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Abstract

As a significant global commodity in the 19th century, coffee fueled the rapid economic growth of Brazil, resulting in significant social and ecological transformations. The study of the coffee frontier in the Paraíba do Sul Valley allows us to understand how the growing demand for coffee in North America and Europe since the mid-19th century led not only to changes in labor patterns, but also saw environmental ramifications such as the deforestation of the Atlantic Rainforest, soil erosion and regional changes in climate patterns. To comprehend the geographic expansion of capitalism in the latter half of the 19th century, this thesis, employing a commodity frontier perspective, seeks to understand the factors driving the transformation of coffee production in the Paraíba Valley from its peak in 1850 to its eventual decline in 1888, a period characterized by the transition from an early capitalist to an industrial commodity regime.

Abstract

Als bedeutende globale Handelsware im 19. Jahrhundert trieb Kaffee das schnelle Wirtschaftswachstum Brasiliens voran, was zu signifikanten sozialen und ökologischen Transformationen führte. Die Untersuchung der Kaffeegrenze im Paraíba do Sul-Tal ermöglicht es zu verstehen, wie die wachsende Nachfrage nach Kaffee in Nordamerika und Europa seit Mitte des 19. Jahrhunderts nicht nur zu Veränderungen in den Arbeitsmustern führte, sondern auch ökologische Folgen wie die Entwaldung des Atlantischen Regenwaldes, Bodenerosion und regionale Veränderungen in den Klimamustern nach sich zog. Um die geografische Expansion des Kapitalismus in der zweiten Hälfte des 19. Jahrhunderts zu begreifen, sucht diese Arbeit, die eine Perspektive der Warengrenzen einnimmt, die Faktoren zu verstehen, die die Transformation der Kaffeeproduktion im Paraíba-Tal von ihrem Höhepunkt im Jahr 1850 bis zu ihrem letztendlichen Niedergang im Jahr 1888 vorantrieben, eine Periode, die durch den Übergang von einem frühkapitalistischen zu einem industriellen Warenregime gekennzeichnet ist.

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1. Introduction

„Nos campos não é menor a desolação. Leguas a fio se sucedem de morraria aspera, onde reina soberana a sauva e seus aliados o sapé e a samambaia. Por ella passou o café, como um Attila. Toda a seiva foi su-gada, e sob forma de grão ensaccada e expedida para fóra; mas do ouro recebido em troca nem uma oitava permaneceu alli empregada em restaurar o torrão. Transfiltrou-se para o Oeste na avidez de novos assaltos á virgindade da ter-ra: parte se transfez nos palacetes em ruina; muito delle reentrou na circulação européa por mãos dos filhos-familias dissipadores. A’ mãe fecunda que o produziu nada coube; por isso, resentida, vinga-se agora, enclausu-rando-se numa esterilidade feroz. E o deserto reganha as posições perdidas...”

“The desolation in the countryside is no less. Leagues upon leagues of rough hillsides follow one another, where the ant and its allies, the sapé grass and the fern, reign supreme. Through it, coffee passed, like an Attila. All the juice was drained, and in the form of grain, bagged and sent away; yet, of the gold received in return, not an ounce remained there to restore the soil. It filtered westward in the eagerness for new assaults on the virginity of the land: some of it transformed into now-ruined palaces; much of it reentered the circulation of Europe through the hands of wasteful heirs. To the fertile mother that produced it, nothing was left; thus, resentful, she now avenges herself, encasing herself in fierce sterility. And the desert regains the lost grounds...”¹

In *Cidades Mortas*, Brazilian author Monteiro Lobato (1882-1948) narrates the tragically comical cultural and ecological consequences of the decline of the coffee industry in the Paraíba Valley, a once fertile region that by the beginning of the 19th century could only be recognized as a devastated pastureland “ruled by ants.” This rural area surrounding the Paraíba Valley in southeastern Brazil, along the Paraíba River between São Paulo and Rio de Janeiro, already began to be integrated into an emerging global coffee market in the 1820’s. As this “global countryside”² became the

¹ Lobato 1919, 11-12.

² Beckert and Bosma 2021, 435.

center of the Brazilian coffee economy by the mid-19th century, the demand for Brazilian coffee in Western European and North American countries continued to rise. When the Paraíba Valley witnessed a decline in coffee production by the 1880's, other regions rose as new centers of coffee production, and, over these decades, Brazil's slave-based coffee frontier gradually shifted westward to the areas around São Paulo and Paraná, where, following the end of slavery, the mode of production shifted towards the colono system with a reliance on immigrant labor from Europe.

To comprehend the geographic expansion of capitalism in the latter half of the 19th century, this thesis, employing a commodity frontier perspective, seeks to understand the factors driving the transformation of coffee production in the Paraíba Valley from its peak in 1850 to its eventual decline in 1888, a period characterized by the transition from an early capitalist to an industrial commodity regime.³ The periodization indicated for this topic may vary in certain instances, as for the purpose of coffee production in the Paraíba Valley, most of the land was acquired at the end of the 18th century through sesmarias, that had already been established during Brazil's colonial period. Meanwhile, certain ecological consequences, particularly the conversion of agricultural land into pasture, only became apparent toward the latter years of the 19th century.

The structure of this thesis follows the frameworks proposed by Sven Beckert and Ulbe Bosma, which explore the transformation of the commodity frontier through the organization of labor, land distribution, and ecological repercussions. Additionally, this study examines the external drivers of expansion, such as British capital, the establishment of international banks, and the evolving consumption patterns in North America and Europe, all of which are of particular significance for the case of Brazil. An emphasis is also set on Brazil's increasing institutionalization of scientific field such as geography between 1850 and the 1880's, a development that was primarily initiated under the pretext of expanding the coffee economy.

³ Beckert and Bosma 2021, 445.

Although not being examined through the lens of a commodity frontier approach, the land conditions and labor organization in Brazilian fazendas, as well as their role in the emerging global coffee market in the second half of the 19th century, are well-documented. Among the most important historical studies of 19th-century Brazil is undoubtedly the monograph by American historian Stanley J. Stein, *Vassouras: A Brazilian Coffee County, 1850-1900*. First published in 1957, the book deals with the socio-economic and cultural implications of coffee cultivation in Vassouras, a municipality in the Paraíba Valley. While its focus lies on the power dynamics between Brazil's political elite, the plantation owners, and the enslaved people, Stein's monograph is also an important assemblage of sources and eyewitness reports from planters in the Paraíba Valley. While most of these sources have been reviewed during the writing of this thesis, the source reports, and their translations, which could not be attained, because they largely required access to archives in Brazil, have been adopted from Stein.

The ecological consequences of coffee production in the late 19th century, on the other hand, are less explored. The first key work that placed the Atlantic Rainforest at the center of historical investigation is Warren Dean's 1995 publication, *With Broadax and Firebrand: The Destruction of the Brazilian Atlantic Forest*. It represents a long-term analysis of the socio-political and economic reasons for the deforestation of the Atlantic Rainforest from the pre-columbian ages until the 1970's. In many ways, the chapter of his book dedicated to Brazil's coffee economy in the 19th century serves as a foundation for the subsequent thesis.

Having a global perspective on a subject, especially within environmental history also means adopting a transdisciplinary approach. Therefore, current studies from Environmental Sciences, Climatology, and Earth System Sciences are also considered for this thesis. A detailed study of the environmental factors affecting coffee production can be found in the anthology by Rogério Ribeiro de Oliveira and Adi Estela Lazos Ruiz, *Geografia Histórica do Café no Vale do Rio Paraíba do Sul*. It presents a historical geographic analysis of the region above Rio de Janeiro, and comprises thirteen interdisciplinary contributions exploring ecosystem services and

anthropogenic landscape changes within the region. The contributions primarily emerge from fields closely aligned with geography and use methods such as mapping, fieldwork, and modern technologies like geographic information systems (GIS) to reconstruct historical alterations of the region's surface. On the other hand, a focus of the edited book by Oliveira and Lazos Ruiz is also to provide political solutions for the development of sustainable agricultural practices in the region.⁴

⁴ “Editora PUC-Rio.” 2018. Accessed March 3, 2024. <http://www.editora.puc-rio.br/cgi/cgilua.exe/sys/start.htm?infoid=548&sid=3>.

2. Theory and Method

There have been many concepts surrounding the idea of the Anthropocene, the age in which “humans” apparently rose to become the most dominant geological force on the planet. So-called Earth System scientists and climatologists now widely agree to set the beginning of that newly proposed geological era in the mid-20th century, with the testing of the first atomic bombs. James W. Moore advocates for a different conceptualization of this “era of humanity” by holding a particular mode of production responsible for the Earth’s shift from the Holocene to a new geological era that he refers to as the Capitalocene. According to Moore, the age of this “Era of Capital” did not begin in the middle of the 20th century but already with the start of the colonization of the Americas. Consequently, the planetary ecological crises can only be understood through an examination of the expansion of capitalism over the last 600 years.

In academic discourse, there is a continuing debate regarding the integration of non-human nature into historical narratives, with multiple theoretical frameworks being suggested. Too often, historians have oversimplified the notion of “nature” and placed it as an unspecified background in their historical narratives on economic and social matters. In this way, the ontological foundation for most of these explanations “are premised on the idea that capitalism develops upon Nature—not through the web of life.”⁵ Since economic processes are inherently ecological, Moore portrays capitalism as a way of “organizing nature”.⁶ In these terms, any crisis is not just something happening “to” nature but “through” nature. Within the capitalist mode of production, not only human actors are included in the labor process, but also ecological processes provided by nature, such as soil fertility and water cycles. In this respect, Moore argues from a planetary perspective in which labor and energy are to be understood as inseparable from each other. In this way, he contributes to including non-human actors in attempts to explain capitalism. Within Jason W. Moore’s theory of the Capitalocene, the concept of the commodity frontier plays a pivotal role. These commodity frontiers are sites of production and represent processes where resources are integrated into a

⁵ Moore 2015, 86.

⁶ Ibid, 176.

growing capitalist economy by progressively absorbing more land, labor, and natural resources.⁷

“The commodity frontier thesis”, Moore writes, “insisted that capitalism emerged through a prodigiously generative nexus of Cheap Labor, imperial power, and the unpaid work/energy of previously uncaptialized soils, forests, streams, and all manner of indigenous flora and fauna.”⁸

By engaging with commodity frontiers, the emphasis is therefore placed on the restructuring of rural landscapes and natural environments without however neglecting the social histories of land appropriation or labor organization and resistance. It is on Moore’s foundations that Sven Beckert and Ulbe Bosma expand their conception of the commodity frontier. According to Beckert and Bosma, the expansion of commodity frontiers is divided into different socio-political regimes. They distinguish two “commodity regimes” that are central to their work. According to them, an early capitalist commodity regime, characterized by forced labor, slavery, and land dispossession extended from 1450 to 1850, with its frontiers primarily expanding by merchant capital. A second industrial regime, accordingly, occurred in the years from 1850 to 1970 and is characterized by the increasing use of fossil fuels and an unprecedented expansion of technological infrastructures in transportation and telecommunications. These observations understandably do not apply equally across all economic sectors, and the following thesis will demonstrate the extent to which the coffee economy in the Paraíba Valley experienced a phase of overlap between both commodity regimes during the period in the years 1850 to 1888. Transformations within commodity frontiers, according to Beckert and Bosma emerged “because each regime ran into frictions that eventually made the further expansion of commodity frontiers impossible without fundamental changes.”⁹ Under these “frictions,” a term that can also easily be understood as “challenges” or “struggles,” the authors comprehend ecological frictions, and the competition for land and labor. While the external market and coffee consumption in North America and Europe also play a vital

⁷ Beckert and Bosma 2021, 435.

⁸ Moore 2021, 3.

⁹ Beckert and Bosma 2021, 444.

role in the configuration of Brazil's coffee frontier, these three pillars of labour, land and ecology are the framework for the subsequent thesis and serve as the structure for the main body of this work. In addition to a nuanced comprehension of the commodity frontier concept and the incorporation of interdisciplinary viewpoints, this master's thesis adheres to the conventional historical methodologies of critical engagement with sources and scholarly literature.

3. Global Coffee Market and Dynamics of Consumption

3.1. Financialization of Brazil's Coffee Frontier in a Global Market

The global coffee market in the mid-19th century saw tremendous growth and expansion. During the years 1860-1890, coffee had become one of the world's most widely traded commodities and the main coffee frontiers were located in the tropical or subtropical regions of South America and Southeast Asia with the expansion of coffee cultivation in these regions shaped mainly by the demands of the world market, thus by the interests of European colonial powers and the United States. In Southeast Asia, the coffee frontier was focused primarily on the Dutch East Indies. Other countries in Southeast Asia included the Philippines and India. In 1888, coffee production began in Vietnam, which has since become a major competitor to Brazil's dominant position in the world market.¹⁰

In the early 19th century, the majority of globally exported coffee still came from European colonies, with French colonies, particularly Saint-Domingue, contributing the majority. The years from 1850 to 1890, however, saw Brazil emerging as the dominant coffee producer, outcompeting colonies to meet the growing demand in Europe and the United States. By 1850, Brazil generated over half of the global coffee output, and by 1906, its production had almost grown to five times that of the rest of the world.¹¹ In fact, approximately 80% of the 19th-century global coffee production growth was attributed only to Brazil, with most of the remaining growth being observed in Spanish America.¹² Initially, the expansion of Brazil's coffee market was facilitated by virgin forests, suitable climate, commercial infrastructure, slave labor, and relative political stability. By the end of the 1800's, Brazil's economy however grew significantly due to their increased international trade in coffee. While the main area of cultivation in these years was the Paraíba Valley, by the end of the 1880s, Brazil's coffee production had shifted to rural regions surrounding the cities of São Paulo and Rio de Janeiro. Although Brazil's total share continued to increase until the

¹⁰ Topik 2019, 36.

¹¹ Instituto Brasileiro de Geografia e Estatística 1986, 85.

¹² Samper and Fernando 2003, 412-415.

first years of the 1900's, coffee production in the Paraíba Valley by that time had largely declined due to a variety of socio-ecological factors.

The factors behind Brazil's rapid expansion are diverse. Unlike commodities such as sugar and rubber, the technology needed for coffee cultivation was minimal. One of the most dominant factors that enabled independent nations like Brazil to engage in massive production of coffee certainly was the combination of vast fertile land and the use of slave labor, resulting in drastically reduced coffee prices. Although technological factors like the advent of the railroad in the mid-19th century not only dramatically reduced transportation costs but also crucially impacted the landscape transformations in the intermediate regions of São Paul and Rio de Janeiro, Steven Topik is reluctant to ascribe a significant portion of Brazil's rapid economic expansion to these technological factors, "the rate of export expansion after the advent of the railroad and the steamship in South America, between 1860 and 1900", he asserts, "was barely greater than it had been with mules and sail between 1830 and 1860".¹³ Nonetheless, the advent of the railroad made coffee production much more efficient and enabled a faster expansion of plantations into new territories outside of the main coffee sites like the Paraíba Valley, while also the shipping revolution between 1850 and 1900 benefited Brazil's trade in coffee immensely.

Coffee production also stemmed the core of urbanization in Brazil. Within a span of 20 years, Brazil doubled the size of its population and with the expansion of cities, the lifestyle of the Brazilian population changed. This prompted the need for the expansion of industries, railways, and port facilities, leading to a significant increase in urban consumption and driving the creation of new sectors that led to an increased development of the employment sector. The trade in coffee fueled the agricultural expansion in new territories and eventually also led to the urbanization of cities like São Paulo and Rio de Janeiro, with Rio becoming the center for financial matters.¹⁴ Between 1840 and 1870, the scale of global, as well as Brazilian trade, multiplied by five and with it, foreign investments and banking operations increased while the British

¹³ Topik 2004, 20-21.

¹⁴ Almeida 2017, 388 & Artiaga 2020, 106.

became the key investor in Brazil. These developments finally led to the expansion of Brazil's activities in international trade and financial institutions, most importantly, international banks and insurance companies became vital in folding the economy.¹⁵ Following the growth of Brazil's coffee sector, in the 1850s, the Bank of Brazil, already founded in 1808, transitioned from a regional institution to a nationwide financial entity that oversaw international trade and represented public corporations. In the meantime, Banks specializing in the coffee industry also started emerging. In 1855, Rothschilds became the main financial partner of the Brazilian government.¹⁶ Later, privately-owned domestic banks, like Banco Mauá and Mac Gregor & Cia appeared, and, starting in 1862, international banks such as the London & Brazilian Bank were founded. Mainly engaged in services like foreign currency exchange, the bank was also an important financier of infrastructure such as railways.¹⁷

In fact, by the late 19th-century Brazil was increasingly viewed as a lucrative market. As an emerging node in a global capitalist landscape, its financial sector was an international battleground for economic influence and expansion. Only a few months after the launch of the London & Brazilian Bank, another British financial institution was established in Rio de Janeiro. Initially called The Brazilian and Portuguese Bank, later rebranded as The English Bank of Rio de Janeiro Ltd due to the insolvency of its Porto branch in 1866 opened its activities in Brazil with a starting capital of 500,000 pounds.¹⁸ Simultaneously, German investors with funds from leading Hamburg-based banks set up the Deutsche Brasilianische Bank. Although the bank was dissolved in 1875, the institution for a short time was a major challenge to the dominant British banks.¹⁹ Additionally, the insurance sector grew steadily as from 1860 to 1875, Brazil witnessed the registration of twenty-one foreign-based insurance firms.²⁰

The terms of the global economy were, as for many other countries in Latin and South America, largely defined by Britain, with Brazil being their “most accommodating and

¹⁵ Artiaga 2020, 107.

¹⁶ Cain and Hopkins, 2016, 281.

¹⁷ Almeida 2017, 386.

¹⁸ Ibid, 387.

¹⁹ Ibid, 387.

²⁰ Artiaga 2020, 109.

most successful satellite in South America during the first half of the nineteenth century.”²¹ This status didn’t change much in the second part of the 19th century. After 1850, the British interest in Brazil broadened particularly in the sectors of finance and commerce and the United States could not weaken this British dominance up until 1914.²² During the global economic crisis in 1873, in between many countries facing difficulties, Brazil managed surprisingly well, in part because the Rothschilds facilitated the sale of Brazilian bonds in the London financial market.²³ In the end the strong coffee prices were one of the main reasons the country managed to maintain creditworthiness during the Baring Crisis in 1890, a crisis that was set off when Argentina faced an economic downturn not being able to repay its debts to the British banking house Baring Brothers.²⁴

At first, Brazil’s Government was cautious to regulate the quickly emerging financial sector because it saw the new banks as risky enterprises. This political ideal though changed, and their policy eventually shifted to a more “laissez-faire” approach.²⁵ In the end, the Government became directly involved in financing of agricultural activities through the Bank of Brazil and subsequently five new banks were given permission to operate by the Finance Minister, Bernardo de Souza Franco.²⁶ One of these new banks, the Banco Commercial e Agricola, opened in a key coffee-growing region around Vassouras. Coincidentally or not, the director of this bank was related to an important financier in the coffee business and a close friend of the minister of the treasury Bernardo Souza.²⁷ Stein argues that “the opening of a Vassouras branch of the (...) Banco Commercial e Agricola in 1859 marked the transition from one financial era to another: from personal to impersonal credit relationships.”²⁸ While production of coffee in the Paraíba Valley previously relied on local wealthy individuals who were

²¹ Cain and Hopkins 2016, 280.

²² Ibid, 281.

²³ Ibid, 281.

²⁴ Ibid, 282.

²⁵ Stein 1985,20.

²⁶ Ibid, 20.

²⁷ Ibid, 20-21

²⁸ Ibid, 238.

willing to invest, with the establishment of national and international banks, planters now had to turn to regulated financial institutions to secure their loans.

The increasing financialization by national and international banks that fueled the expansion of the country's coffee frontier was closely tied to a surge in liberal economic policies. Although Edward Poppino writes that "with the establishment of the Republic all constraints on economic expansion were removed"²⁹, the relationship between the public and private sectors in Brazil has always remained ambiguous. Even after the establishment of the Republic, the state remained a driving force and one could even argue that the state even expanded its role in the economy, as its investments in railroads, banks, ships, and telegrams only grew with the dawn of the republic.³⁰ In any case, the ideological landscape of Brazil by the late 1800s was deeply influenced by liberal economic ideas, and the foundational principles for emerging liberalism were certainly laid during the era of the monarchy. From 1822 to 1889, most ministers, 73%, held degrees in Law. Most of these ministers went through the same educational system and shared the same economic courses that largely focused on a basic understanding of Adam Smith and David Ricardo's classical liberal theories.³¹

Already in the 1860's and 1870's there were financial crises that affected Brazil's coffee production, but it was only in the 1880's that the coffee plantations of the Paraíba Valley faced major economic and financial challenges, when the value of land, crops and enslaved people all declined, and the large banks reacted by becoming increasingly hesitant to extend loans for coffee production.³² Since the financial stability of the coffee plantation in that period was highly dependent on slave labor, there were concerns that the abolition of slavery in Brazil might destabilize the entire economic infrastructure of coffee cultivation and the whole fazenda complex could face financial risk.

²⁹ Poppino 1968, 202.

³⁰ Topik 1984, 467-469.

³¹ Versiani 2022, 134.

³² Stein, 1985, 238.

The financial stability of coffee plantations in the Paraíba do Sul valley was deeply related to slavery, and in fact, the end of the slave trade led to a sudden financial boom in Brazil's coffee industry. After the slave trade was abolished in 1850, a lot of money that was previously used to buy enslaved people now became available for other investments. In the meantime, as the supply of new slaves diminished, the value of already-owned slaves even doubled.³³ For a lot of planters, their slaves became a form of capital that acted as a security for new loans. So called *commissarios*, who were intermediaries between the banks and the coffee sector, tried to take advantage of this development by lending even more money to coffee planters. Funds were obtained from the newly established banks that were appearing everywhere around the urban center of Rio de Janeiro in that time. In the 1870's Charles Pradez, an author born in Switzerland who has been living in Brazil since 1843 observed in an intriguing testament highlighting the entanglements of finance capitalism and social structures like slavery, that "all plantation property has nothing readily salable except the Negroes, they are the clearest, the most liquid of their capital. The real assets have little value."³⁴ In the 1880's, when the uncertainties became ever more evident a planter of Vassouras in the Paraíba Valley reflected on the consequences of the devaluation of the slaves, he estimates, that "in view of the present situation in which slaves are depreciated and perhaps will be valueless shortly, the fazenda will lose its value too if shorn of its slaves."³⁵ The 1880's then were undoubtedly a transitional period for Brazil's coffee production and the end of slavery in 1888 only accelerated this transformation with workforce since then mainly coming from internal migration from the Northeast region of Brazil and immigrant labor from Europe or Asia.

The accumulation of capital in Brazil's coffee plantations, in agrarian spaces such as the Paraíba do Sul fueled the development of financial institutions in Brazil and led to the implementation of industrial technological innovations such as the construction of railroads, which had an integral role in the transportation of coffee and the expansion of the frontier. "The distinctively modern form of industrialization begins not in cities

³³ Stein, 1985, 20.

³⁴ Pradez 1872, 238-239.

³⁵ Stein 1985, 246.

but in the countryside. Agrarian, not urban, spaces offer the most fruitful terrain for accumulation by appropriation”³⁶

3.2. An Era of Bourgeois Mass Consumption

Caffeine is a psychoactive drug, and chemically belongs to a class of organic compounds known as methylxanthine. It acts on the central nervous system and stimulates the release of neurotransmitters like dopamine, which contribute to increased alertness, improved mood, and faster reaction times. Its effects vary according to the amount consumed, but in any case, caffeine has the potential for dependence and withdrawal symptoms. Pharmacologically, it possesses all the characteristics of a drug. Over the course of centuries, the perception and cultural significance of coffee have evolved considerably. Shaped by shifting social norms, rituals, and ceremonies, the daily consumption of coffee has been normalized to such an extent that it is no longer predominantly regarded as a psychoactive substance, and, in some contexts, it has even acquired the status of a basic commodity. In fact, coffee today is the most used psychoactive substance in the world.³⁷

Much like production methods, the growth of consumerism was also facilitated through advances in transportation, communications and the movement of goods and people over long distances. The development of mass production and mass distribution enabled capitalists to produce and sell goods on a large scale, contributing to the growth of consumption. “The profound changes in the pattern of consumption and food in Europe in the 18th and 19th centuries were not fortuitous, but a direct consequence of the development of technical and human apparatuses.”³⁸

In the 19th century coffee’s significance changed in important ways as it became a mass commodity and Brazil’s coffee cultivation in that period undoubtedly “helped to redefine the nature of consumption by dropping prices and boosting volume

³⁶ Moore 2015, 144.

³⁷ Caffeine: Cognitive and Physical Performance Enhancer or Psychoactive Drug?" *Current Neuropharmacology* 13, no. 1 (2015): 71-88. doi:10.2174/1570159X13666141210215655.

³⁸ Oliveira and Lazos Ruiz 2018, 66.

sufficiently to reach a mass market.”³⁹ The rise of coffee as a mass commodity is closely tied to narratives of modernity. “Rather than being precluded from daily life,” Topik writes, “coffee has helped fuel modern life. Coffee has been seen as a drug supplying wakefulness; a medicine to prevent digestive ailments and other diseases; a stimulant to intensify labor power, reduce fatigue, and mute hunger pangs; a soberer to spark intellectual clarity and creativity; and a performance enhancer on the battlefield and on the sports field.”⁴⁰

In the United States, the consumption of coffee was heavily restricted until 1830 due to its high cost, causing it to be largely viewed as a luxury rather than a basic need. Just under 30 years later, in the year 1859, the *Merchants Magazine and Commercial Review*, a magazine published in the years 1839-1870 that focused on various topics related to commerce and finance, wrote, that coffee “is now considered a necessary of life by the masses”⁴¹. However, until the beginning of the 20th century, the drink remained inaccessible to a broad spectrum of people. The “masses” referred to in the citation predominantly referred to the emerging bourgeoisie in 19th-century United States and Western Europe.

North America in the mid-19th century had by far the highest consumption of coffee in the world. In fact, “half of the growth in world consumption in the nineteenth century was due to increased United States purchases!”⁴² In the second half of the 19th century, the United States became the dominant coffee consumers, and the increasing consumption by Americans led to the expansion of Brazilian cultivation areas, which ultimately also meant the perpetuation of slavery and the displacement of indigenous populations. The elimination of import taxes on coffee in 1831 made coffee more affordable for the public and consumption quickly increased. It was the beginning of the era, when the partnership “between the world's largest grower of coffee and the largest consumer of coffee produced an intense ecological shock in southern Brazil.”⁴³

³⁹ Clarence-Smith and Topik, 2003, 32.

⁴⁰ Topik, 2009, 84.

⁴¹ “Coffee and the coffee trade” *The Merchants Magazine and Commercial Review*, 1859, 165.

⁴² Topik 2019, 24.

⁴³ Tucker 2000, 59.

As Steven Topik points out, the extraordinary surge in coffee consumption was much less an “anti-colonial” reaction against the British custom of tea-drinking, as is commonly assumed. The drink, instead “became an integral part of the American way of life, not so much because Americans rejected the “British-ness” of tea but simply because slavery made coffee cheap — and profitable.”⁴⁴

The central locations for the newly emerging bourgeois lifestyle were coffeehouses. These stood for modernity like few other institutions and became meeting points for writers and artists, as well as assembly places for organizing strikes in cities like Paris and Vienna.⁴⁵ The rise of European middle classes in urban spheres was intricately tied to imperialism and was characterized by distinct social practices in coffeehouses, clubs, other cultural organizations such as Grand Hotels. Meanwhile, a rising fascination of non-European cultures that were mostly displayed in the newly founded museums and gardens led to a heightened interest in colonial goods like tea and coffee.⁴⁶ In fact, coffee, along with sugar, tobacco, and tea, belonged to the goods “that members of the lower strata could often not afford on a regular basis until the turn of the twentieth century.”⁴⁷ In the year 1862, the same year the London & Brazilian Bank was founded, Brazil first took part in an International Exhibition. Although the attempt of Brazil’s officials was to portray the country as a part of the community of “progressed” nations, it was the coffee pottery that received awards.⁴⁸ European consumers’ perceptions of Brazil and coffee were highly permeated by a sense of tropical exoticism with Brazil being mostly perceived as a romantic, distant place.

Consumerism was also promoted by the growth of advertising and other forms of marketing, which sought to create demand for goods and services by appealing to people’s desires and fears. Well-known brands like Arbuckle Coffee included collectible trading cards in every coffee package by the mid-19th century. The themes of these popular cards varied from romanticized depictions of smiling women working

⁴⁴ Pomeranz and Topik 2017, 90.

⁴⁵ Markman 2005, X.

⁴⁶ DeJung and Motadel 2019, 9-10.

⁴⁷ Ibid, 254.

⁴⁸ Schwarcz 1998, 394-395.

in the fields to “exotic” animals. The target of advertisements for coffee products were most dominantly white middle-class women.⁴⁹ The book *Mrs. Beeton’s Book of Household Management*, a guide on how to run a household in Victorian Britain, first published in the United Kingdom in 1861 quickly became a best seller. The book also provides clear advice on how roles should be assumed during a dinner party, “to invite a person to your house,” Beeton writes, “is to take charge of his happiness so long as he is beneath your roof. The mistress of the house should always be certain that the coffee be excellent; whilst the master should be answerable for the quality of his wines and liqueurs.”⁵⁰

The capital for the urbanization of cities like Rio and São Paulo originated from agricultural regions. It was the commodity frontiers, such as those of the Paraíba Valley, that facilitated the financing of infrastructure and enabled the integration into an emerging capitalist world market. Consumerism helped to create new social and cultural norms that encouraged people to buy more and to consume more, regardless of whether they needed the goods and services being offered. The expansion of coffee consumption and the establishment of a coffee culture in the form of coffee houses in the mid-19th century is a manifestation of these cultural and social norms being created by consumerism as a capitalist strategy.

⁴⁹ Mehaffy 1997, 137-139.

⁵⁰ Beeton 2000, 125.

4. Land Appropriation

4.1. Property Rights and Land Acquisition– The Rise of the Coffee Barons

The question of land in Brazil can be seen as a paradox. In the vast territory of the country, there has always been a perceived shortage of land for agricultural purposes. “The solution of the problem required the conquest of more land, either through the reorganization of land ownership, the study of the geography and natural resources available, or the creation of better means of transportation.”⁵¹ The extension of land for agricultural purposes can therefore either be physical, or legal, through the reorganization of land ownership. In this process, the land has been reconfigured and the power dynamics have shifted, as the expansion of the coffee frontier in the Paraíba do Sul Valley has dispossessed ever more people of lands and rights and resulted in the consolidation of a dominant class - the coffee barons.

Before they were forced to move to the mountainous areas to escape the slavery and domination of the European colonizers, it was the Puri tribes that settled in the Paraíba Valley area. Culturally these indigenous people were very different from the other indigenous peoples such as the Tupis who occupied the coastal region of the province as they spoke a very different dialect. In contrast to European agriculture, which has been intensive all along since the conquest of the American territories, the Puri's crop yields depended mainly on an extensive form of agriculture and their subsistence culture was mostly based around the territory of the Serra do Bacaina, which translates to “way to the top” or “path in the bush”.⁵² The main historical sources about this period are the reports of foreign travelers and naturalists who stayed in the region in the 19th century. Many of them had direct contact with the indigenous people, whose social structure had already become very fragmented due to the interference of the colonizers.⁵³ The arrival of the Europeans turned the Puri people into nomads. In their constant flight from the Europeans, the Puris created a network of roads and smaller trails that extended from the coast throughout the Paraíba Valley and the Serra do Mar.

⁵¹ Oliveira and Lazos Ruíz 2018, 64-66.

⁵² Figueirôa 2007, 152.

⁵³ Oliveira 2012, 1-8.

These connections between the Paraíba Valley and the coast that reached through the Serra do Mar were later used for the flow of minerals and later for coffee production.⁵⁴

Prior to the arrival of coffee in the area, only small villages and settlements lay between the port of Rio de Janeiro and cities like Minas Gerais. The roads that were once developed by Puri tribes were now crossed by mule troops. The economic exchange increased and attracted more and more squatters, who began cultivating the fertile lands along these routes. In that way, the expansion of coffee plantations in the 19th century contributed decisively to the decimation of the Puri people in the first half of the 19th century, and “at the height of the coffee period, little more than toponymy was left of the indigenous culture.”⁵⁵ In the mid-nineteenth century, this ethnic group was considered “extinct”, insofar that they disappeared from official documents.⁵⁶

Fundamentally, these processes of land appropriation were the most important factors that were necessary for the establishment of coffee cultivation in the Paraíba Valley and in the end created the conditions for the accumulation of capital in the region. At the beginning of the 19th century, land occupation for coffee cultivation was initially developed at the foot of the hilly landscapes. The hillsides had the rich red *massapé* soils and received decent rainfall, which promoted the growth of coffee trees. Additionally, the slopes allowed for natural drainage, which prevented waterlogging and root rot - common problems in flat areas. As a result, coffee production initially concentrated on the hillsides, and land occupation for coffee cultivation expanded from there. During the first half of the 19th century, the Paraíba Valley emerged as a center for coffee production in Brazil. In that time, among the most prominent coffee production sites in the region were Vassouras, Valença, Resende, and São João Marcos in the state of Rio de Janeiro, as well as Bananal and Areias in the state of São Paulo.⁵⁷

As was the case in many other former colonies, the power relations within land ownership were not significantly altered with the founding of the nation in Brazil. In

⁵⁴ Oliveira and Lazos Ruíz 2018, 64-66.

⁵⁵ Ibid, 65.

⁵⁶ Oliveira 2012, 20-24.

⁵⁷ Oliveira and Lazos Ruíz 2018, 66.

that way, the concentration of land ownership in Brazil is undoubtedly a legacy of the colonial era, which was largely shaped by the *sesmaria* system, an invention of the colonial era. Indeed, “the sesmaria was the instrument of colonization”⁵⁸ The practice was introduced by the Portuguese Crown already in the 16th century to encourage the colonization of Brazil’s large territory.⁵⁹ The *sesmarias* consisted of royal grants that were either given to members of the Portuguese nobility or military leaders under the condition that it is being used for economic productive uses such as agriculture or mining.⁶⁰ The establishment of thousands of coffee plantations since the late 18th century would not have been conceivable without these grants.⁶¹ With the availability of large tracts of land the transition from sugar to coffee cultivation in the early 19th century was undoubtedly facilitated. These were given away very generously or were even “virtually free for purchase by any speculator, Brazilian or foreign, who had connections to the imperial court in Rio.”⁶² In fact it was possible for any person entering Brazil to reside illegally on lands that the crown had not yet claimed. While this practice was illegal, it was only persecuted in the rarest cases. In any case, the use of corruption was not a rare occurrence.⁶³

The large agricultural areas, ranging from about 20 to 50 square miles, were distributed to only a few major landowners. This enabled the formation of large estates, known as *latifundias*, which were already established in Brazil at the beginning of the 19th century. In 1850, land policy in Brazil was reformulated and with the enactment of the Land Law (Lei de Terras) in 1850, the *sesmaria* system formally ended. Before the introduction of this legislation, there had been no framework for controlling land ownership. Such an absence of land regulation often led to chaotic scenarios with many, often bloody disputes over the boundaries of land between so-called squatters and people who were granted land by the Crown.⁶⁴

⁵⁸ Motta 2005, 11.

⁵⁹ Williams 2006, 350.

⁶⁰ Dean 1971, 607.

⁶¹ Dean 1995, 149-150.

⁶² Tucker 2000, 183.

⁶³ Dean 1971, 607

⁶⁴ Dean 1971, 610-611.

Ultimately, the purpose of the legislation was to end the arbitrary seizure of land and instead implement the act of purchasing as the only legal way to acquire land. The decision however was also part of a broader process of modernization in Brazil in the mid-19th century, where *sesmarias* were seen as an obstacle to the country's economic development. The land squatters represented a challenge for the owners of the large coffee fazendas, as their presence impeded the expansion of coffee production. The private appropriation of lands that should be under the crown's ownership was simply no longer viable for the Imperial government to allow. It is therefore not surprising that the reason for the legislation in the mid-19th century, where coffee planters were most often relatives of court officials and legislation around land ownership was essentially shaped to the needs of the fazenda owners, particularly in the region of the Paraíba Valley, was a stronger centralization of coffee production.⁶⁵

The law of 1850, however, was not implemented in its entirety. For instance, the objective of mapping land ownership in Brazil was never achieved. While the state surveys did document some transportation routes and military bases, the ownership of agricultural lands was scarcely recorded. By the end of the 1870s, the Ministry of Agriculture ultimately declared that the undertaking was an “abandoned task.”⁶⁶

The independence of Brazil in 1822 already favored the landowners, but between 1850 and 1890, the most politically influential elite in Brazil cemented their position. After several agrarian families began acquiring aristocratic titles, the social class became recognized as the coffee barons. “The titles gave them an active political participation in the Court and gave them the possibility to influence decisions in favor of their own interests. They kept the fortunes and control of the land in the hands of a few families through marriages, alliances, partnerships and consortia.”⁶⁷ Meanwhile social injustices in this period not only persisted but were even exacerbated.

⁶⁵ Dean 1971, 611.

⁶⁶ Dean 1971, 622.

⁶⁷ Oliveira and Lazos Ruíz 2018, 69.

4.2. Landscape Transformation through Infrastructural Development

The “restructuring of the countryside”, as Beckert and Bosma put it, in commodity frontiers such as the Paraíba Valley did not only transform through the creation of contracts on landownership but also changed significantly due to the rise of infrastructural development.⁶⁸ Since railway construction in Brazil was not possible without the clearing of vast tracts of native forest, the expansion of such infrastructures of course also had profound ecological impacts.

Jason W. Moore asserts, that “the revolution in appropriation reached a definitive turning point after 1830. For the commodity frontier strategy that enabled the rise of capitalism was, by the middle of the nineteenth century, propelled to new heights by the coal/steam power nexus. This nexus came into its own—for capitalism as a whole—with the first major wave of railroad and steamship expansion beginning in 1830.”⁶⁹ While Moore’s statement is correct for the most “industrialized” countries of the 19th century like Britain and the United States, the impact of railroads on Brazil’s coffee production followed a slightly different timeline.

The construction of railways was not solely a national endeavor. In the mid-19th century, the Brazilian government relied heavily on foreign capital to fund the construction of the railroads. The start of the railroad in Brazil was marked in 1855, when the Brazilian imperial government commissioned Edward Price for the construction of a railroad that would connect the court in Rio de Janeiro with the provinces of São Paulo and Minas Gerais. The contracts that Brazil’s government signed with the British firm Edward Price & Company of course also involved the concession of large tracts of land to the foreign companies.

For Brazil the “locomotive became the emblem of nineteenth-century progress”⁷⁰ “The railroad renders the unorganized and organic Brazilian forest into efficient, rational, and mechanical order.”⁷¹ The natural environment in Brazil was viewed as wild and

⁶⁸ Beckert and Bosma 2021, 435.

⁶⁹ Moore 2015, 137.

⁷⁰ Cribelli 2013, 151.

⁷¹ Ibid, 153.

uncontrolled, and in need of transformation to bring about social and economic progress. A belief that was closely linked to the belief that modernization and development required the imposition of order and control over the natural environment. From that perspective, progress and development in Brazil could not be attained without scientific knowledge and technological progress.

Only in 1864, at the height of Brazilian Coffee production, the São Paulo Railway, also known under the name Estrada de Ferro Santos-Jundiaí, was inaugurated. It connected the region of São Paulo to the important port of Santos, “then and now the world’s great coffee port”⁷² The building procedure of the railway was a monumental task, as it had to overcome the mountain ranges around Cubatão.⁷³ Railway infrastructure undoubtedly had become the most important technological element to expand Brazilian Coffee production for a rising global market in the mid-19th century and maybe, the construction of these railroads for the expansion of commodity production represent the most emblematic example for a global infrastructure of the 19th century Capitalocene. Most notably, the railroad meant that coffee production became cheaper as fertile lands in the interior now became a lot more accessible. Steven Topik even insists that “if Brazil had not constructed by far the largest rail network in any coffee producing country, the explosion of exports and the creation of a mass market abroad would have been impossible.”⁷⁴ The only alternative to the expansion of railways in the mid-19th century would have been the reliance on traditional means of transportation such as mules and riverways. These were not only slower, but also inefficient, as they had lower carried capacity and required a greater amount of slave labor - a considerable expense for the coffee planters.⁷⁵

“The peak of the mule market coincided with the coffee production in the mid-nineteenth century, as well as the arrival of the train in the region, between 1870 and 1880, also resulted in a significant decline in the importance of the troops. The presence of numerous troops from mules and

⁷² Marchant 2020, 236.

⁷³ Ibid, 236.

⁷⁴ Topik 2004, 21.

⁷⁵ Stein 1985, 81 & 108.

horses imposed the need for extensive areas of pasture, which represented one more vector in the destruction of the Atlantic Forest.”⁷⁶

The railways also disrupted traditional transportation networks, which had often provided a source of income for small local communities. “In practice, this displaced small squatters toward the west, and the expansion into the Paraíba Valley or the western plateau of São Paulo. As such, the displacement of small squatters as well as indigenous communities “was characterized by a series of displacements: squatters displaced Indians toward the west, only to be displaced by estate owners as roads or railroads stretched further into the interior.”⁷⁷ For the region around the Paraíba do Sul, the most important railroad was the Estrada de Ferro Dom Pedro II., mostly known as the Estrada de Ferro Central do Brazil. Its construction also brought important changes to the roads in the era of the Paraíba Valley, as the main highways were now constructed around the railroad.⁷⁸

While the cultivation of coffee only became industrialized in the first half of the 20th century, The introduction of railways in the late 19th century revolutionized the transportation of coffee in Brazil, reducing transportation costs, increasing efficiency, and most notably enabling the expansion of the coffee industry into new regions. “Coffee and rails”, Graham rightly assumes, “spread together and were partners in the conquest of a new frontier, an economic frontier, from which were to spring the pioneers not only of coffee but of industry.”⁷⁹

4.3. The Role of Science and Modernization in Land Development

In the pursuit of modernizing Brazil, in the 19th century, the institutionalization of geography was deeply interconnected with the country’s economic demands. In the institutionalization of science, an efficient solution was anticipated for the economic problems of the mining and coffee industries. For this purpose, two scientific institutions were developed in Brazil and knowledge was mostly imported from the

⁷⁶ Oliveira and Lazos Ruíz 2018, 71-73.

⁷⁷ Roseberry 1991, 360.

⁷⁸ Stein 1985, 107.

⁷⁹ Graham 1968, 51.

United States. Although mining was one of the most industrialized economic endeavors in the second half of the 19th century, the geological surveys in Brazil in the latter half of the 19th century mostly became a means to pursue the expansion of the coffee industry.⁸⁰

When in 1875, the Geographical and Geological Commission (CGB) was founded within the Ministry of Agriculture, Commerce and Public Works, Carles Frederic Hart (1828-1910) became the director of the Commission. Hart has previously been the first Professor of Geology in the recently founded Cornell University in Ithaca, New York, where he was responsible for the discipline “General, Economic and Agricultural Geology”. Hart had already traveled to Brazil in the 1860s on an expedition to the Amazon region, where he investigated the connections between agriculture and geology with the Swiss born natural scientist Louis Agassiz, “a prominent supporter of racial segregation and white supremacy”⁸¹. The objectives of the commission, as stated by Menezes in 1878, were to “conduct preliminary studies for the preparation of a geological map of the Empire (...) so that the geological structure of the country, its paleontology, and its mineral wealth, as well as the means of exploiting them, will be known; this work will be supplemented by an analysis of the rocks, minerals, lands, and waters that can be exploited; finally, to study the archaeology and ethnology of the existing tribes, collecting and classifying samples which will illustrate [what is found]”.⁸²

Initially, the group’s primary focus was the simple mapping of the area, followed by the exploitation of the available resources. Although, at first, the main attention was on minerals, the search for the red *massapé* soils soon also became an important task of the commission. Intensifying its work during the 1880’s, around the same time coffee production in the Paraíba Valley began its definitive decline, the Geological Commission of Brazil, that since 1886 took the name Geographical and Geological Commission, started to concentrate on the issues of the coffee farmers. It was a routine

⁸⁰ Figueirôa 2007, 152.

⁸¹ Department of Earth & Planetary Sciences, Harvard University, “Louis Agassiz”, accessed February 6, 2024, <https://eps.harvard.edu/louis-agassiz>.

⁸² Figueirôa 2007, 154.

part of coffee production to move to other areas when fertile land became scarce in a region and the goal of the Brazilian government was to expand coffee production beyond the Rio-São Paulo axis, which included the Paraíba Valley. Ecological and social problems, such as soil degradation and a decline in labor power, were already prevalent in the 1860's. Modernization has consistently been a major point of discussion regarding how to enhance coffee production. Again, knowledge was imported from the United States, as Orville Adelbert Derby, an American Geologist and student of Charles Frederick Hartt was named the head of the CGB. Their initial research was conducted along the rivers of Itapetininga and Paranapanema, with the former located in the state of São Paulo, and the latter forming part of the border between the states of São Paulo and Paraná. In addition to identifying new lands for coffee cultivation, the CGB also contributed to the development of infrastructure that was essential for the expansion of the coffee industry and was critical for the development of Brazil's infrastructure and economy, as it provided important information for the construction of roads, railways, and other transportation networks. Although the Geological Commission of Brazil (GCB) was disbanded in 1878 due to financial reasons, it served as a model for institutions that followed, such as the Geographical and Geological Commission of São Paulo in 1886 and the Geological and Mineralogical Survey of Brazil in 1907, which have continued in various forms up to the present day.⁸³

The commission's work in mapping and exploring the interior of Brazil helped to identify new areas suitable for coffee production and other agricultural activities. Until the early 1880's, there were already scientific methods in place for measuring land area that mostly stemmed from German and French scientific traditions. In fact, the development of geological sciences in Brazil is highly shaped by a transatlantic exchange of knowledge, mostly by German influences.⁸⁴ When the country experienced enormous economic growth through coffee cultivation, the demand for suitable agricultural land increased significantly and out of commercial interest, Brazil

⁸³ Figueirôa 1994, 168.

⁸⁴ Figueirôa 1990, 132–37.

then opted for a North American model, which was practiced in considering not only geology and topography as factors, but also included arable land to produce cash crops.⁸⁵ The geographical survey of the Commission in the 1870's however was carried out according to American geological standards, their major target was clearly economic and consisted of the examination of "the extensive eruptions of igneous rock which decomposes into red soil; this soil is the main source of the present wealth of the Province"⁸⁶.

⁸⁵ Figueirôa 1994, 168.

⁸⁶ Report of the Comissão Geográfica e Geológica de São Paulo to the Barão de Parnaíba 1886, 4. (Translated in Figueirôa 2007, 168.)

5. Labor Organization in Paraíba's Coffee Cultivation

The British abolishing the slave trade in 1808 led to a growing number of international efforts to end the practice as well and Brazil followed suit by agreeing to abandon the trade in 1831. This Anglo-Brazilian Treaty that was already signed in 1826 however never became effective due to massive pressure from domestic interest groups such as landowners and *fazendeiros*, who greatly benefited from the slave trade. The import of enslaved people was also classified as illegal in 1831 due to British political pressure in the Lei Feijó. The 1831 law, however, was never genuinely enforced by the Brazilian government, as the nation's coffee economy still heavily relied on slave labor, and there were few incentives from the political side to pursue corruption regarding these practices. Officially, the Atlantic Slave Trade in Brazil was only abolished in 1850 through the Eusébio de Queirós Law. By that time, Brazil was the last destination in the Americas for enslaved Africans who primarily came from Central and West African regions, countries such as present-day Angola, the region around Mozambique and the Bay of Benin.

Although the importation of enslaved people was officially prohibited by that time, slavery continued within Brazil until 1888 and ultimately the country became the largest importer of enslaved people from Africa compared to all other nations. The abolition of the African slave trade led to a sudden drastic labor shortage in Brazil. To counter this, structures were increasingly developed for an internal slave trade, which was secretly continued for decades. The years between 1850 and the end of slavery in Brazil were characterized by an internal slave trade within the country.⁸⁷

Despite prohibiting the Atlantic Slave Trade, Brazil's reliance on slave labor did not decrease. In fact, the demand for slave labor in Brazil remained consistent, and ultimately, the ban of the Atlantic Slave Trade resulted in a large number of enslaved Africans being moved to different provinces in Brazil. After the restriction of the transatlantic slave trade, Creoles, enslaved people born in Brazil, still remained the primary available source of slave labor in Brazil. However, since the incentives to

⁸⁷ Slenes 2008, 14.

abolish the slave trade in the 1830's were never enforced, it was not surprising that a large proportion of the enslaved people who moved from the Northeast to the hinterlands of Rio de Janeiro and São Paulo after 1850 were actually African natives.⁸⁸

The main route of the internal slave trade began in the northeastern sugar-growing areas and ended in the economically profitable coffee plantations of the southern east, in the regions around Rio de Janeiro and São Paulo and in the Paraíba Valley.⁸⁹ By the mid-19th century, these central east regions saw a boom in the coffee industry, making them the primary regions for slave relocations. While most areas observed a decrease in the enslaved population from 1870 to 1880, the enslaved population in the coffee regions in Rio de Janeiro increased by 4.85%, the Paraíba Valley by 10.54%, and the new coffee sector in São Paulo by 45.51%. The enslaved population in the Northeast was 23% at the start of the 1820s but dropped to just 10% in the 1870s. In the second half of the century, half of all the enslaved people in Brazil were located in the southeastern region of Brazil, in the Centro Sul.⁹⁰ The combined number of enslaved people in Rio's coffee area around 1880 was 156,000, with 76,000 in the regions around São Paulo, and half of them situated in the Paraíba Valley segment within São Paulo.⁹¹

Enslaved people were seen as propriety and in fact were considered among the most important capital in the Brazilian coffee plantations. The end of the Atlantic Slave Trade meant that prices for enslaved people in Brazil rose dramatically. Within a span of five years, the average price of enslaved people almost tripled from 500 milreis to 1400 milreis and until the end of slavery in 1888, the price in Brazil constantly grew to 1900milreis.⁹²

With the diminishing arrival of new enslaved workers, a demographic issue posed itself to the coffee economy and fazenda owners encountered labor shortage with the increasing aging of the enslaved population until the end of slavery. Younger enslaved

⁸⁸ Graham 1968, 296.

⁸⁹ Oliveira and Lazos Ruíz 2018, 74.

⁹⁰ Seylery and Silvez 2022, 3-4.

⁹¹ Conrad 1972, 294-295.

⁹² Stein 1985, 229.

people, who were subjected to the harsh working conditions on the coffee plantations, were in general perceived as more robust and therefore more efficient. Also, in the eyes of the financiers, these young workers were seen as a more valuable form of asset, as they were valued as more productive and needed less maintenance costs. In the most frigid economic terms, the aging of slave labor meant for the coffee producers a diminishing return on investments.

“Vassouras could not long finance replacement of an aging labor force—in Brazil, unlike in the United States, slaves simply did not reproduce themselves. Neither would planters modify appreciably workloads, discipline or general living conditions of the slave laborers, nor could they nor would they provide monetary, sharecropping nor tenancy arrangements to attract West European immigrants.”⁹³ (Stein, 1985, XIV)

By the 1860s, a decade after the abolition of the Atlantic Slave Trade, many planters began to recognize these issues. In the 1840s, it was estimated that for a plantation in Vassouras, enslaved people aged between eighteen and forty constituted 62% of the workforce. However, by the 1860s, this number had declined to only 40% of the slave labor force being in their ideal working age for the harsh work on the coffee fields, with a significant portion being over forty.

It is believed that slavery in Brazil was primarily dampened by international pressure, especially from the British. Indeed, it is certainly true that British diplomats posed significant pressure towards Brazil's government and as criticism kept growing in the 1860's it became ever more difficult for Brazil to uphold the institution. However, it is primarily due to the fear of slave revolts that in 1871 the “Lei do Ventre Livre”, the Law of the Free Womb, was enacted.⁹⁴ The law, also known as the Rio Branco Law, was intended to ensure that newborn children of enslaved people would be free. Nevertheless, many children were forced to work in the fields until they reached the age of 21. Thus, this law hardly represented a genuine first step towards the abolition of slavery; on the contrary, “all the children of slave mothers continued to be raised as

⁹³ Stein 1985, 228.

⁹⁴ Graham 1966, 130-131.

enslaved people and exactly in the same conditions in which they would be if the law of 1871 did not exist.”⁹⁵ Also, the Lei dos Sexagenários, or the Law of the Sixty-Year-Olds, enacted in 1885, four years before the formal abolition of Slavery in Brazil, cannot truly be considered a milestone towards the definitive abolition of slavery. Despite efforts to gradually abolish slavery, the concentration of enslaved people in the Paraíba Valley until the 1880s was the highest in all of Brazil. Only a few years before the final abolition of slavery with the Lei Áurea, on some of these estates, records indicate between 200 and 400 enslaved people.⁹⁶

Industrial enterprise does not only include factory-based production in urban centers and only because the mode of production of Brazil’s coffee fazendas was not powered by steam engines, it doesn’t mean they couldn’t be read as such. In the Paraíba do Sul Valley, coffee was produced for mass consumption with exploitative labor organizations based on slavery and the brutality of efficiency. The highly organized structure of these plantation complexes was not that different to what Sidney Mintz describes for the sugar plantations. In terms of labor organization and scale of production, coffee fazendas, from Mintz’ perspective, were therefore highly industrial. The Brazilian fazendas were particularly so in comparison to the French coffee plantations in Martinique or Île de Réunion as they differed in scale of production. In fact, the Paraíba Valley, in comparison to other plantation complexes, was highly organized, as it had access to other markets, and through railways, it was also connected to the largest ports of Santos, Bahia and Rio de Janeiro. In that sense, the Paraíba Valley was also the most centralized coffee plantation region in Brazil and the government was able to exert a high level of control over this region.⁹⁷

The fazendas were a complex that encompassed numerous aspects of daily life and reflected the socio-economic as well as the ecological conditions in Brazil’s regions of coffee production. “The coffee plantation of the nineteenth century”, were therefore “more than a unit of production and a way of life.”⁹⁸ The plantation headquarters

⁹⁵ Stein 1985, 231.

⁹⁶ Marquese 2008, 200.

⁹⁷ Lima 2011, 213.

⁹⁸ Stein 1985, 190.

served as the symbolic center, that comprised the main house, slave quarters, terraces for drying coffee, in some cases tanks for washing coffee and processing machines. The expanse of these fazendas in the Paraíba region never exceeded a thousand hectares, enabling the landowners to ensure control over their territory.⁹⁹ Most of the coffee farms were self-sufficient, producing most of what they needed to supply food, and clothing.

To facilitate the supervision of the enslaved people, the coffee groves were arranged in vertical rows. In the late 1870's, for a fazenda in Resgate, it was estimated that five thousand coffee bushes were allocated to a single worker.¹⁰⁰ The work in the field was such that each slave was assigned a row of coffee bushes. For each field, an overseer directed and controlled the activities, ensuring the enslaved people advanced in unison in weeding and picking. In addition to the overseer and a general manager, on fazendas with more than fifty field workers, there was always a field driver, called *feitores de roça*, who in most cases was part of the enslaved people. The organization of slavery is most often characterized by distinctions in gang and task systems. In the fields of the Paraíba Valley, unlike in many other regions, such as the Caribbean, both forms of organization were combined. A task system was in place to the extent that enslaved people could claim a certain compensation if they exceeded a prescribed minimum amount of daily work on the field. On the other hand, also punishment was executed on an individual basis.¹⁰¹

⁹⁹ Lima 2011, 198.

¹⁰⁰ Marquese 2008, 208

¹⁰¹ Marquese 2008, 200.



Figure 1 *Coffe Harvest*. Marc Ferrez, 1880's. Col Thereza Christina Maria, BN.

The drive for strict work organization can also be observed in the photographs of Marc Ferrez (1843–1923). Between 1882 and 1885, Ferrez, belonging to one of the most influential photographers in Brazil at that time, worked on a total of 60 pieces commissioned by the Centro da Lavoura e do Comércio, an organization representing the interests of *fazendeiros* and merchants in Brazil. This series of photographs was displayed as a propagandistic tool at a number of international exhibitions, aiming to portray coffee cultivation in Brazil as a non-violent enterprise. Like few other photographic works, Ferrez's photographs, reflect the idealized perceptions of coffee growers in dealing with labor organization. The panoramic images, which present a depiction far from representing the real and brutal conditions on the coffee plantations, already show in their geometric composition a highly organized arrangement of enslaved people. "Slaves at a Coffee Yard in a Farm, Vale do Paraíba, São Paulo" refrains from showing scenes of violence, instead promotes a seemingly harmonious setup where the enslaved people are portrayed not in their typical work rags but dressed

in “crisp, clean white clothing”.¹⁰² The only sign of resistance is observed in the expressions of the enslaved individuals, with a few directing their gaze towards the camera, as interpreted by Juanita Solano Roa.¹⁰³



Figure 2 *Slaves at a Coffee Yard in a Farm, Vale do Paraíba, São Paulo*. Marc Ferrez, 1882. Platinum print, 40 x 30 cm. Instituto Moreira Salles, Rio de Janeiro, Brazil.

¹⁰² Solano Roa, Juanita. 2021. “Marc Ferrez, Slaves at a Coffee Yard in a Farm, Vale do Paraíba, São Paulo.” Smarthistory, December 3. Accessed February 22, 2024. <https://smarthistory.org/marc-ferrez-slaves-coffee-yard/>.

¹⁰³ Ibid.

6. Cultivating Crisis – The Ecological Impact in the Paraíba Valley

6.1. How Coffee Lost Its Shade

Coffee plants are not solely dependent on full-sun monocultures for growth; on the contrary, they originally developed as understory trees in the hill forests of Ethiopia's jungles in northeastern Africa. About 10-15,000 years ago, coffee emerged as a hybrid from *Coffea eugenoides* and *Coffea canephora*. Originally, coffee is a shade-loving plant that flourishes naturally in forested lands and densely vegetated areas under the cover of larger trees or shrubs that block out a portion of the sunlight.

Coffee beans come in two different varieties: Robusta and Arabica. The Arabica bean thrives best at higher altitudes, between 600 and 2000 meters above sea level. The ideal temperature range for growing Arabica coffee is between 15 and 24 degrees Celsius. Arabica coffee requires sufficient rainfall, ideally about 1500 to 2000 mm per year and rainfall should be evenly distributed throughout the year to ensure a certain quality. In addition, the soil should be permeable and rich in organic nutrients. An ideal pH for the soil is between 6.0 and 6.5. At first sight, the ecological conditions in the Paraíba Valley in the middle of the Atlantic Forest seemed ideal for its cultivation. While Arabica can only be produced in high growing areas, Robusta can be cultivated at lower levels. Although the cultivation of Robusta beans most likely started hundreds of years ago, it was only first documented in Africa in the early 18th century. Towards the end of the 19th century, the Robusta bean was then produced in large quantities for the world market. The cost of producing Robusta beans is lower, and, today, it is one of the most widely produced coffee beans in the world. Its ability to be grown on low lying soils and its resistance to the coffee leaf rust has undoubtedly helped Robusta to become an important part of global coffee production since the dawn of the twentieth century.

Throughout history, coffee has adjusted to many different social and ecological conditions. As Steven Topik notes,

“Coffee’s widespread success derives from its ability to adapt to many geographical, ecological, social settings, and disease regimes and its ability to evolve over time through natural mutations and human assistance.”¹⁰⁴

Before the 13th century, the coffee plant was largely confined to its native lands in Ethiopia and the neighboring regions. In the earliest days of its domestication, the coffee plant was planted in groves in Yemen. It was only in the 13th century that coffee arrived on the shores of the European Mediterranean region by Arab traders.

In Europe, coffee, still being a luxury good, became wider spread only with the beginning of the Renaissance during trade with the Ottoman Empire.¹⁰⁵ Coffee is by no means native to the Americas. One of the earliest ways that coffee reached the Americas in the 16th century was through the Dutch colony of Suriname. From there, coffee plants were brought to the neighboring French colony of Saint-Domingue in the late 18th century and from there it spread to other French colonies in the region such as Martinique and Guadeloupe. Coffee has been grown in these areas since the 18th century and was an important source of income for France in the early years of colonialism. The exact introduction of the coffee bush in Brazil is not entirely clear. According to a legend, Francisco de Mello Palheta, a Portuguese officer and diplomat who was stationed in French Guiana in the 18th century, secretly smuggled the coffee plants to Brazil in 1727. It is said that after starting an affair with the wife of the French governor, she gave him coffee seeds as a gift.¹⁰⁶ The authenticity of this story, however, is highly doubtful and other reports propose the entrance of the coffee bean to Brazil already happened in the late 17th century, arguing that the bean could have come from India.¹⁰⁷ By the end of the 18th century only around a ton of coffee was produced for local markets in Brazil. It was only in the early 19th century that coffee had become an important export commodity in Brazil, when due to the decline of gold

¹⁰⁴ Topik 2009, 82.

¹⁰⁵ Tucker 2000, 180.

¹⁰⁶ Dean 1995, 179.

¹⁰⁷ Ibid, 179.

mining, Brazil found itself in a position for seeking new sources for economic growth.¹⁰⁸

While the coffee tree is originally a shade loving shrub, in the Paraíba Valley, like in every other site for coffee production, the coffee bean was exclusively cultivated in the form of monocultures under full sun, even though the region around the Paraíba Valley in at the beginning of the 19th century still was full of shade-giving plants.¹⁰⁹ It was the premise of coffee production to destroy the natural habitat of the coffee plant, the shadow. In Brazil, this destruction “was the cheapest way of initiating production, and perhaps that was all the justification that was, or would have been, necessary.”¹¹⁰ The exposure to constant sunlight certainly leads to higher production, but the quality of the beans may be lower and more susceptible to pests. Estimates of the life span of a coffee bush in Brazil varied in this period. Before coffee cultivations spread across the hillsides of the Paraíba Valley, in 1813, Domingos Borges de Barros, a planter and viscount of Pedra Branca, believed a coffee bush could endure from twenty-five to forty years in fertile soil. Generally, it was thought that that coffee bushes were considered old when they reached twenty to twenty-five years of age.¹¹¹ By 1860, Frederico Leopoldo Cezar Burlamaqui (1803-1866), the director of Brazil’s Museu Nacional, lowered the estimate even further, saying, “It’s not worth harvesting after fifteen years.”¹¹² The only way to counteract the inevitable decline in coffee production in their eyes, was to establish new plantations and remove other types of crops that were being grown for subsistence consumption because they were seen as rivals for available land - practices that potentially increased the risk of soil erosion.

The practice of growing coffee in shaded areas may tend to lead to lower production and requires a higher degree of handcrafted processes, yet it leads to improvements in the quality and longevity of the plants. Also, this form of cultivation opens the opportunity to obtain various non-coffee forest byproducts and it is not only

¹⁰⁸ Dean 1995, 179.

¹⁰⁹ Jonasson 1933, 356.

¹¹⁰ Dean 1995, 182.

¹¹¹ Stein 1998, 46.

¹¹² Burlamaqui 1860, 33.

ecologically advantageous but under the right circumstances could also be economically viable.¹¹³ The maintenance of shade plants required for coffee cultivation was most certainly seen as an expensive challenge. The cultivation of coffee was primarily viewed as a cash crop, aimed at maximizing yields and profits.

There were other alternative agricultural techniques for cultivating a crop like the coffee bean. Terracing cultivation has been an agricultural tradition for many centuries and is a method that generally preserves the quality of the soil. Terracing involves creating slopes on hilly terrains to reduce water runoff and lessen soil erosion. In the late 19th century, terracing for coffee production was practiced exemplary in Guatemala, Central America. While practices for “sustainable” management of land have existed well before the 19th century, incentives for the management of land have not. In the regions of the Paraíba do Sul where coffee has been extensively cultivated, its legacy has been marked by the depletion of lands and natural resources.

Interestingly, the legacies of coffee and brandy production in the region have had environmental impacts quite different to those of coffee production. Unlike coffee cultivation, the history of brandy production in the Paraíba Valley, that was not meant for export, but which largely served as subsistence for workers on coffee plantations, had been notably different, and may even have contributed to the revival of the area’s forests. Recent studies indicate that rather than depleting the environment, brandy production that took place in the same period as coffee cultivation even appears to have played a role in restoring forests in the area,

“the legacy of brandy production that fed part of the workforce for the coffee plantations in the Paraíba Valley was that of a regenerated forest, today essential for the maintenance and conservation of the biodiversity of the Atlantic Forest.”¹¹⁴

¹¹³ Oliveira and Lazos Ruíz 2018, 132.

¹¹⁴ Ibid, 104-105.

6.2. Environmental Perceptions on Coffee Cultivation on Brazil's 19th Century

Coffee Cultivation in the North-East

During the period known as the Coffee Cycle in Brazil, certain concepts like ecosystem, ecological connectivity, and even the notion of natural reserves were either non-existent, “or at least the importance we now attribute to them was not recognized.”¹¹⁵ On the one hand, the lack of awareness about ecological interdependencies surely has influenced the way environmental impacts were perceived and managed, on the other hand, for many contemporaries, particularly cultivators, the ecological consequences of deforestation and coffee cultivation were long known, although interpreted in different ways. A very early form of political environmentalism in Brazil dates to the early 19th century and was closely tied to anthropocentric enlightenment ideals. The rich natural environments were read as resources that needed to be “preserved” to protect the progress of Brazilian society. While these voices posed criticism towards exploitable colonialist techniques in sugar and coffee production, their proposed solution was the modernization of agricultural technologies.

The most evident effects of monocultural farming in Brazil were in fact already known to people in the 16th century when sugar plantations were cultivated in the northeastern regions of the country. These plantations encountered similar problems to the monocultures in the Paraíba Valley of the 19th century, including soil erosion, soil depletion, as well as the emergence of plant pests and diseases that easily spread across the entire cultivation area. The mode of production of coffee was essentially no different from that of sugar cultivation, which was the most profitable until the introduction of coffee cultivation. The management of the land in the Paraíba Valley as well as in any other area where coffee was cultivated in that time was driven by the ever-growing demand in North America and Europe.

Numerous testimonies from contemporary observers show that there was widespread awareness of the ecological consequences of Brazil's agriculture, most and for all

¹¹⁵ Oliveira and Lazos Ruíz 2018, 148-149.

coffee cultivation. This is most notably supported by Stanley Stein's compilation of these reports, referencing to the fazenda of Vassouras. From the assemblage of sources, it becomes evident that already in the 19th century, there was a widespread critical perspective on the agricultural practices in Brazil that emphasized the wasteful routine of the so-called coffee barons, the landowners and fazeinderos in Brazil, who were already among the most politically influential social classes in Brazil long before the dawn of the 19th century. A planter from the Cantagallo municipality, located downstream in the Paraíba Valley, reflected on the mindset that shaped the farming practices of coffee cultivation. The coffee bush, he confirms, "is only something to make money, but not a crop affording occupation and happiness to those who come after us." With limited consideration for long-term implications and measures to mitigate risks, *fazendeiros* lived from "year to year at the will of nature."¹¹⁶ Focusing exclusively on maximizing their harvests and accumulating large quantities of coffee beans on their farms for short time profit, the planters habitually disregarded any inquiries into the ecological consequences of their methods. Myopia permeated the mindset of coffee farmers during the Brazilian coffee cycle of the 19th century. In the 1870's, two decades before most of the coffee fields of the Paraíba Valley were turned into vast grasslands, a regional magazine report pointed out that the practice of passing down farms from *fazendeiros* to their sons merely propagated "routine techniques that were inadequate in an area facing diminishing forest reserves."¹¹⁷ When confronted with suggestions on how to ensure enduring practices for coffee cultivation, a planter of a coffee fazenda in Vassouras stated, "I have done things this way, let the next generation do as it pleases"¹¹⁸ The *fazendeiros*, generally driven by their greed for profit, remained oblivious to the long-term repercussions their agricultural practices had on the environment and future generations. While most of them understood the concern about soil depletion in specific highland regions, they recognized the exploration of new areas with native soils as the sole solution to counter lowering

¹¹⁶ Stein 1995, 215-216.

¹¹⁷ Ibid, 215.

¹¹⁸ Ibid, 216.

yields and were unwilling to embrace agricultural techniques that would allow a production that today one might call “sustainable”.

This shortsightedness persisted despite numerous voices highlighting the ecological consequences of coffee farming in the region. However, it is important to recognize, that the great majority of these voices placed less emphasis on the diversity of ecological networks and instead focused more on the efficiency of agricultural practices. When there were arguments against such wasteful practices, they were primarily interested in optimizing agricultural methods to produce more cost-effectively. It is also in that sense that in the Vassouras region planters expressed criticism that planters were “mining the land without art or science.”¹¹⁹ “Art and science” in late nineteenth century Brazil was, as in many European countries in that era, mainly understood as the desire for a quicker modernization of agricultural techniques - a key focus for a country increasingly integrating into an emerging global economy.

Another prominent voice was Wilhelm Schüch von Capanema (1824-1908), an Austrian-born scientist and engineer who also rose to the rank of Major in the Brazilian military. In the period from 1850 to 1890, he played a pivotal role in various scientific and technological transformations within the country. As early as 1855, he foresaw that the depleted soils in the highlands, which were ideal for the production of Arabica coffee, would have to be abandoned in a few years to seek more fertile areas.¹²⁰ Following his tenure at the National Museum and his academic contributions in the fields of natural sciences and mathematics, Capanema delved into agricultural issues, creating a chemical treatment against the leafcutter ants that posed a severe threat to Brazil’s coffee farmers.¹²¹ The insecticide was subsequently also referred to by the name “Capanema”.¹²²

¹¹⁹ Stein 1985, 214.

¹²⁰ Capanema 1885, 2-4.

¹²¹ Schüch von (de) Capanema, Wilhelm (Guilherme) Baron. “Coleção Guilherme Capanema.” In *Österreichisches Biographisches Lexikon 1815–1950 (ÖBL)*, vol. 11, 285-286. Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1999.

¹²² Figueirôa 2005.

Around the same time, Nicolau Joaquim Moreira (1824–1894), a Brazilian pharmacist awarded a member of the National Academy of Medicine in 1859, was a vocal advocate for agricultural matters and was appointed as an advisor to the emperor, eventually receiving an invitation from the Minister of Agriculture in 1883 to lead a national initiative for the promotion of agricultural formation. In 1873, he expressed his concerns towards the agricultural practices in coffee cultivation, stating,

“For 372 years a routine and wasteful system of agriculture which raises to the level of a system production based on the axe and billhook, clearing virgin forest and burning it, tears from fertile Brazilian soil the elements of greatness and prosperity of future generations.”¹²³

In this quote, however, one cannot necessarily find any notion of “sustainability” or even an advocacy for indigenous agricultural techniques. As a pharmacist, Moreira’s primary focus was on the medicinal benefits of plants that the native forest provided, and he was particularly concerned about the unsuccessful exploitation of these plants. Only a page later, he praises the acceleration of private enterprise in Brazil and proclaims the necessity to optimize and modernize agriculture in Brazil to compete against international competition, primarily from the United States,

“The opening of new roads, steam navigation, the exploration of important rivers, and the locomotive rumbling through our forests, attempting to penetrate the interior of the country while accompanied by telegraph wires,” he was assured, “overcome time, shorten distances, and connect production centers with consumer markets.”¹²⁴

In essence, Moreira’s argument circles around the expansion of capitalist enterprise in Brazil, further opening its economy to a global market and even expanding new commodity frontiers for medical purposes.

¹²³ Stein 1985, 214

¹²⁴ Moreira 1873, 7.

6.3. From Sugarcane to Coffee – The Transformation and Deforestation of Brazil’s Atlantic Rainforest

Alongside the tropical moist forest, the tropical dry forest, and the tropical mountain system, the tropical rainforest is one of the four types of tropical forests. The largest expanse of tropical rainforests is found in the Americas, with approximately half of the world's tropical rainforests located in Brazil and Peru. It is especially in the 19th century that the profound ecological repercussions arising from the global cultivation of cash crops on tropical forests became apparent.

The tropical rainforest Mata Atlântica remains one of the world's most biodiverse ecosystems to this day, even though its functions are reducing critically.¹²⁵ Before European colonization, the Atlantic Rainforest extended over 1,300,000 square kilometers; now, stretching along the Atlantic coast, it covers only approximately 140,000 km². Often called the “smaller brother” of the Amazon, the tropical rainforest has for a long time been a crucial carbon sink that helped stabilize climate for millennia by absorbing large amounts of carbon dioxide from the atmosphere. While this function has not yet dissolved, the once expansive Atlantic Forest, due to anthropogenic impact, shrunk to merely 13% of its original size, and, today, less than 20 percent of the remaining forest fragments of the Mata Atlântica are larger than 50 hectares.¹²⁶

While coffee plantations were the most substantial reason for deforestation in the latter half of the 19th century, they were not the only cause of destruction for the Atlantic rainforest. During the first half of the 19th century, approximately 7,500 square kilometers of the Mata Atlântica, often called the “birthplace of Brazil” were converted into sugarcane plantations.¹²⁷ Native tree species like Jequitibá and Tapinhoa were popular for making crates for transporting crystalline sugar because they did not impart color or affect the taste. Canela wood was used for making cachaça barrels. Although wood was required in several more stages of sugar production, the total amount of

¹²⁵ Lima et al. 2020, 1-4.

¹²⁶ Shugart 2022, 206.

¹²⁷ Ibid, 183.

wood needed was less compared to the demand for the cultivation of the coffee bean. During the 19th century, the production of sugar beets in Europe significantly challenged Brazilian sugarcane producers and as a result, by the mid-19th century, it was coffee production that had the greatest impact on the forest reserves of the Atlantic Rainforest. “As a cause of additional primary forest loss”, Warren Dean accesses, “sugarcane remained quite secondary for the rest of the century.”¹²⁸ While coffee cultivation was less harmful than sugar in terms of not requiring fuelwood, its production resulted in the deforestation of an even greater expanse. Despite coffee plantations never occupying more than 5 million hectares at any given time, they significantly reduced forested areas in any area they were established.¹²⁹

A significant explanation for the recklessness of those who deforested the land at will lies in the way land was allocated, as there was an abundance of land that the state essentially gave away for free. This absence of land valuation by the government can even be seen as one of the primary causes for the destruction of the Atlantic Rainforest.¹³⁰ With the expansion of large coffee plantations, the Atlantic Rainforest was not anymore perceived as an obstacle for economic development, but rather became “the true source of wealth”¹³¹. The coffee industry in Brazil during the 19th century expanded from the state of Pará to the Paraíba Valley, then eastward into regions around São Paulo and Rio de Janeiro in a pattern similar to sugar, with deforestation in its wake. In the year late years of the 1820’s, Robert Walsh, a British traveler to Brazil noticed during his observations in the Atlantic Forest the density of the forest’s treetops in a region close to Vassouras in the Paraíba Valley,

“The road, or rather path, winded along the edge of deep valleys and ravines, from the bottom of which trees shot up to a most extraordinary height; and some of them could not be less than 400 feet... when they have attained that

¹²⁸ Dean 1995, 177-178.

¹²⁹ McNeill 1986, 125.

¹³⁰ Dean 1995, 180.

¹³¹ Dean 1995, 145.

eminence, many of them begin then, and not till then, to send out lateral branches... forming a canopy over the heads of their neighbors.”¹³²

In the years from 1830 to 1860 it was the region of the Paraíba Valley that was most affected by deforestation for the establishment of expanding coffee plantations. Already in the 1860's, various municipalities within the valley had already fully depleted all untouched forests within twenty-five years.¹³³ Although aware of the wasteful character of these wood fellings, only few paid attention to the critics because it was less expensive and less labor intensive to move to virgin territories that were “available for almost nothing by a government eager to conquer the forest.”¹³⁴ Until the 1890's the landscape around the Paraíba Valley then saw a dramatic transformation as it turned from forest, to coffee plantations, to grassland.

Deforestation is the initial stage in preparing terrain for coffee cultivation, as in Brazil it was a common belief that the regions with virgin soil were ideally suited for coffee agriculture.¹³⁵ So called virgin soils are found underneath the canopy of native forests in land that has never been cultivated for agricultural purposes. It is extremely rich in nutrients and therefore has a favorable composition for plant growth. Due to the abundance in virgin forests in the region of the Mata Atlântica, Brazilian planters, as soon as they decided the soil did not support optimal coffee growth, moved inwards to exploit new territories. Until the 1840's, before the Brazilian coffee frontier extended towards areas close to São Paulo and Rio de Janeiro, the extensive forests of Minas Gerais and neighboring regions, such as Espírito Santo, situated to the south of the Paraíba Valley, were succumbing to this expansion of this form of cultivation, also known as slash and burn agriculture.¹³⁶

The assessment of soil fertility and the clearings for the cultivation of coffee, also known as *derrubada* were done rather arbitrarily than by scientific methods.¹³⁷

¹³² Walsh 1830, 30-31.

¹³³ Stein 1985, 215.

¹³⁴ Tucker 2000, 184.

¹³⁵ Dean 1995, 181.

¹³⁶ Williams 2006, 353.

¹³⁷ Stein 1985, 31-32.

Lacerda Werneck who co-wrote an important agricultural manual in 1847, vaguely advises to find the right soils merely by observations, stating,

“Recognising good or poor soils is without doubt a great advantage to the farmer who can, in relation to one who cannot. The lands reveal themselves through their forests when seen from afar, principally in the months of spring. The foliage of the shrubs, the configuration of the branches, their height, all reflect their quality even from a distance. Entering into the woods, at first glance one can recognise in the trees the quality of the land, whether it is good, medium, or poor.”¹³⁸

The most significant phase of deforestation in the Paraíba Valley occurred between 1830 and 1860, when through slash-and-burn techniques trees and under brushes were cut down and left to dry before being set on fire. With the nutrients released in the soil through the process of burning, the procedure guaranteed a shortly lasting fertile ground for the initial years of coffee cultivation. The task of tree felling in Brazil took place annually during the winter months and was known as *picaria*. The process started at the base of the hills in the Paraíba Valley and ended at their summits. Supervisors were essential in this process; part of their role was to identify the tree, whose felling would cause all the other trees in the area to fall. If correctly felled, such a master tree would cause the collapse of an entire area on the hillside. In that manner the tree trunks were able to “collapse with a tremendous explosion, raising a cloud of debris, swarms of parrots, toucans, songbirds, and, from the woodsmen, a shout of joy and relief.”¹³⁹ This process however was extremely risky as it required precise judgment, since all these trees were interconnected through lianas and branches. The failure to accurately predict the fall of the master tree could lead to only partial collapses or unpredictable falling patterns of the surrounding trees. Without a precise approach, this job was a life-threatening endeavor and given these hazardous conditions, the labor involved in

¹³⁸ Werneck 1847, 11. (Translated in: De Oliveira and Winiwarter 2010, 502-503.)

¹³⁹ Dean 1995, 183.

timber harvesting was acknowledged through a compensation that doubled the usual daily wage.¹⁴⁰

Most of the trees cut down in this manner were chopped into charcoal on-site, which was either used for personal use or sold at the nearest local market. The remainder was burned just before the rainy season to cultivate fertile soil. As it was vital to prevent damage to the humus layer and ensure adequate ash production for soil enrichment, this task required experienced individuals. If the areas were burned too strongly, one could risk destroying the nutrient soil, if it wasn't burn, the insects living beneath the soils could not have been destroyed. And, if the fire was set incorrectly, or winds blew in unpredictable ways, it was often the case that the workers trapped themselves within the fire, thereby risking their own lives. Such a task was seen unsuitable for the enslaved people, as there was a significant risk of them being caught in the fire, a danger their overseers were acutely conscious of.¹⁴¹

There have always been voices for diversifying the cultivation of crops in Brazil. In the 1870s, Lourenco da Costa Leite advocated for the native *cipo lactescente*, a milky vine, as a substitute for cotton and flax in the production of textiles. Leite was also in search of alternatives to coffee, which he believed was nearing an ecological and economic crisis due to the exhaustion of agricultural lands from its cultivation. He posited that *cipo lactescente* was a sustainable choice, as it required little soil enhancement for yearly growth, unlike new coffee plantations that contributed significantly to forest degradation.¹⁴² A study conducted by the Imperial Instituto Fluminense de Agricultura for the Ministry of Agriculture, focusing on Leite's vine, even emphasized this aspect. The vine has a reliance on tall trees for growth and was highlighted as a method for conserving untouched forests: "without the sad and lamentable need to destroy it, and to damage the earth for other cultivations perhaps not as profitable and certainly more demanding."¹⁴³

¹⁴⁰ Dean 1995, 181.

¹⁴¹ Dean 1995, 181.

¹⁴² Cribelli 2013, 26.

¹⁴³ Pereira 1873, 2.

6.4. Soil Erosion in a Fragmented Land

Soil erosion is a natural process. However, with increasing mono-agricultural activity, and a growing coffee market, human-induced soil erosion significantly accelerated in the Paraíba Valley during the 19th century. The deforestation of the native trees of the Atlantic Forest for coffee production resulted in a drastic transformation of the landscape in the Paraíba Valley during the second half of the 19th century and crucially impacted the resilience of the natural area. To understand the environmental impacts of land use, it requires, on the one hand, an analysis of historical documents and records, and on the other hand, researchers calculate the sedimentation rates of anthropogenic deposits that are associated with Brazil's coffee cycle in the 19th century. From these data, statements can be made about the amount and rate of the sedimentation processes during the decline of the Paraíba Valley.

In most cases, coffee was planted in virgin soil, as it was assumed that these areas were particularly rich in nutrients. In some instances, however, coffee was also cultivated on land that had already been cleared for fuelwood gathering or sugar plantations. It was simply easier to apply for a new *sesmaria*, a feudal land title issued by the Crown, than to focus on the long-term care of coffee bushes. “The forest was felled in a restless cycle as the coffee frontier moved continuously inland.”¹⁴⁴ The accelerated erosion caused by the exploitative agricultural practices in the hilly regions of the Paraíba Valley since the 1830's undoubtedly had impacts on the local ecosystem. Together with the abolition of slavery at the end of the 19th century, the degradation of soils is often interpreted as the main cause for the end of the production of coffee in the region around the Paraíba Valley.¹⁴⁵

Through paleoenvironmental reconstructions and geomorphological analysis, it is possible to draw conclusions about past soil erosion rates. Therefore, it can be deduced that the deforestation of the hills in the Paraíba Valley resulted in substantial gully and sheet erosion phenomena. While gully erosion refers to the formation of deep channels in the soil that were carved out by flowing water, sheet erosion, on the other hand, is

¹⁴⁴ Williams 2006, 353.

¹⁴⁵ Oliveira and Lazos Ruíz 2018, 151-152; Tucker 2000, 184.

the process whereby the top layer of soil is removed across a wider area of land. From 13000 to 8000 BP, the sedimentation rate in the region of the Paraíba Valley was 300m³ per year. In only 100 years, from 1830 to 1930 the sedimentation per year doubled to 750m³.¹⁴⁶ The impact of the agricultural expansion during the 19th on the region's sedimentation processes were immense and for many scholars this is a strong indication suggesting that the so-called Anthropocene did not, in fact, start only in the mid-20th.¹⁴⁷

The impacts of soil erosion are by no means something that can only be evaluated in retrospect. On the contrary, the erosion of soils and its consequences were omnipresent for contemporaries in the Paraíba Valley. When examining paintings of Brazilian fazendas from the late 19th century, it is noticeable that, in general, these depictions can be interpreted as anthropocentric, since human labor in the fields are the most dominant motifs. The representation of nature is frequently stylized, illustrating the routine labor of enslaved people within surroundings that could almost be described as lush gardens. This view changed especially in the late 1870s when plein air painting was introduced in Brazil and painters were encouraged to capture what they saw more realistically, painting in the open field. A pioneer of painting 'en plein air' in Brazil was Johann Georg Grimm, a German landscape painter who, starting in 1882, worked at the Academy of Fine Arts in Rio de Janeiro and traveled through the Paraíba Valley between 1877 and 1879.¹⁴⁸ In 1879, when many plantations in the Paraíba Valley were going bankrupt due to declining of productivity and the increasing aging of slave labor, Grimm created illustrations of fazendas that were virtually surrounded by mud. There are hardly any paintings that so drastically illustrate the denuded hills and soil erosion at the foothills of the Paraíba Valley.¹⁴⁹ In the painting, the fazenda remains central, yet the left side of the canvas is overwhelmed by collapsing slopes and barren soils, while the right side is dominated by deforested hills. The fact that coffee is cultivated at this location is almost insignificant in the artwork.

¹⁴⁶ Oliveira and Lazos Ruíz 2018, 125.

¹⁴⁷ Ibid, 80-83.

¹⁴⁸ Ibid, 117.

¹⁴⁹ Levy 2010, 7.



Figure 3 *Calçado Farm in São José do Vale do Rio Preto*. Johann Georg Grimm, 1879. Oil on canvas, 56,4 x 75,5 cm, Fundação Maria Luisa e Oscar Americano, São Paulo.



Figure 4 *Fazenda Flores do Paraíso*. Nicolau Facchinetti, 1875. Oil on canvas.

In an 1875 painting by Nicolau Facchinetti, a similarly barren nature can be observed. Alongside the nearly entirely stripped land area and the sparse hills, the painting also more clearly reveals the river beside which the fazendas in the Paraíba Valley were typically situated. These streams and rivers around the Paraíba do Sul were also suspect to a higher level of sedimentation, which not only polluted the waters but also led to an increased risk of flooding. On top of that, the conservation of the soils is

crucial for water supply to the plantations and essential to the irrigation of vegetation during dry seasons. Until today, the drainage basin of the Paraíba do Sul is faced with ecological problems such as the silting of the waters, and the degradation of the riverbanks. The removal of the vegetation cover for the cultivation of short-lived coffee bushes, was a decisive reason for this.¹⁵⁰

In the book *Explorations of the Highlands of Brazil*, Richard Francis Burton, a British anthropologist, and diplomat in Brazil during the 1860s, documented his impressions of the coffee plantations in the Paraíba Valley - an area he claimed to be “cleaned out for coffee”. When observing the rivers, he noted that “every stream is a sewer of liquid manure, coursing to the Atlantic, and the superficial soil is that of a brickfield.”¹⁵¹ It is primarily the fertile topsoil with nutrient-rich humus, which is most important for plant growth, that is eroded and washed into the streams.

Another reason for the accelerating soil erosion was the layout of the plantations. While a lot of the coffee plants were planted in disorganized clusters in the lower areas, in soil that was only irregularly moistened, the plantations on the slopes were in most cases organized in the same pattern as in viticulture, creating vertical plantations parallel to each other. Any form of sustainable soil management was by no means a priority in this matter. On the one hand, coffee shrubs were planted in rows on steep slopes to facilitate the drainage of cold air, on the other hand, the wide corridors were formed between the plantations to simplify the supervision of the labor force. In these corridors, the work of the enslaved people could be better overseen and controlled.¹⁵²

¹⁵⁰ Oliveira and Lazos Ruíz 2018, 152.

¹⁵¹ Burton 1869, 42.

¹⁵² Oliveira and Lazos Ruíz 2018, 120 & Williams 2006, 353.

6.5. On Pests and Diseases – Coffee Cultivation and its Impact on the Region’s Ecological Connectivity

Ecological and economic factors are deeply interconnected. Organisms such as birds, moths, parasites, and fungi are not just passive elements but active agents that interact with and shape the environments that capitalist agriculture wants to control. Forests build communities for a multitude of species and play a vital role in supporting a diverse range of organisms. In that way, they provide habitats, shelter, and sustenance to countless species and promote ecological interactions. According to the Convention on Migratory Species, ecological connectivity is defined as the “unimpeded movement of species and the flow of natural processes that sustain life on Earth”¹⁵³

In comparison to the Convention’s definition Moore’s conceptualization (that he borrowed from Fritjof Capra) in principle wants to underline the same idea. By analyzing capitalism in the “web of life”, he aims to highlight the intricate relationship between economic and ecological processes by uncovering the often-neglected history of non-human species that he refers to as “extra-human natures.” Pest control, in Moore’s words, therefore becomes a matter of class struggle.

“Extra-human natures, too,” he writes, “resist the grim compulsions of economic equivalence: superweeds frustrate genetically modified agriculture; animals resist their assigned roles as objects and forces of production. In this way, capitalism’s correspondence project meets up with all manner of contending and contentious visions and resistances to create a contradictory historical process.”¹⁵⁴

A good example for this kind of class struggle, according to Moore is the “revolt of extra-human nature in modern agriculture, where a distinctive form of struggle manifests: the battle with weeds and troublesome pests.”¹⁵⁵

¹⁵³ “Ecological Connectivity”, *Convention on the Conservation of Migratory Species of Wild Animals*, accessed January 8, 2024, <https://www.cms.int/en/topics/ecological-connectivity>.

¹⁵⁴ Moore 2015, 206.

¹⁵⁵ Ibid, 207.

The deforestation of native forests deemed necessary for coffee production in the Paraíba Valley had a significant impact on the fauna of that environment. Deforestation reduces the habitat for many animals, while it opens a new one for others. While some organisms suffer from human-induced deforestation, others benefit. Coffee plantations introduced new species into the ecosystem of the Paraíba Valley that disrupted local food webs by preying upon native fauna or competing with endemic species for food or nesting sites.

In particular, the increasing deforestation due to coffee agriculture had a significant impact on avian species. Birds and bats can cover large distances, and for example contribute to the reproductive success of plants by distributing pollen. Trees are essential for them as they serve as perches, provide opportunities for rest, and act as pivotal “stepping stones” within pasturelands.¹⁵⁶ For birds, crossing large areas without vegetation is dangerous and trees therefore can be seen as “nodes of connection, creating a microclimate that helps other plant species to regenerate, keeping a rich seedbank in the subsoil, increasing organic matter in the soil, and providing wildlife refuge.”¹⁵⁷ The few trees standing in the Paraíba Valley at the end of the 19th century, however, merely served as refuges for cattle and other pasture animals seeking shelter from the intense heat in the shade.¹⁵⁸

The idea of pests as organisms that pose a threat to human-related concerns is perhaps the most anthropocentric term there is. As a slogan, it only functions in an agricultural environment, where there is a need for maximizing production. The occurrence of such pests in the Paraíba Valley was often perceived as an unpredictable, divinely chosen stroke of fate. In response to a pest species, Maria Isabel Peixoto de Lacerda Werneck, known as the Baroneza do Paty in 1863, was assured that “the efforts employed in improving the coffee groves will be, thanks to Divine Providence, crowned with a most satisfactory result”.¹⁵⁹

¹⁵⁶ Oliveira and Lazos Ruíz 2018, 126.

¹⁵⁷ Ibid, 126.

¹⁵⁸ Ibid, 126.

¹⁵⁹ Stein 1985, 51.

In 1861, the provincial government of Vassouras in the region of the Paraíba Valley conducted investigations to determine the severity of a threat to the coffee plantations and was discovered that this threat was a species of butterfly.¹⁶⁰ A year later, it became apparent that coffee groves older than twenty years had suffered irreparable damage due to this butterfly species, now known as the coffee leaf miner.¹⁶¹ The coffee leaf miner, also known as *leucoptera coffeella* is a moth that severely affected coffee plants in Brazil in the 19th century. Benjamin Pickman Mann (1848-1926), an American botanist and entomologist who visited the fazendas of São Sebastião and Secretário in Vassouras even describes the coffee leaf miner as “the greatest enemy of the coffee-culture in Brazil.”¹⁶² In a very detailed report that he published 1872, Mann describes the effects of the coffee leaf miner on coffee production while also giving advice on how to combat the pest. Although the pest was first documented from samples collected in the early 19th century in Guadeloupe and Martinique in the Caribbean, the introduction of the coffee leaf miner into South America remains unclear.¹⁶³ According to Mann, most likely, the moth was unintentionally introduced to Brazil in 1851 when the government imported coffee plants infested with larvae from the Antilles and the island of Réunion.¹⁶⁴

As a monophagous insect, the coffee leaf miner only eats one specific plant species. The larvae of the coffee leaf miner that live inside the leaves feed on the parenchyma, the inner tissue of the plant, causing damage to the plant’s ability to photosynthesize. In most cases, the damage can be recognized as rust-colored to black spots on the surface of the leaf.¹⁶⁵ According to Mann, the insect was the primary reason why coffee cultivation was abandoned in Martinique and he expected that the moth could “lessen the coffee-crop of Brazil by at least one-fifth.”¹⁶⁶ Besides some parasites, the moth only knows a handful of predators in Brazil.

¹⁶⁰ Stein 1985, 51.

¹⁶¹ Ibid, 51.

¹⁶² Mann 1872, 3

¹⁶³ Pantoja-Gomez et al. 2019, 926.

¹⁶⁴ Mann 1872, 5.

¹⁶⁵ Ibid, 11.

¹⁶⁶ Ibid, 12.

In the second half of the 19th century, there have been no known scientifically proven remedies against the dissemination of the coffee leaf miner in Brazil. High temperatures and dry conditions are favorable to the insect's dissemination and a way to avert moth infestations is to manage shade effectively.¹⁶⁷

Stein also refers to a bird pest that is said to have been an important pest in the Paraíba Valley since the early 19th century. He writes that “once (...) a semi-parasitic plant borne by birds feasting on coffee cherries, got a foothold on coffee trees left untended, it spread from branch to branch and drew away sustenance that might have gone into producing coffee cherries.”¹⁶⁸ However, this statement cannot be not verified in other sources. On the contrary, recent studies on the impact of birds and bats on tropical coffee plantations even assume that bird species could in fact benefit the coffee farmers by helping with the control of pests. Especially bats target night-active pests, such as moths.¹⁶⁹

On a visit to Brazil, the British entomologist Hamlet Clark noticed the overwhelming presence of ants everywhere. In a letter that he sent back home from Rio de Janeiro in 1857, he calls out, “The ants abound! Brazil is one great ants’ nest!”¹⁷⁰ The most significant challenge for coffee farmers was undoubtedly the Sauva Ant, also called *Atta Sexdens*, a leaf-cutter ant species native to the Americas. It is at the end of the 19th century that the Sauva Ant occurred more often in the Paraíba Valley. The Sauva Ant is a mycophagous, which means that it is an organism that eats fungi and eventually turns them into spores. To secure their main food source, they need to cut leaves to create a substrate for such fungi farms. Mycophagy is important not only as a food source to this ant species, but also plays an important role in forest ecosystems, as the process of mycorrhiza transports fungi to new tree roots, indirectly influencing succession, that is the natural return of plants and tree species that are characteristic of a site. In agriculture, these leafcutter ants of course are considered a pest. The ants damage coffee plants in two primary ways. On the one hand, by removing the leaves,

¹⁶⁷ Vega 2006, 2.

¹⁶⁸ Stein 1985, 51-52.

¹⁶⁹ Karp et al. 2014, 1072.

¹⁷⁰ Clark 1867, 131.

they reduce the photosynthetic area of the plant. On the other hand, the ants can also carry pathogens and promote the diffusion of fungi that can infect coffee plants. These ants are important herbivores in the tropics of the New World and each year they carry many kilograms of plant biomass into their nests and make no distinction between wild and cultivated plants.¹⁷¹

Although the ant plague was already a political and economic issue in the Paraíba Valley in the 1850's, most of this destruction caused by the Sauva Ant in the Paraíba do Sul Valley only occurred towards the end of the 19th century.¹⁷² The warm and humid climate of Brazil, along with the availability of suitable vegetation for the ants, provided an ideal habitat for the sauva ants to thrive. The expansion of monocultural coffee cultivation in the Paraíba do Sul Valley since the early-19th century created the basis for rapid spread of the Sauva Ant. The introduction of coffee cultivation, the expansion of monoculture plantations with accelerating deforestation led to a reduction in the natural predators of the sauva ants. The leaves of the coffee plants provided a new and abundant food source for the Sauva ants, which began to build their nests in the coffee plantations and subsequently, the ants were allowed to establish larger colonies that ultimately lead to their proliferation on coffee farms.

During this period, Brazilian coffee production remained unaffected by the Coffee Leaf Rust, one of the most important diseases for coffee cultivation elsewhere in the world, where “the rust outbreak simply helped consolidate Brazil’s advantage.”¹⁷³ In Brazil, this disease only first emerged in the Paraíba do Sul Valley in the 1920s, having reportedly journeyed across the South Atlantic from Africa to Brazil.¹⁷⁴

Starting from the 1830's, regional reports in the Paraíba Valley increasingly emphasized the need for more effective pest control.¹⁷⁵ Regarding the moth infestation on coffee plantations, Benjamin Pickman Mann in 1872 admits that entomology is still too young to provide helpful instructions for combating such pests. “The practical

¹⁷¹ De Carvalho Cabral 2021, 4.

¹⁷² Ibid, 15.

¹⁷³ McCook 2019, 8.

¹⁷⁴ Ibid, 14.

¹⁷⁵ Stein 1985, 53.

entomologist,” he wrote, “can only recommend measures to be put to the trial, and in this way gradually gather a body of experimental facts which may serve as a guide in the future.”¹⁷⁶ Among the methods Mann suggests is on the one hand the careful removal of individual infested leaves, which is certainly a labor-intensive and costly approach from the perspective of coffee planters. On the other hand, it is recommended that fires should be lit during the time the moths emerged from their cocoons. Since moths are attracted to light, workers could walk around the fields with torches that attract the moths.¹⁷⁷

Mann concludes his segment with a statement on nature's role that precisely reflects the modernist and anthropocentric nature of Brazil's capitalist coffee cultivation enterprise,

“Men gain time to advance in civilization and prosperity, by mastering the laws of nature, and converting natural forces into tools which do their work automatically as it were. Nature has provided enemies for the moth whose history we have been studying. Let us only learn how to cherish and encourage these natural friends of ours, and they will work for us thoroughly. They were made to work for us whenever we should learn how to command them.”¹⁷⁸

To combat the sauva ant, coffee planters initially attempted to eliminate the ants using water or heat and by sealing their burrows. Soon enough, more technically sophisticated means were used to combat ants, for example expensive bellows were used to blow smoke into them. On some farms, enslaved people were even trained to use these bellows, these were known under the name “formigueiro”. This procedure however “was expensive and not very successful while it took its toll of nearby coffee trees whose roots often overheated and withered.”¹⁷⁹

¹⁷⁶ Mann 1872, 17.

¹⁷⁷ Ibid, 18.

¹⁷⁸ Ibid, 19.

¹⁷⁹ Stein 1985, 52.

A result of the ant plague was also the growing introduction of pesticides and insecticides into agriculture. Already by the mid-19th century, there have been reports in which plantation owners requested chemical substances to eradicate the sauva ant, since the labor cost for this task was perceived as too high. According to an agricultural manual, it would need „half-dozen blacks to extinguish only one ant heap.”¹⁸⁰ Even a reward was introduced for the discovery of a means to eliminate the ant.¹⁸¹ In response, several insecticides were developed. The most popular most likely consisted of sulfur dioxide and was marketed under the name “Capanema.”¹⁸²

Certainly, the extinction of animal and plant species due to agricultural practices by the mid-19th century is a global phenomenon. This period marks the beginning of what is known as the “Sixth Extinction.” As Oliveira and Lazo also point out, it is, however, very difficult, even “impossible” to determine which species might have been lost due to coffee cultivation in the Paraíba valley, since most of the region's flora “was not even known.”¹⁸³

6.6. From Forest to Tropical Savanna – Local Changes in Climate Patterns in the Paraíba Valley

Until the end of the 19th century, the climate was perceived, at least in public perception, as a constant.¹⁸⁴ While the link between fossil fuel combustion and global warming was not recognized until 1896, with Swedish scientist Svante Arrhenius’ hypothesis that the burning of coals could lead to increased concentrations of CO₂ in the earth’s atmosphere, the importance of forests for the regulation of the planet’s climate was already pursued in scientific detail a little time earlier. In 1867 George Perkins Marsh first published the work *Man and Nature: Or, Physical Geography as Modified by Human Action*, in which he argued that forests hold a crucial role in

¹⁸⁰ Stein 1985, 216.

¹⁸¹ Ibid, 216.

¹⁸² Ibid, 216-217.

¹⁸³ Oliveira and Lazos Ruíz 2018, 80.

¹⁸⁴ Lamb 1995, 9-10.

maintaining climatic stability and also noted their influence on local climate conditions. Although the work of Marsh never focused on tropical rainforests in South America, according to Marsh, forests not only prevent soil erosion but also maintain moisture levels, impact rainfall and regulate temperature. By highlighting the dangers of deforestation, he was not only aware of the anthropogenic impact on agricultural landscapes but also addressed the likely economic decline of agricultural productivity due to the mishandling of the environment.

“The extension of agricultural and pastoral industry”, he wrote in 1864, “involves an enlargement of the sphere of man's domain, by encroachment upon the forests which once covered the greater part of the earth's surface otherwise adapted to his occupation. The felling of the woods has been attended with momentous consequences to the drainage of the soil, to the external configuration of its surface, and probably, also, to local climate; and the importance of human life as a transforming power is, perhaps, more clearly demonstrable in the influence man has thus exerted upon superficial geography than in any other result of his material effort.”¹⁸⁵

Dealing with the complexities of climate history means that historians encounter challenges concerning the source material. For a historical narrative that effectively captures past climatic conditions, it is essential to blend social explanations with insights from recent paleontological and climatological scientific papers. An interdisciplinary approach is therefore essential.

When examining the global anthropogenic greenhouse gas emissions of the 19th century, it becomes clear that, despite the slowly advancing industrialization, the bulk of global greenhouse emissions up until the start of the 20th century, initially still originated from agriculture. Brooke categorizes the 19th-century global greenhouse gas emissions into three phases. Initially, the majority of emissions were due to rice farming in Southeast Asia, particularly in China, where rice cultivation in flooded wetland areas led to substantial methane emissions. The second stage is characterized

¹⁸⁵ Marsh 1864, 4.

by deforestation in North America for the purpose of timber extraction and the expansion of agricultural lands for maize, wheat, and cotton cultivation.¹⁸⁶

The third stage, according to Brooke, ultimately unfolds at the end of the 19th century in the tropical regions, with an abrupt increase of agricultural emissions in the tropical zone. “Tropical emissions”, he notes, “expanded in two phases, driven by empire and global markets; the first and longer expansion between 1870 and 1900 started in South and Southeast Asia, doubling the annual carbon flux from ~100 million to ~ 225 million metric tons; a second short burst focused on the tropical Americas, almost doubling again to 400 million metric tons.”¹⁸⁷ In these regions too, it was the transformation of forested areas into grassland that was central to the emissions. The emissions from agriculture in the tropical zone in the second half of the 19th century include those from the production methods of sugar plantations, the rubber industry, and ultimately also from coffee production. In fact, in the years from the mid-19th century to the early 20th century, Brazil was the scene for the most destructive environmental transformations, especially in the regions “where the Atlantic Coastal Forest was finally destroyed in the rapid development of coffee agriculture, driven by American and European investment. These agricultural expansions resulted not only in massive greenhouse emissions, but in the loss of huge quantities of tropical lateritic soils.”¹⁸⁸

Each frontier has different geographical, climatological and ecological characteristics. The material conditions in the Arctic differ from those in subtropical or tropical rainforests that are themselves by no means homogeneous actors and their resilience to factors like climate changes and human activities are not globally uniform. Each rainforest displays distinct levels of vulnerability in the face of pressures from climate and land-use. As opposed to the Congo Basin or the Amazon region, the Mata Atlantica for example are especially sensitive to occurrences of drought and alterations in land use, including deforestation for agricultural purposes. With its tropical climate,

¹⁸⁶ Brooke, 2014, 481.

¹⁸⁷ Ibid, 482.

¹⁸⁸ Ibid, 483.

the area around the Paraíba Valley, located within the ecoregion of the Mata Atlântica, typically sees average temperatures of 16°C in July, increasing to 23°C in February. It records an average precipitation of 1,400 mm annually, with a notable 70% of this occurring mainly in the spring and summer, from September to February. These climatic conditions however, Oliveira writes, “may have undergone severe changes with deforestation.”¹⁸⁹ Both the forest and the soils of the Mata Atlântica form a carbon sink, an important planetary carbon reservoir. In fact, soils are even capable of storing twice as much carbon as the atmosphere.¹⁹⁰ Compared to other agricultural areas, native forests exhibit higher soil carbon stocks than other land and forestry uses and there is no scientific doubt that the loss of carbon and methane in these soils is directly linked to changes in forest cover through deforestation and improper land management.¹⁹¹

A study by the University of São Paulo and the University of Campinas revealed in 2019 that even minor deforestation in Brazil’s Atlantic rainforest can significantly raise local temperatures. The research used satellite data to calculate average temperatures for numerous forest fragments of the Atlantic rainforest. The researchers conclude that if you have a fragment of 1 hectare in size, and you remove 25% of the forest cover through deforestation, the local temperature in that area could increase by up to 1°C.¹⁹² The researchers emphasized that deforestation affects not just climate, but also has an impact on the local biodiversity. Of course, these are very recent reports that are influenced by the multitude of climatic and ecological processes that climate change has produced over the past 100 years. Also, the discourse around global or planetary climate change in the 19th century has not yet evolved. The vulnerability of the local climate to deforestation, however, is unquestionable and existed in a local area to some degree also at the end of the 19th century.¹⁹³

¹⁸⁹ Oliveira and Lazos Ruíz 2018, 63.

¹⁹⁰ Searchinger et al. 2019, 249.

¹⁹¹ Oliveira and Lazos Ruíz 2018, 152-154.

¹⁹² Wanderley 2019, 1-2.

¹⁹³ Oliveira and Lazos Ruíz 2018, 80.

Surely, it is not enough to rely on oral reports to prove these climatic changes through coffee cultivation in the Paraíba Valley of the 19th century. In the Paraíba do Sul Valley region, however, some noticeable climatic changes can also be identified within the 19th century based on statements from source reports. While the region is now characterized only by drought in summer, an unidentified person by the name of Figueira stated in a report from 1852, “It is rare for a day from April to September not to have thunderstorms accompanied by heavy rains.”¹⁹⁴ A resident of Vassouras assumed that the reason for these seasonal changes were the “mass felling of trees on all the elevated points of the Province.”¹⁹⁵ Clearly, the impacts of deforestation in the Paraíba Valley have become evident by the mid-19th century and the observations have also been shared by a provincial report in 1859 from the coffee county Vassouras, which expressed concerns about the potential decrease in coffee production due to changing weather patterns and highlighted in their report a noticeable “irregularity of the seasons.”¹⁹⁶

¹⁹⁴ Oliveira and Lazos Ruíz 2018, 80.

¹⁹⁵ Ibid, 218.

¹⁹⁶ Ibid, 218.

7. Conclusions and Further Research

According to the assessments by Beckert and Bosma, the production of coffee in Brazil since 1850 had been transitioning from an early capitalist to an industrial commodity regime. However, this assessment does not uniformly apply to all aspects of coffee production. More accurately, it can be observed that characteristics of both regimes were present during the expansion of the coffee frontier in Brazil in the second half of the 19th century. By the mid-19th century, the arrival of international banks marked the expansion of the Brazilian coffee economy. While it can be argued that Brazil benefited from increasing urbanization and technological advancements, a significant portion of the capital remained in American and European centers. Most importantly, in the Paraíba Valley and beyond, there was a pivotal shift in credit relationships from personal to impersonal, which can be seen as critical step towards the rationalization of the economy.

Rationalization and modernization were key drivers for the state to align with the major economic powers of Europe and North America. For this purpose, technical know-how and knowledge, primarily from America, were imported to optimize production and support the expansion of the coffee industry from the Paraíba Valley into other regions westwards to São Paulo, the Paulista region and southwards to Paraná. This development was accompanied by the increasing institutionalization of academic fields such as geography and the establishment of scientific commissions such as the Geographical and Geological Commission in 1875, whose primary objective was the commodification of unexploited land for the purpose of expanding the coffee economy. Between 1850 and 1888, Brazil experienced an expansion of state capabilities, particularly evident in the reform of land distribution practices. The „industrial commodity regime, according to Beckert saw “the conversion of a system of customary land rights into legally defined titles to land ownership”¹⁹⁷; Indeed, in Brazil, this development can undoubtedly be observed with the gradual end of the sesmaria system and the introduction of the Lei de Terra in 1850, when the practice of the free and rather arbitrary land distribution by the crown was abolished, and

¹⁹⁷ Beckert 2021, 43.

purchasing became the only legal way to acquire land. This development could very well be interpreted as a market-oriented step towards privatization. The state, increasingly influenced by politically liberal ideologies, as well as the dominant classes such as the so-called coffee barons, were able to benefit the most from this. Between 1850 and 1888, the organization of labor only underwent gradual changes. It was not until the abolition of slavery with the Lei Áurea that the mode of production for coffee cultivation, which had heavily relied on slave labor, underwent a significant transformation and Brazil introduced the so-called *colono* system. Although the prevalence of large estates remained unchanged, Brazil shifted its reliance towards the labor of immigrants, particularly from Italy and Japan, whose families were allocated smaller landholdings and worked as tenant farmers or sharecroppers.

The expansion of commodity frontiers is shaped not only by political, social, and technological factors but especially by ecological frictions. In the case of the Paraíba Valley, these ecological frictions were in the end the decisive reason that ultimately led to the decline of production in this area. The intensive farming practices associated with coffee production have resulted in environmental degradation and it is mass production for an emerging global coffee market that are most responsible for the ecological repercussions experienced in the Paraíba Valley. Contemporaries living in the Paraíba Valley during the 19th century certainly did not possess the understanding or perspectives on ecological and climatic interrelations as we do today. With contemporary climatological or geomorphological research, precise insights into the consequences of deforestation in the native rainforest of the Mata Atlantica can be traced. Phenomena such as soil erosion and even the climatic changes resulting from the deforestation of forests were, however, recognized in the latter half of the 19th century, although their global implications were not fully understood. Despite awareness of the fact that agricultural practices were unsustainable, the *fazendeiros* were tenaciously resistant to changes that could have led to forms of “sustainable” farming. Their primary goal was maximization of profit at the expense of ecological networks by extending the commodity frontier further into regions where the native rainforest once more became endangered.

Further research could explore the ecological consequences of coffee cultivation in Brazil following the transition to the colono system when the agricultural practices shifted from slave labor to a system of tenant and sharecropping farming.

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