that the flexed soy complex accounts for 35% of all pesticide use in Brazil (2014, 63). Intensive use of agro-chemicals are required to neutralize the Cerrado's soils high acidity and infertility. When agro-chemical fertilizers are applied to the soil, Nitrous Oxides<sup>15</sup> are released into the atmosphere contributing to global warming (Garrett & Rausch 2016, 478). In the fields, agro-chemical applications negatively affect pollinators and other species and can decrease yields (ibid, 477). Oliveira & Hecht have noted that as a result of the continuous evolution of resistance to the agro-chemicals, farmers have to apply pesticides as many as 15-16 times per harvest. They identify glyphosate as the most commonly used chemical with soybeans, a toxin that is linked to cancer, as well as genetic developmental and reproductive disorders. Applications have additionally been found to adversely affect earthworms, fungi and other components of healthy soil. When there are outbreaks of weeds resistant to conventional chemicals, farmers have been cited as applying toxic chemicals such as DOW's 2, 4-D (a component in Agent Orange) and Atrazine which are extremely harmful to the environment and people exposed (Oliveira & Hecht 2016, 256).

In an interview, Cleber Folgado asserts that many cases of pesticide poisoning go unreported or uncertified by doctors (Sineiro & Berger 2010, 112). According to one estimate, only an approximate 2% of cases of agro-chemical poisonings were officially registered between 1986 and 1991 (Gutberlet 1999, 229). Certification of health related impacts of agro-chemicals can lead to unofficial sanctions on doctors by agribusiness actors, explaining the failure to disclose agro-chemical related deaths, chronic and other non-chronic problems. Via Campesina's campaign against agrottoxins led to an investigation by Mato Grosso University into the presence of pesticides in the breast milk of 62 women exposed to agro-chemicals. The study found that agrottoxins were present in 100% of the women including toxins that had been banned (Sineiro &

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<sup>15</sup> Nitrous oxides contribute to global warming more than carbon dioxide based on a per-unit analysis (Garrett & Rausch 2016, 478).

Berger 2010, 112). As discussed in the previous section, many laborers are forced to work in unsafe conditions where they are exposed to such chemicals signifying systemic environmental injustices rooted in exploitative labor conditions, socio-economic disparities and racial/ethnic discrimination.

In Brazil, soybeans are typically cultivated in a no-till system leading to a decrease in tractor use which, other than polluting less, decreases soil erosion, retains more carbon in the soil and decreases the need for agro-chemical applications. However, Garrett & Rausch found that farmers still typically over applied agro-chemicals (2016, 478) and the WWF reports uneven application of no-till practices (2014, 62). Garrett & Rausch further discuss a study that found that the Cerrado stores 97-170 mg of CO<sub>2</sub> per one ha. As soybeans only contribute .9 mg of CO<sub>2</sub> per ha, biofuels from soybeans that are cultivated on newly converted soils have a higher carbon footprint than fossil fuels. Consequently, the conversion of savanna into pasture or cropland has been the largest source of CO<sub>2</sub> emissions in Brazil for the past two decades (2016, 477). Further impacts of land conversion include changes to the watershed and water quality, especially when agro-chemical usage is present as well (ibid, 478). A study by Lathuillière et al. observed that the flexed soy complex in Mato Grosso results in the exportation of its “water resources, photosynthetic capacity and nitrogen fixing capabilities to China and Europe” (2014, 10). In other words, China and Europe are able to consume soybeans (usually as meat when soybean meal is fed to animals) without feeling the negative environmental impacts, an example of ELD facilitated through EUE. The data collected here suggests that there are definitive negative environmental impacts, as well as health, caused by the agro-industrial cultivation of soybeans. Additionally, transformations in indigenous and rural land use have led to overexploitation through shortened fallow periods, the clear-cutting of forests and expansion of cultivation into less productive lands in order for communities to be able to subsist in the evolving socio-economic landscape (Gutberlet 1999, 231).

#### 5.2.4 Infrastructure

The development of the flexed soy complex in Brazil has featured massive infrastructural projects in order to attract investments and capital to the sector as well as to make cultivation, transportation, processing and exportation feasible and profitable (Fearnside 2001, 24). Although my text research primarily focused on the impacts of road expansions, it is important to note the transformative socio-environmental impacts of industrial processing factories, ports, and agrocities. As noted in the environmental degradation section above, large-scale soybean cultivation relies heavily on biotechnical and mechanical inputs that necessitate an intensive system of transport. Most soybean cultivation has expanded into rural and remote areas and so agricultural development policies have largely focused on building roads, transport waterways, railways as well as ports, factories and agrocities. Fearnside notes the general trend of Brazil's regional and national governments to prioritize soybean infrastructural development, specifically in the Ministries of National Integration, Planning, Transportation and Agriculture (2007, 601). For example, the Amazonian section of Brazil's 1996-99 action plan largely focused on building soybean transportation infrastructure and proposed the construction of three railways, an extensive network of highways and eight transportation waterways to connect and cross the Pantanal Wetlands, Cerrado and Amazon (2001, 24).

The building or paving of highways have historically led to deforestation and other social and environmental impacts. In 1982 the World Bank financed the paving of BR-364 in Rondonia that resulted in an explosion of deforestation so bad that it prompted the organization to create its Environmental Department (Fearnside 2007, 602). A more recent case is the paving of BR-163, otherwise known as the 'soy highway'. Stretching from Cuiaba, Mato Grosso to Santarem in Para - an Amazonian river port - it was originally built in the 1970s and existed as a dirt road until a government initiative led to its being paved (Fearnside 2007, 601; Miller 2012). In 2006 the government stated that they would take precautions to minimize environmental and social impacts of paving the road. However, according to Miller writing for Greenpeace international, as of 2012 with nearly 80% of the road paved, environmental and social protections have gone largely unimplemented. Reportedly, 6.8 million ha of protected primary forests have been reduced by deforestation initiated by cattle ranchers, loggers and agro-industrial expansion (2012). Garrett & Rausch point out that in a 2016 ecological zoning plan for BR-163, surrounding land occupied by indigenous and rural land holders have been re-designated as soybean producing land leading to

expulsions or economic incentives/coercions to sell the land (2016, 475). Overall, there have been further reports of land grabbing and conflicts between communities and migrants consequent to these infrastructural projects (Miller 2012).

I found well documented cases of consistent patterns of deforestation around highways as better transport infrastructure attracts large-scale farmers and agribusinesses who convert land into pastures or cropland (Fearnside 2007, 602). Infrastructural developments, such as roads, lead to an expansion of agro-industrial activities that result in biodiversity loss, soil erosion, and increase agro-chemical applications with subsequent health and environmental externalities. The secondary data I found suggests that projects systematically lead to the displacement of communities and re-orient food production towards commodity crops and away from local consumption. Furthermore, in focusing capital in infrastructural development, the government directs money away from social welfare programs and education that could reduce rather than contribute to environmental inequalities (Fearnside 2001, 24).

### 5.3 Discussion

The contemporary crises are compounded with unprecedented global environmental destruction and finite resources that necessitate revolutionary strategies of re-envisioning capitalistic activities. The promotion of flex crops and a *bioeconomy* within an EM framework represent the next phase of capitalistic development that is advanced as progressive and reactionary without affecting any real structural changes to the capitalist world system. In effect, the development towards a flexed soy complex in Brazil can be seen as a method within the logic of capitalism to foster new arenas for accumulation to avoid or overcome crises. In response to my first question - *Although typically rationalized through an Ecological Modernization theoretical framework, how can the development of a flexed soy complex be understood within a World-Systems perspective of capitalist over-accumulation and crises?* – I found that flex crops provide an opportunity for the current phase of financial capitalism to expand into new, or outdated territories both in the material world and financial realm. Beyond its usefulness as a means of accumulation, such a complex offers a vision of a more sustainable, bio-based economy without major alterations to current levels of fuel consumption (Gillon 2016, 129, 132). However, the

increased agro-industrialization of a handful of staple crops slated for flexing – maize, soybeans, sugarcane and oil palm – have led to a decreased diversity in ecosystems, culinary traditions, and resilience to market volatility in food prices. Increased production and investments have encouraged the observable scramble to gain control over land and water to the detriment of local populations and ecosystems (Oliveira & Schneider 2016, 188, 199). The cultivation and processing of soybeans exists in a global complex where farmers, agribusinesses and governmental institutions interact at a transnational level determining the flows of capital and the soybean trading network. Thus at the global level, taking into consideration the fact that soybeans are primarily processed and consumed in areas separate from cultivation, the flexed soy complex in Brazil can be understood as a mechanism of ABD that comprises of systemic EUE and ELD between core and periphery.

In addition to situating the rise and expansion of flex crops into a WS framework, I sought to understand the ways that these trends have manifested themselves into violence and injustices in Brazil. I found that in Brazil, the processes of ecological modernization under which the flexed soy complex has arisen has led to systemic and routine cases of environmental injustices. In order to ensure the accumulation of capital by domestic and transnational actors, methods of violence, repression and extraction have been institutionalized into legitimate state action. This is not new to the flexed soy complex or processes of agro-industrialization but has been an integral strategy of capitalist expansion since the beginning of the capitalist world-economy. In order to ensure a favorable environment and infrastructure for investment by MNC and TNCs, state violence and environmental injustices have facilitated the EUE of soybeans under the justification of EM at the cost of disruptive and catastrophic environmental and social transformations (Bonds & Downey 2012, 172). Wolford found that distributional and procedural inequities are major components of the forms of environmental injustices encompassed in the flexed soy complex in Brazil. She further maintains that these inequalities have been enforced by governmental institutions in Brazil that have encouraged the agro-industrialization of areas, such as the Cerrado, in order to create economic zones of accumulation and agricultural surpluses oriented for export (2008b, 215). The bulk of my thesis has focused on examining the different ways that the flexed soy complex has resulted in environmental injustices in the Cerrado in order to understand the specific physical manifestations of processes of ABD, EUE and ELD in Brazil.



During my text research I looked for widespread structural patterns of land concentration, deepening socio-economic divisions and environmental degradation stemming from the flexed soy complex. In section 5.2.2 I found evidence of land concentration as indigenous and rural communities have been displaced from their land and large soybean plantations have become the norm. Soybeans and cattle ranching are the main activities that these large-scale farms undertake, however there are other cash-crops being grown in the area as well. Ultimately, the agro-industrial complex and government finance schemes have led to this land concentration. However, the dominance of soybeans as a main focus of investment and expansion in the Cerrado can be seen as a current leading causal factor in the expansion of the agricultural frontier. As a capital intensive crop, soybeans must be cultivated at a large-scale in order to attract investors or credit and to be economically viable necessitating land concentration in areas of cultivation. This contributes to environmental injustices for the indigenous and rural communities in the Cerrado.

My second indicator of environmental injustices is the deepening of socio-economic divisions. Mechanized soybean cultivation does not require many farm laborers, and most of the technical jobs go to migrant workers from the South. According to my findings, migrant workers from Southern states receive preferential treatment based on their race/ethnicity as well as their technical knowledge. This discrimination largely relegates those who have been forced off their lands, or who have sold them willingly, to menial and hazardous low paying laborer jobs or unemployment. This has resulted in racial/ethnic conflict between the various groups as well as segregation as agrocities spring up to cater to those with money and those who do not are relegated to marginal areas or slums. Furthermore, the exportation of soybeans out of the Cerrado can be seen as a form of EUE where the marginalized are negatively impacted by the flexed soy complex and only a small percentage benefit economically from the exchange. The manifestation of elite privilege based on the socio-economic political and historical context of Brazil and the Cerrado are an integral contributor to instances of environmental injustices in industrial agricultural production (Caceras 2015, 641).

The third indicator, environmental degradation, is a well document consequence of industrial agricultural production. I found that large-scale soybean cultivation in Brazil is

dependent on agro-chemical inputs. Although many farmers use a no-till system requiring a smaller amount of agro-chemicals, the data suggests that agro-chemicals are often over applied. This has had negative consequences on water quality, soil health as well as endemic plant and animal species. I found evidence of widespread negative health effects of agro-chemical exposure, although many cases go unreported by the individual or the doctor. Additionally, the expansion of mono-crop systems has led to biodiversity loss, soil erosion and a general transformation in one of the most diverse savannas in the world. Overall, the literature points to widespread environmental and health ramifications caused by soybean cultivation in the Cerrado signifying vast environmental injustices in the cultivation system of soybeans.

Section 5.2.4 focused on the impact of infrastructural development for transportation. I found that paving and building highways leads to deforestation, expulsion of communities and the expansion of activities such as soybean cultivation, cattle ranching and logging. These consequences contribute to environmental degradation and land concentration suggesting that infrastructural development into the Cerrado and the Amazon contributes to environmental injustices in numerous ways. Overall, my secondary data collection indicates that soybean cultivation in the Cerrado within the flexed soy complex is a major contributor to environmental injustices. In response to my second question: *To what extent does the expansion of a flexed soy complex contribute to environmental injustices in areas of production in Brazil?* I thus argue that the further intensification of soybean cultivation as a flex crop will only increase environmental injustices preventing ecological sustainability and fails to respect the calls for justice in the Brazilian EJ movement.

## 6 Conclusion

*“The offensive of Capital is threatening rural life and our entire society, including our health, Mother Earth, the climate, biodiversity, and our peoples and cultures. Mass migration, the destruction of the social fabric of our communities, urban sprawl, insecurity, agrochemicals, GMOs, junk food, the homogenization of diets, global warming, the destruction of mangrove forests, the acidification of the sea, the depletion of fish stocks, and the loss of anything that resembles democracy, are all symptoms of what is taking place. The emergence of this new alliance between financial capital, agribusiness, the State and mass media—and its capacity to dispute territories, public opinion and the State, even where the government is “progressive”—*

*has forced us once again carry out a process of reflection and reformulation of our concepts and proposals, as well as our strategies, forms and practices of struggle” – Maraba Declaration 2016 (Via Campesina 2016).*

The topic of agro-industrialization and cyclical crises of accumulation within the WS is an extensive topic that has, admittedly, barely been brushed upon in this thesis. Even within the specific case study on Brazil I have been unable to address the complex ways that various levels of domestic elites interact within one another and internationally within the flexed soy complex. On a global level, an examination into land-grabbing by MNCs, TNCs and governments would reveal how actors interact as well as various contextual motivations to a deeper extent. Other significant areas for further research is a deeper look into how notions of EJ have been incorporated into social movements in Brazil and the ways in which the dynamics of agro-industrialization, soybean cultivation, marginalized communities, migrants and the numerous other actors. This thesis has suggested that situating the rise of flex crops within a WS understanding of the historical developments of capitalism is integral to understanding why they are being proposed as a sustainable solution and how they are a strategy within the broader context of agricultural restructuring within the current phase of capitalist expansion. In order to understand how a flexed soy complex has affected the environment and society in areas of cultivation and processing, I have focused on how the EJ movement in Brazil have constructed understandings of injustices within agriculturally producing areas. Through analyzing how the cultivation of soybeans affects three indicators of environmental injustices as well as some of the impacts of infrastructural development, I have concluded that the flexed soy complex has an overwhelmingly negative affect on EJ.

Within an increasingly globalized and financialized world, understanding how the world-economy functions under cycles of capitalist expansion and retraction and how this informs agricultural developments is crucial to contextualizing the conceptualization of soybeans as a flex crop. The fact that industrialized soybean cultivation leads to environmental degradation comes as no surprise. It has been well established that the agro-industrial complex is a main contributor to climate change and leads to the widespread loss of biodiversity in a system of heavily mechanized practices that transforms cultivation into an energy consumer whereas it had previously been a producer (Martinez-Alier 2011, 146). The EJ movement in Brazil combines environmental

degradation with societal transformations and inequalities resulting from capitalist expansion and the agro-industrial complex. As one of the most important crops in Brazil today with forecasted expansion and intensification in cultivation as well as processing, the orientation of soybeans as a flex crop promotes a correlated increase in environmental injustices in areas of cultivation in Brazil. In response to the same crises, organizations that have incorporated the principles of EJ into their programs such as Via Campesina, MST, Agroecology and more have been working on promoting alternative models based on food sovereignty and regenerative farming practices to the industrial agricultural model under which flex cropping is promoted. As the flexed soy complex has seemingly systematically contributed to environmental injustices, any serious discussion into the future sustainability of such a complex should involve an understanding into how it contributes to environmental injustices in Brazil. Although further research is warranted, this thesis suggests that the expansion of a flexed soy complex effectively undermines prospects of ecological sustainability and any promises of a just future for the marginalized in peripheral areas. As such, the flexing of soybeans seem to be a mechanism of further capitalist expansion rather than a revolutionary solution to the contemporary crises that should be viewed as the consequences of capitalist expansionary and exploitative logic.

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