Olaf Kaltmeier, María Fernanda López Sandoval, José Augusto Pádua,
Adrián Gustavo Zarrilli (eds.)

Land Use – Handbook of the Anthropocene in Latin America I

[transcript]

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The Anthropocene as Multiple Crisis:
Perspectives from Latin America

Editorial

The aim of the six-volume Handbook **The Anthropocene as Multiple Crisis: Perspectives from Latin America** is, first, to think about the Anthropocene from a particular region of the Global South. Thus, this Handbook offers a platform to discuss the multiple "anthropocenic" socio-environmental crises from a specifically Latin American point of view, without losing sight of their global and planetary dimensions. The second objective is to systematize, from the perspective of Latin American social sciences and humanities, the multifaceted environmental crises that reached and crossed the planetary boundaries of the earth-systems and led to the new geological time of the Anthropocene. In doing so, we generate an empirical basis for the genealogy of the Anthropocene in an unprecedented global region with key regional and historical differentiations.
The series is edited by Olaf Kaltmeier, Eleonora Rohland, Gerardo Cham and Susana Herrera Lima.

Olaf Kaltmeier is a professor of Iberoamerican history at Universität Bielefeld. Since its foundation in 2008, he has been the director of CALAS – Maria Sibylla Merian Center for Advanced Latin American Studies in the Humanities and Social Sciences. He is founding director and member of the Executive Board for the Center for InterAmerican Studies (CIAS) at Universität Bielefeld and director of the collaborative research project "Turning Land into Capital".
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Acknowledgements

This Handbook series on *The Anthropocene as Multiple Crisis: Latin-American Perspectives* is the outcome of the Laboratory of Knowledge on multiple ecological crisis of the Maria Sibylla Merian Center for Advanced Latin American Studies, CALAS.

As editors of the series, we would like to pay tribute to the hard work and patience of our authors, who were fundamental to the existence of this publication project consisting of six thematic volumes on the Anthropocene from Latin American perspectives. Such a monumental work on the Anthropocene – covering diverse historical epochs and all regions of Latin America and the Caribbean – is only possible with the support of the international academic community. More than 65 reviewers from 17 countries contributed their expertise and sharp criticism, motivating the improvement of each chapter. All these reviewers constitute our Academic Advisory Board. Furthermore, all chapters were collectively reviewed in editorial conferences by the editors of the other volumes of this series.

Under the direction of Olaf Kaltmeier, we set up an editorial office at Bielefeld University. The general coordination of this editorial office was in the hands of Luisa Raquel Ellermeier. Luisa, Omar Sierra Cháves, and Eric Rummelhoff organized the editorial process and proofread, translated, and revised all chapters. Omar was the main coordinator of the volume on Land Use. Rafael García was responsible for formatting the texts. Ann-Kathrin Volmer and Nadine Pollvogt organized the editorial conferences in the CALAS headquarters in Guadalajara, Buenos Aires, Quito, and San José de Costa Rica. They all did an outstanding job in making this Handbook a reality.

Special thanks go to our publisher, Bielefeld University Press (BiUP), who supported this project with great enthusiasm right from the start. Sabrina Diab-Helmer clarified all organizational aspects of publishing, and Vera Breitner and Gero Wierichs handled the editorial details, attending to all our extra requests. Bielefeld University has generously supported the open-access publication.

The series also stands out with its aesthetic design. Fernando Efrén Sandoval has created a work of art for each of the volumes. Using these pieces, Leon Che Ernst Pöhler from BiUP has designed memorable book covers.

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General Introduction

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The Anthropocene as Multiple Crisis

Latin American Perspectives on Land Use[1]

Olaf Kaltmeier, Eleonora Rohland, Gerardo Cham, Susana Herrera Lima, Antoine Acker, León Enrique Ávila Romero, Juan Arturo Camacho Becerra, Virginia García Acosta, Anthony Goebel McDermott, Ricardo Gutiérrez, Regina Horta Duarte, Cecilia Ibarra, María Fernanda López Sandoval, Sofía Mendoza Bohne, José Augusto Pádua, Elissa Rashkin, Heidi V. Scott, Javier Taks, Helge Wendt, Adrián Gustavo Zarrilli

The Anthropocene is probably one of the most disruptive concepts in contemporary science. It has the intellectual power to question ideas previously thought to be obvious, such as the modern-Western separation between nature and culture, because Earth's history no longer follows only natural laws but is shaped by the history of human societies. Conversely, these histories can no longer be understood without the inescapable consideration of planetary systems and their boundaries. Beyond its impact on academia, the emergence of the Anthropocene concept is a historical-political event, as it marks the global need not only to rethink but also to fundamentally remake the relationship between humanity and nature.

The concept of the Anthropocene has gained strength in the global public arena over the past 20 years and has been hotly discussed by the social sciences and the humanities for the past decade. The word was coined in 2000 by the Dutch atmospheric chemist Paul Crutzen and the U.S. American biologist Eugen Stoermer at a conference in Cuernavaca, Mexico. Both scientists observed the profound changes that human beings had caused to the environment. Based on this, they attempted to express the global reach of the great anthropogenic changes with the new term. Thus, the Anthropocene emerges as a new geological era in which humans introduce unprecedented amounts of CO_2 into the atmosphere through the massive use of fossil fuels. In addition, another major anthropocenic problem has been the large-scale extraction of non-renewable resources. Other processes by which human beings have come to change all spheres of the planet include plastic pollution, nuclear

1 This introduction aims to provide the reader with an overview of the conceptual and organizational principles of this six-volume handbook on the Anthropocene in Latin America. To improve readability, we have dispensed with the usual academic references. In each article, the reader will find a detailed and individualized bibliography.

waste, ocean acidification, the extinction of species, the fossil energy regime, the depletion of water sources, and the massive use of agrochemicals and pesticides. All of this constitutes the multiple crisis of the Anthropocene.

Given the above, it is clear that the Anthropocene is more than just a new fashionable term to refer to climate change as it has been widely, yet incorrectly, understood through the media. Nor is it simply a new concept useful for comprehensively addressing known environmental problems, although these issues obviously play an important role in its understanding. The novelty of the perspective that led to the coining of the term "Anthropocene" is fostered by the technological and informational possibilities of Earth system sciences to collect and process data like never before since the 1990s. In this way, it was possible to make visible the alterations, or rather the anthropogenic damage, in all the systems of the planet.

This is not the place to present all facets of the reflections on the concept of the Anthropocene carried out in the social sciences and the humanities. For our purposes, it is sufficient to refer to debates that offer novel perspectives to understand the historical singularities of Latin America in the Anthropocene. In this regard, discussions have recently resumed and continued about the Anthropocene and its derivatives such as the Capitalocene, Plantationocene, Chtulocene, Necrocene, etc.

In this context, the Latin American debate is particularly useful when it comes to relating multiple environmental crises to various sociocultural crises related to capitalism, coloniality, and racism. Here, approaches to environmental justice, the ecology of the poor, Latin American environmental history, nineteenth and twentieth century Latin American critical thought, and the approaches developed by Indigenous, Afro-descendant, peasant, and/or feminist movements and communities become relevant. An example of this from the Andean region is the concept of *Buen Vivir* (Good Living), *sumak kawsay*, based on the idea of the need for a turning point, *pachakutic*, according to which the poor governance and immoral leadership of global neoliberal capitalism with its colonial foundations must be substantially overcome.

Planetary thinking in the Anthropocene can and should be approached differently depending on the places of enunciation embedded in different constellations of power. In this regard, our concern is to broaden the debate, which so far has been largely carried out predominantly in the Global North by the natural and Earth sciences, to include a perspective from Latin America rooted in critical humanities and social sciences.

The aim of this six-volume handbook, *The Anthropocene as Multiple Crisis: Perspectives from Latin America*, published by the Maria Sibylla Merian Center for Advanced Latin American Studies (CALAS), is, first of all, to think about the Anthropocene from a particular region of the Global South. In this way, this handbook offers a platform for discussing the multiple "anthropocenic" socioenvironmental crises and their possible solutions from a specifically Latin American point of view, without los-

ing sight of their global and planetary dimension. The second objective is to systematize, from the perspective of Latin American social sciences and humanities, the multifaceted environmental crises that have met and crossed the planetary boundaries of Earth systems and led to the new geological time of the Anthropocene. With this, we have produced an unprecedented empirical basis for the Anthropocene's complex genealogy in a specific region of the world – in this case, Latin America – with key regional and historical differentiations.

Thus, our perspective combines the already mentioned planetary dimension with a perspective that takes into account the local and regional specificity of ecosystems and socioenvironmental relationships in Latin America. The humanities and social sciences pose different questions in relation to the new geohistorical temporal layer of the Anthropocene. This task is by no means trivial. Rather, it is a multifaceted search process in which the initial assumptions of the definition of the Anthropocene in the Earth sciences are questioned, corrected, completed, and expanded. This starts with historical classification. The question of whether there is an epoch called the Anthropocene, and also of when it begins, was initially addressed by the Anthropocene Working Group (AWG) of the International Commission on Stratigraphy and was weighed according to geological considerations.

Based on the geological and socioecological evidence, 1950 has been proposed to be the year of the "Great Acceleration" despite the first defenders of the Anthropocene having proposed previous historical periods, such as the Industrial Revolution or the invention of the steam engine by James Watt in 1769. Reference may be made here to the smoking chimneys of Manchester factories. But precisely this origin narrative, based on the historical experience of the West, is criticized from a Latin American perspective. Manchester's industrial dynamics relied on the supply of cotton for textile production or sugar as a source of calories for the labor force. Both resources were produced in new plantation systems on the Atlantic coasts of America based on the introduction of neobiota and the labor of enslaved people forcibly brought from Africa. Equally worth mentioning is the mega-mining that emerged during the European colonization of Latin America, symbolically expressed in the system of Potosí, the silver mining center in present-day Bolivia. The silver mined there laid the foundations for the capitalist development and subsequent industrialization of Western Europe. Thus, mega-mining and plantation economies do not constitute mere gradual changes in human use of the environment, but rather mark a fundamental and planetary rupture in the social metabolism, that is, in the management, use, and exploitation of natural resources.

Recognizing the deepest historical roots of the Industrial Revolution leads us to reconstruct a genealogy of the Anthropocene in which it cannot be separated from coloniality, the rise of the capitalist world system, and racial capitalism. Thus, 1492, the year of European contact with the Caribbean and the Americas, is a turning point in world history and represents a fundamental rupture for the Indigenous peoples

and cultures of America. Along with the conscious and unconscious introduction of new plant and animal species, European pathogens arrived in America, together with the colonial violence against Indigenous peoples, a massive number of fatalities, and the consequent cultural ruptures. Ninety percent of the Indigenous population died as a result of the conquest, either through direct violence, the destruction of their living conditions, or the introduction of new germs. It was one of the greatest genocides in history, wiping out 10 percent of the world's population. The abandonment of a large part of the agricultural area and the subsequent spontaneous reforestation caused a drop in global temperature at the beginning of the seventeenth century, coinciding with the beginning of the Little Ice Age – responsible for extreme atmospheric events on the planet.

In biological terms, the Columbian Exchange was so fundamental that biologists set 1492 as the milestone for the categorization of neophytic plants, distinguishing them from plants established in biomes (archaeophytes). With the Columbian Exchange of species, a homogenization of flora and fauna took place between the American continent, Africa, and Eurasia.

The criticism of European/Western capitalism as a driver of the Anthropocene goes hand in hand with a radical critique of European/Western modernity and the recognition that the Anthropocene puts an abrupt end to the European teleological notions of development, progress, and civilization. We stress the criticism of the leveling effect of the Anthropocene concept in the way that it has been coined by the natural sciences, insofar as it implies that the human species is responsible for the great transformations of the environment to which the concept refers. The danger of this approach is to ignore not only the sociohistorical differences between the Global North and the Global South but also the differences between different ethnic and "racial" groups (even if we acknowledge the fact that there are no biological races), as well as those between social classes within the respective regions of the world, especially in terms of consumption patterns or even cosmological representations.

Not all human societies have a predatory approach to the non-human environment, nor do all humans have the same ecological footprint. Perceiving human beings as a single species that destroys ecological environments ignores asymmetric power relationships and how they influence interactions and practices between human beings and the environment. Some voices from the humanities, however, are beginning to question the absolute rejection of the species category. They advocate the cultivation of a dual perspective that addresses not only the asymmetries of power that fracture human experiences and histories but also the geobiological history of the planet, where the human species constitutes a minority life form, despite having undoubtedly become a geological force with a profound impact on the entire planet.

In this sense, the notion of the Anthropocene requires us to question precisely the gap between the scientific idea of a single planetary system, the universe, and the

multiverse of forms of existence and life on Earth. Despite recognizing and stressing the need for planetary thinking, this handbook highlights the current disconnect between global quantifications of systemic limits and the political and social realities historically constructed in the territory. This is where the handbook revisits the concept of planetary boundaries, approaching it from the social sciences and the humanities. In other words, while Earth system sciences conceive of the planetary from a satellite's point of view, we will get closer to the ground without completely losing the planetary perspective. We will reduce the spatial scale to the regional and local while also adding temporal depth, which we will then attempt to reconnect with the planetary perspective. This approach is necessary if we want to investigate the impact that different regions had on the acceleration or slowdown of the planetary rise of the Anthropocene during different historical conjunctures. It is also relevant for keeping the focus on the extremely unequal socioenvironmental dynamics of the Latin American Anthropocene, where European/white settlers "naturalized" Indigenous and Afro-descendant peoples as exploitable resources.

On the other hand, the Anthropocene's genealogy is invariably constituted as a history of conflicts and crises, having developed in Latin America from the beginning of the Conquest to the present day in a very violent way. However, those who were subject to such violence should by no means be understood only as passive victims. In this particular region, there have always been creative social responses to overcome multiple socioecological crises. From our perspective, these approaches are an integral part of a genealogy that cannot be conceptualized solely as a linear history of decline.

Through these debates between the editors of the handbook, we identified the most important thematic axes for understanding the Anthropocene's genealogy. We enter into a critical dialogue around the general approaches of a planetary Anthropocene, expressed, for example, in the debate on planetary boundaries and the historical and contemporary experiences and reflections proposed by the social sciences and Latin American environmental humanities. Faced with the continuous conjunctures of colonization from the Conquest to current extractive practices, the importance of deforestation, and the dynamics of the technosphere's advance, especially in urban zones, we identify **land use** as a paradigmatic theme for understanding the Anthropocene from Latin America. For this reason, we dedicate the first volume of the series to this topic. Within this theme, we are interested, firstly, in aspects of environmental change associated with different forms of land use, such as planting, ranching, livestock, or the large-scale clearcutting of forests for infrastructure projects. In addition, we are especially interested in the interconnection with extremely unequal and sometimes violent social processes and crises that originate from these aggressive land uses.

Biodiversity is another central aspect of the Anthropocene discussion. Latin America and the Caribbean are home to 40 percent of the world's biological diversity

and seven of the world's 25 biodiversity hotspots, including six of the 17 megadiverse countries and the second-largest reef system on the planet. This region also has Indigenous forms of management, as well as a long history of preservation that is threatened by dynamics of commodification and dispossession. For this reason, a volume is dedicated precisely to biodiversity.

A research project on the Anthropocene, such as the one we present here, must necessarily pose questions related to **climate change** without reducing it exclusively to the global variation of the Earth's climate due to natural causes. The Anthropocene has caused unprecedented changes in this regard in Latin America, often linked to social conflicts and demands for environmental justice. On the other hand, the issue of **water** is inevitably related to climate change and raises important questions on issues such as human consumption and pollution. This vital resource has generated numerous socioenvironmental conflicts during the Anthropocene. Therefore, two volumes in this series are dedicated to climate change and water, respectively.

Due to its importance since the beginning of the conquest, we dedicate a volume to **mining and energy,** which addresses mining extractivism from the silver of Potosí to the lithium of the Altiplanos' salt flats. Mining is inextricably intertwined with the energy sector and its various regimes. Both are linked to specific social processes and structures, in particular, the extreme exploitation of labor leading to slavery, as well as the displacement of Indigenous populations in favor of the use of fossil, or even renewable, energy. These tensions and contradictions comprise the focus of our volume on the subject.

In the discourse on the Anthropocene in the humanities and social sciences, the visual and artistic representation of the concept has occupied a special place, as the question of what images we use to narrate the Anthropocene emerged quite early on. For this reason, we are dedicating a special volume to the **visual representations** of the Anthropocene's genealogy.

In a complex project such as this handbook series of the Anthropocene from Latin America, it seems appropriate to provide guidelines to facilitate reading for all kinds of audiences. The handbook is neither a simple edited volume nor a compendium. Rather, it is organized according to a conceptual matrix in order to understand and address the Anthropocene's genealogy from Latin America. Therefore, all volumes have the same basic structure. Each is structured by a temporal axis divided into three historical periods: the colonial era, the middle of the nineteenth century to 1950, and 1950 to the present day. In turn, each of these respective periods is preceded by a general historical introduction to the topic. This allows for a contextualization from a broad Latin American perspective, making it easier for the reader to navigate the general debates. After this contextual introduction, the main entries follow. These entries synthetically discuss the Anthropocene's genealogy with respect to the volume's theme in large regions of Latin America. From the south to the north of the Latin American continent, the reader will find for each of the three

historical periods five descriptive and analytical chapters of about 10,000 words, including a coherent bibliography, on the Southern Cone, the Andes, the Amazon, Mesoamerica, and the Caribbean. To depict the structure of the handbook's matrix in more detail, we first present a concise characterization of the three relevant periods, placing special emphasis on the phases of intensification and acceleration of anthropocenic dynamics. Secondly, we present the regions of Latin America and the Caribbean that will help us to analyze anthropocenic dynamics beyond the methodological nationalism that still predominates in the social sciences. And thirdly, we explore the different elements and variables that are covered in this volume on land use.

Periods of the Anthropocene's Genealogy in Latin America

Since its proposal in 2000 by Paul Crutzen and Eugene Stoermer, the Anthropocene has now begun the process of being ratified as a new geological epoch in Earth's history. Although the Anthropocene Working Group, a subgroup of the International Commission on Stratigraphy, is interdisciplinary, the argument for the ratification and acceptance of a new epoch is purely geological. In other words, for the Commission to recognize the Anthropocene, it needs, first and foremost, stratigraphic evidence of such planetary human influence on all natural systems. That is to say, it looks for a marker, the so-called "golden spike," in the natural record of soil and rock layers, as well as the atmosphere. Evidence from Earth system science and human history points to a post-World War II marker in the 1950s. In 2023, the Anthropocene Working Group (AWG) proposed Lake Crawford, in Canada, as the Golden Spike, given that the radioactive fallout from the atomic bomb tests of the 1950s and other anthropogenic changes in the environment are especially marked here. Although this proposal has not been accepted by the Geologists of the Subcommission on Quaternary Stratigraphy in 2024, it coincides with the beginning of a phase that members of the AWG and associated researchers have dubbed "The Great Acceleration." This time reference, from 1950 to the present, is included as the last of three axes that we have identified as relevant to a specifically Latin American perspective on the genealogy of the Anthropocene. However, we argue that to understand the process that led to the geological definition of the Anthropocene, it is necessary to grasp dynamics and processes prior to the 1950s.

From a Latin American perspective, we propose tracing the Anthropocene's genealogy to the European Conquest of the American continent starting in 1492 with the Columbian Exchange, the plantation system, and mega-mining. Thus, the colonial era in Latin America is understood as the phase of intensification of important features in the genealogy of the planetary Anthropocene. A second phase begins with the end of the colonial empire and the processes of independence in America. In ad-

dition to profound political changes, this phase encompasses an accelerating moment for the historical construction of the Anthropocene, especially from the 1860s to the world economic crisis of 1929. Finally, we include in a *sui generis* manner the Anthropocene phase from 1950 to the present day. Within this phase, it is possible to detect an intensification of anthropocenic factors in Latin America, especially since the 1960s with the Green Revolution and oil exploitation, as well as the eighties with neoliberal policies that accelerated extractive economies and mass consumption.

Colonial Period

1492, the year of European contact with the Caribbean and the Americas, marks a turning point in world history. For the Indigenous peoples and cultures of America, it represents a fundamental rupture and even the end of their worlds. From the perspective of the European conquerors, the so-called "New World" emerges, altering the existing medieval vision of the world. For the first time, the imagination of a global "single world" arises. At the same time, the conquest and colonization of the Americas become the starting point for the formation of a capitalist world system.

In this way, 1492 marks a milestone in environmental history. An intercontinental exchange of biota begins that fundamentally changes both the "Old" and the "New World." Plants from America, such as potatoes, tomatoes, or corn, leave their mark on European cultures and become national foods. At the same time, cane sugar makes its way into Europe and provides the energy reserves for the subsequent Industrial Revolution. The Americas today are hard to imagine without the biota introduced by European colonizers, from bananas, citrus fruits, and coffee to chickens, cows, pigs, sheep, and horses.

In 1492, a large-scale socioenvironmental transformation began, from landscapes characterized by Indigenous land use to Europeanized ones. From this abrupt alteration arises the accumulation of extractive capital. It is important to recognize that, clearly, the Caribbean and American environment was not only extensively modified by Europeans, but also by the numerous and diverse Indigenous populations that inhabited both continents, as well as the Caribbean archipelago for millennia before. Our argument for 1492 as a turning point is one of scale and intensification. In other words, with the arrival of European contact, specific practices of exploitation and extractivism that were unprecedented on the continent became widespread. In fact, the introduction of new species favored the conquest of Indigenous populations, as well as the domination of vast rural areas of the American territory.

One of the anthropocenic processes of the colonial phase was the massive reforestation that occurred after the genocides of Indigenous populations as a result of pathogens and European violence. The natural scientists who have modeled this process argue that the disuse of cleared agricultural space led to a large-scale regrowth

of forest cover – a massive carbon sink – which, in turn, tangibly cooled the climate around 1610. This theory is known as the Orbis Spike Hypothesis and has also been suggested as the beginning of the Anthropocene. This is a highly controversial topic in climate science, given that this period is also associated with the beginning of the Little Ice Age, but it raises important questions about the relationship between human societies and the Earth system. In any case, the continuity of the colonial process reversed this environmental dynamic, producing extensive deforestation.

On the other hand, the colonial era left as a legacy the development of the plantation system that some academics have called the plantationocene. In the plantations, systematic techniques of overexploitation of nature were developed, connected also to the excessive exploitation of subaltern labor, that is, Indigenous and African slavery. Human muscle strength (African or Indigenous) was violently exploited as energy to power these plantation machines, thus connecting to the energy history of the Anthropocene's formation and to the process of building European modernity from the margins. The plantation system became an epicenter of confluence between early capitalism and racism, becoming part of the Anthropocene's genealogy. Starting in the last years of the eighteenth century, this process of colonial occupation was decisive in abolishing the natural limits of the solar energy economy in the imaginary of modern capitalism, opening the way for the unrestrained and unlimited expansion of extractive frontiers. This made overexploitation of the land a fundamental characteristic not only of the Americas and Europe but of the global capitalist system.

From the Mid-Nineteenth Century to 1950

During the nineteenth century, the industrial model developed in the European eighteenth century was consolidated. Although the Latin American countries that were becoming independent sought their own ways to carry out social, political, and economic transformations, such transformations were part of global and international struggles of an accelerated imperialism and nationalism. Political and economic changes brought about social transformations in the forms of production, the management of natural resources, and the dimensions of exploitation, accelerating towards the end of the nineteenth century. Although the break with the colonial model was gradual, the oligarchies acquired greater power through the Latin American independence processes, dividing and distributing capital together with the territories of production and the complicity of the landowners.

Nationalism, represented in forms of development, also fragmented territories and the uses of natural resources. New geographical and naturalistic explorations and a new conquest of the environment marked the beginning of the nineteenth century. This century is also considered the era of the second globalization, entailing the consolidation of unequal ecological exchange. There is talk of a second Columbian

Exchange related to a global metabolic fracture. Based on this logic, exchange networks were consolidated. This involved not only the exchange of raw materials for industrialized goods, but also the trade of difficult or impossible to replace goods – such as energy, soil nutrients, and biodiversity – for rapidly replenished goods, such as industrial products.

The period between the 1860s and the world economic crisis of 1929 served as a phase of economic liberalization and modernization associated with a new integration of the region into world capitalist structures and a strong reinforcement of extractive economic sectors. Within the framework of the handbook, it can be understood as a phase of intensification and acceleration of the Anthropocene, comparable only to the metabolic rift of the Conquest. With the exception of a few regions, the predominant agricultural model was the exploitation of vast *haciendas* and plantations. In addition, this period is characterized by a process of internal colonization and land grabbing in peripheral regions, referred to by some historians as the Second Conquest. The extraction of raw materials such as rubber, henequen, and mate gave rise to new estates (*latifundios*), export-oriented elites, the establishment of feudalized forms of labor exploitation, and the rapid destruction of natural landscapes.

State formation played a crucial role in the structure of the nineteenth century, marking the definition of new forms of land use and outlining enclave economies in various regions of Latin America. This process was strengthened by new technologies such as steam, electricity, and the subsequent modern means of transport derived from these technological innovations. In the economic transformation of independent Latin American countries, foreign capital investment played a key role, both in the exploitation of agricultural land and in mining. Foreign companies from the United States, Great Britain, France, and Germany accelerated economic and political transformations, directly impacting land exploitation.

With regard to land tenure, the transformation of properties contributed to the displacement of Indigenous communities and the cooptation of others who had been exploited under conditions of semi-slavery in the hacienda system. This phenomenon was observed in different regions of Mexico, the Andes, and the *estancias* (ranches) of the Southern Cone. In Caribbean countries, independence came late and led to new dictatorships at the beginning of the twentieth century. Demographic growth went out of control in some regions, leading to a separation and even segregation between the rural and urban worlds. The motto of "Progress and Order" regulated business and daily life in the nineteenth century. This included hygiene and control measures conducive to new forms of segregation and inequality, which in turn had negative impacts, both on Indigenous communities and on increasingly urbanized populations. It should be noted that at the end of the nineteenth century, the first responses emerged to mitigate anthropocenic effects. Conservationism was consolidated with the creation of natural protected areas in several countries. The biotic flow began to be controlled – albeit under a reductionist

conception of conservation spaces – either as untouchable and unaltered areas, intended as pristine or as reservoirs of exploitable resources in the future.

From 1950 to the Present

The period from the mid-twentieth century to the present is known, from an anthropocenic perspective, as the Great Acceleration. It is a period marked by the accelerated consumption of natural resources, raising serious questions about the viability of the Earth system. This phenomenon is the result of important transformations in the world economic system, including the exponential growth of gross domestic product (GDP), population growth, increasing urbanization, energy production and consumption, and the use of fossil-based fertilizers, among other variables.

All of these large-scale socioeconomic transformations have drastic effects on the components of the planetary system beyond the expected natural variations. In the context of Latin America, these changes are reflected in the modification of the phosphorus and nitrogen cycle, which has resulted in the eutrophication of rivers and soil degradation due to industrial agriculture. In addition, an alteration has been observed in the carbon cycle with the loss of sinks due to deforestation and a dangerous increase in carbon dioxide and methane emissions from agricultural sources. Also, changes have been registered in the hydrological cycle with more frequent extreme events of droughts and floods and greater impacts due to the vulnerability of productive systems and urban habitats. Furthermore, there has been an increasing demand for water reservoirs for irrigation and hydroelectricity. Another relevant impact is the simplification of ecosystems and agroecosystems, which has led to a generalized loss of biodiversity.

Since the mid-twentieth century, Latin American governments and elites have assumed changing roles in driving their nations' development models and schemes. In the first stage, coinciding with developmental theory, production and consumption were oriented towards the "catch up," the theory of rapidly reaching the progress and well-being of Euro-Atlantic societies. During this period, local elites and governments adopted a planning approach to the future, with a programmed increase in the scale and pace of production. The import substitution model was implemented, allowing some countries in the region to satisfy the domestic market and to industrialize moderately: Brazil, Argentina, and Mexico being the most prominent. The Economic Commission for Latin America (ECLAC) was created in 1948, and the dependency theory was developed, which allowed the region's situation of marginalization to be explained from a structuralist perspective.

Towards the end of the 1990s, with the wave of neoliberal policies across Latin America, the role of the state was consolidated as a facilitator and intermediary for private transnational capital. Under this scheme of welfare political control, companies were able to freely access natural resources and territories through mechanisms

such as public-private partnerships. In parallel, selective integration into the world market based on the exploitation of natural resources encouraged agroindustry and extractivism, such as mining, agroforestry, or fishing. With the new millennium, progressive or neodevelopmental governments spread throughout the region. Although they assumed greater roles of state control and planning, these governments facilitated the arrival of global capital mainly oriented to the production and export of raw materials associated with the commodity boom, aimed at increasing the public budget allocated to social policies. Despite their differences, all these models have had in common the primary target of economic growth as the governing axis of the economy, as well as public policies aimed at strengthening the economic bases of the Great Acceleration.

In this period of acceleration, an increase in the rate of extraction of natural resources for the world market has been seen, giving rise to what are known as old and new extractivisms that include the mining, agriculture, forestry, fishing, and urban sectors. In addition, there has been a new Green Revolution characterized by the use of monocultures based on transgenics, the massive use of harmful agrochemicals, and intensive water consumption. Large areas of the region have also been deforested for the expansion of the agricultural frontier, leading to a further significant loss of biodiversity.

Another crucial aspect of the Great Acceleration has been the need to increase the production and diversification of energy sources. In Latin America, there has been an early use of hydroelectric energy, creating profound environmental impacts, both in the flow of rivers and in the production of greenhouse gases that have contributed to global warming. Widespread rural and urban electrification processes have been favored. However, hydrocarbon extraction has also played an important role. New frontiers of oil exploitation, whether offshore (the Brazilian coast and the Gulf of Mexico) or in the Amazon rainforest (particularly in Peru and Ecuador), have helped to increase the supply of fossil fuels in the global market and to delay the international energy transition. In fact, the accelerated integration into global markets has led to the advancement of production frontiers towards non-anthropized areas, causing significant impacts on natural ecosystems and local communities. In addition, there has been a growing presence of financial capital and fictitious economies, characterized by cycles of financial crisis. During this period, internal, regional, and international migration has taken on a new dimension in terms of quantity and quality. In particular, regional migration has intensified due to greater obstacles blocking movement to the countries of the North, although there are still migratory flows to those regions. On the other hand, water management has been oriented towards intensive extraction, both in the industrial and agricultural spheres, generating significant pollution of the region's main hydrographic basins.

Anthropogenic climate change and natural climate variability are also prominent phenomena during the Great Acceleration. The Latin American region is one of

the largest terrestrial carbon sinks, in part due to the existence of biomes with less anthropogenic transformation, such as the Amazon, the Mayan Jungle, and Patagonia. Greenhouse gas emissions, however, have not been kept below the sinks. Meanwhile, the increase in the scale of agroindustrial and urban enterprises has produced a continuous increase in waste generation and pollution. During the Great Acceleration, an increase in economic and social inequality has been observed in Latin America, which has meant that different social groups have different levels of destructive capacity. A significant change has been the relative loss of the states' monopoly on the use of force, leading to the emergence of organized crime groups that are involved in the processes of production and environmental predation, controlling territories in both rural and urban areas. At the same time, Latin America has witnessed the rise of resistance movements and proposals for local alternatives, especially around feminism and environmentalism.

Technological changes and transformations in communications have been profound and extensive during this period. Satellization and fiber optics have revolutionized communication media, allowing for a diversity of messages and greater appropriation of the media by subalternized movements and organizations. Nevertheless, there has also been a concentration in the distribution of cultural messages, posing challenges in terms of the democratization of information and culture.

In conclusion, the Great Acceleration has been a period of intense socioeconomic and environmental changes in Latin America. The accelerated consumption of natural resources, development models oriented to economic growth, extractivism, water management, anthropogenic climate change, inequality, and migration are some of the key aspects that define this stage. Latin America faces significant challenges in achieving a sustainable development that guarantees the preservation of its natural resources and the well-being of future generations.

Anthropocene Regions in Latin America

Regarding space, the handbook combines the perspective of planetary boundaries with a regional approach that takes into account the local and regional specificity of climates, ecosystems, and socioenvironmental relationships. The operationalization of this regional approach for the handbook project poses a complicated task. In macro-regional terms, the handbook is limited to what today corresponds to Latin America, including South America, Central America, Mexico, and the Caribbean. However, given the wide variety of climates and ecosystems in this vast region, we have proposed to define smaller and, at times, even larger areas. To this end, we do not want to rely solely on the geopolitical units of nation-states – important entities for the political regulation of the environment. Often, such territorial divisions ignore natural boundaries, while, at the same time, climate extremes tend to disregard

human-created national borders. Finally, from a heuristic standpoint, we chose to define five areas that we consider suit what we would like to show in the six handbooks and that, according to our approach, are characterized by a certain ecological and cultural coherence without national borders. From south to north, these regions are as follows: the Southern Cone, the Andes, the Amazon, Mesoamerica, and the Caribbean.

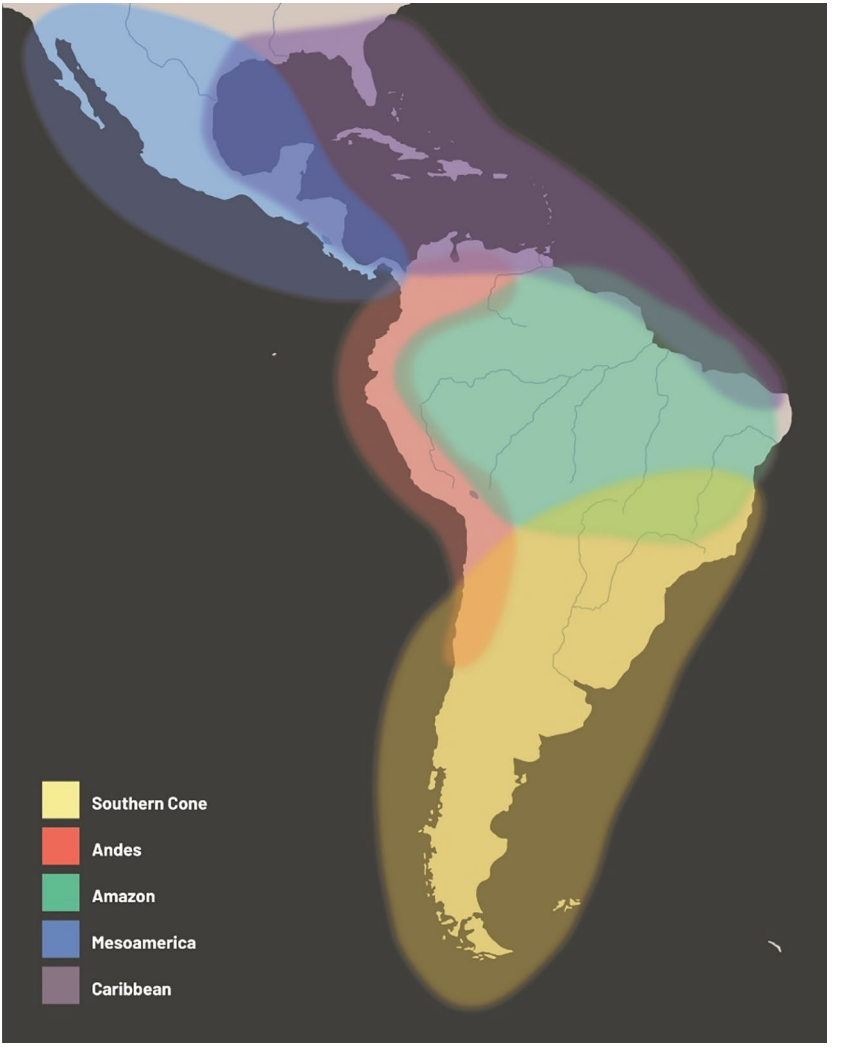
Southern Cone

The Southern Cone can be defined in a combined manner. In biophysical terms, its hydrographic network, which corresponds to the Rio de la Plata Basin, stands out. In geopolitical terms, it is defined by historical processes that determine flows of people and material wealth. While still taken into account, these flows transcend the national borders of neighboring states. From a political-administrative point of view, the definition of the Southern Cone has varied. In the colonial past, the delimitation of the viceroyalty of the Rio de La Plata and the Jesuit-Guarani territory outlined a region. The Southern Cone would encompass Uruguay, Argentina, Chile, Paraguay, southern Brazil, and even the southeastern tip of Bolivia, forming a region with common structures in a heterogeneous scenario. More recently, the Southern Cone acquired geopolitical meaning in the seventies, as well as a commercial and customs significance with the creation of Mercosur in the nineties.

In the colonial period, the region was an important corridor that linked the silver mines of Potosí to the Atlantic. Much of the territory of the Southern Cone had not yet been conquered and controlled by the Spanish Crown, but was kept in the hands of various Indigenous peoples. The southern part of the region, especially, was controlled by the Mapuche, whom the Spanish Crown could not conquer. During the colonial period, the relationship between Indigenous peoples – particularly the Guaraní in south-eastern Bolivia, southern Brazil, northern Argentina, and Paraguay – was fundamental for inter-ethnic relations and landscape transformations, especially due to the Jesuit presence until their expulsion at the end of the eighteenth century.

This geopolitical situation changed dramatically in the second half of the nineteenth century. We can speak in the Southern Cone of a Second Conquest, which found its highest expression in the bilateral Chilean-Argentine military campaign against the Mapuche in the 1860s.

Fig. 1: Anthropocene Regions in Latin America



Source: Own elaboration.

Parallel to this violent grabbing of Indigenous territories, a massive process of European immigration took place. In the middle of the nineteenth century, the Southern Cone states received a large number of settlers of European origin. In fact, the Brazilian Southeast, especially the megalopolis and the interior of São Paulo and even Rio de Janeiro, can be integrated into the Southern Cone due to its similar characteristics in terms of economic structures and the important role played by

European migrations in its overall human composition. Colonial and neocolonial ambitions to create "Neo-Europes" are reflected in many city names, urban landscapes, dietary habits, and agricultural practices in the Brazilian Southeast. From a European perspective, mass immigration was a biopolitical solution for the rural population, impoverished and made redundant by industrialization.

The environmental characteristics of the Southern Cone region vary widely due to its extensive territory and geographical diversity. The region is home to a great diversity of ecosystems, including subtropical rainforests, temperate forests, steppes, grasslands, wetlands, deserts, and glaciers. On this backdrop of complexity, heterogeneity, and abundance of natural resources, there are some structuring features of the territory that provide it with identity. A very important one is the presence of its three main rivers: Paraná (4,352 km), Paraguay (2,459 km), and Uruguay (1,600 km), which make up the Río de la Plata basin. These rivers are among the largest in the world, while the Rio de la Plata estuary is the widest in the world.

The La Plata Basin, the central part of the Southern Cone, integrates a large part of the territory of Brazil, Argentina, and Uruguay, as well as all the territory of Paraguay. In this vast territorial expanse, various biomes or ecoregions converge, each with very distinctive characteristics. Some have already undergone severe transformation or degradation, while others are on the path to degradation: the Paranaense Forest, the Pantanal, the Chaco, the Iberá Wetlands, the Pampas Grassland, the Delta, etc. All these are unique ecosystems globally and hold significant ecological value. One of the largest wetland systems in the world is also in its territory, including the recharge and discharge areas of the Guaraní aquifer.

Historically, the colonization of the interior took place mainly through the Paraná, Paraguay, and Uruguay rivers. These also form the transportation routes that today connect the region to the world market. Large quantities of soybeans, cereals, meat, and iron ore are shipped here.

But it is not only the La Plata Basin that gives the Southern Cone its identity. In turn, a second integrating pillar of the region is the presence of the Andes, as an axis that structures a specific space and a fundamental part of the territory. Chile to the west and the Andean regions of Argentina and Bolivia to the east create a socioenvironmental-cultural framework of notable specificities. In the case of the Southern Cone, the southern Andes, with their two sub-regions, are key. First, the arid Andes – from the north of the Chilean-Argentine border (Cerro Tres Cruces) to the Pino Hachado Pass in northern Patagonia – stand out for their aridity and their great heights, such as Mount Aconcagua (6,960 m MSL). The Atacama Desert is an ecosystem characterized by its extreme drought, with precipitation not exceeding 18 mm per year. It is a subregion with intense geopolitical and socioenvironmental conflicts in which, as a result of productive activities, considerable changes have been observed in the natural environment, related to mining activities, such as large-scale copper and lithium mining. These metals have become emblematic of the new

mining impetus in the triangle of deposits formed by Chile, Bolivia, and Argentina. In this region, there are also a series of socioenvironmental problems, which can be interpreted as the result of human-induced alterations to the natural environment that have affected the population. The second sub-region is the Patagonian Andes, extending south of the Pino Hachado Pass with the Patagonian Andean forest. In southern Argentina and Chile. we find Patagonia, which extends from the Colorado River in Argentina to the Strait of Magellan in Chile, covering approximately 1,043,076 km² in total. The strait, as a natural inter-oceanic passage, saw great commercial activity until the inauguration of the Panama Canal at the beginning of the twentieth century. Another view of this region is from the fragmented and insular coastal edge connected to Antarctica, with a population attentive to maintaining sovereignty flags.

Faced with the vastness of resources, the notion of dispute has been present in the various territories of the Southern Cone, from Gran Chaco to Patagonia and the Southern Andes, the land where colonists exercised sovereignty by eradicating the aborigines. The genocide of the original peoples was accompanied by the destruction of the ecosystems in which they lived. Further west, in Chilean territory, another dispute: the resistance of the Mapuche people to the advance of the Chilean army from the north and the colonists from the south. This conflict remained active for much of the nineteenth century and does not seem to be fully resolved. Conflicts over Indigenous territories are still active and are exacerbated by interest in mining areas, the southern sea for salmon farming, or the rivers for hydroelectricity, among other resources.

The Southern Cone has been blessed with an enormous variety of flora and fauna and extensive ecosystems. However, rapid population growth, industrial expansion, mining, agriculture, forestry, and large-scale hydraulic engineering projects have caused great territorial deterioration and strong socioenvironmental conflicts throughout history. This history is indicative not only of the abundance of natural resources and the natural productivity, goods, and services provided by these ecosystems but also of the tensions, imbalances, and conflicts that their exploitation has caused throughout their historical development. In conclusion, the Southern Cone presents itself as a region rich in biogeographic and cultural diversity, marked also by significant environmental and socioeconomic challenges. The sustainable management of its natural resources, the preservation of its unique ecosystems, and equity in the access and use of these resources are key elements for a future development that guarantees the prosperity of the region and the well-being of its inhabitants. A deep understanding of the region's environmental and social history is essential to address current challenges and build a more sustainable future for the Southern Cone.

Andes

The Andes region encompasses the countries crossed by the Andes Mountains, located in the tropical zone of South America, between 11° North and 27° South latitudes. In administrative terms, it includes the south of Venezuela, Colombia, Ecuador, Peru, and Bolivia, as well as the tropical parts of the Argentine and Chilean extreme north. From a natural point of view, the region has common elements in relief, altitude, and climatic behavior, but with significant variations. While the northern areas of the Andes experience two rainy and two dry seasons, the central Andes are characterized by only one rainy and one dry season.

The Andes Mountains are divided into two main mountain ranges: the Cordillera Negra in the west and the Cordillera Blanca in the east. These are connected by transverse mountain ranges and their valleys, as well as by the elevated lands of the páramo in the north and those of the Altiplano, a wide plateau that reaches its largest extent in Bolivia. The great elevational variation of the Andean region, which ranges from sea level to heights of more than six thousand meters, creates several altitudinal floors with different ecological characteristics. The climatic influence of the El Niño-phenomenon and the Humboldt marine current, which circulates along the Pacific coast, also translates into climatic diversity along the latitudinal gradient. These features range from very humid ecoregions on the North Pacific coast, such as the Colombian Chocó, to desert ecoregions on the Peruvian coast.

The Andes are home to several ecoregions that are internationally recognized as biodiversity hotspots. In fact, the region constitutes a complex mosaic of more than 130 ecosystems, including páramos, punas, and Andean valleys, with high levels of biodiversity. The tropical Andes are a leading region in endemism worldwide, with an estimated rate of more than 50 percent in plant species and more than 70 percent in fish and amphibians. Thus, it is the region with the greatest diversity of amphibians in the world, with around 980 species, 670 of those endemic.

When we refer to the Andes, we mean three diverse geographic zones that comprise the Pacific coast, the Andes, and the Amazonian foothills. The region's diverse ecologies have been used and shaped by humans for more than 14,000 years. The formation of complex human societies based on agriculture dates back approximately one thousand years before the Inca expansion in the fifteenth century. On the coast, the construction of monumental structures and urban centers in several valleys of the central and northern coast of Peru, such as the Supe Valley, cannot be comprehended without taking into account the maritime resources provided by the Humboldt Current, especially the rich fishery. The key characteristics of Andean societies, such as the specialization of social roles, the emergence of formal belief systems, the increase in food production, and technologies for systematic data recording, are evident more than a thousand years before the Incas began their imperial expansion in the fifteenth century.

Over the millennia, Andean societies in the mountain range have employed diverse strategies and technologies to survive and thrive in a challenging physical environment. These strategies include the construction of irrigation systems and terraces, innovations that enabled the spatial and seasonal expansion of agriculture. They also facilitated the proliferation of species suitable for agriculture, such as corn and potato varieties, as well as the domestication of camelids. In addition, Andean societies promoted demographic expansion, especially in the mountain range. These technologies were complemented by the emergence of dispersed settlement patterns, allowing communities to take advantage of a wide range of ecological zones at different altitudes, with their diverse available resources. Although these strategies fostered the self-sufficiency of many communities, the Incan imperial expansion introduced a policy of integration evidenced in the construction of an extensive road network, as well as in the relocation of ethnic groups, and the storage and distribution of food, textiles, and other goods.

From the imperial scale to the level of the *ayllus* – the basic social units in Andean communities – existing physical infrastructure and organizational practices formed the initial basis of colonial society after the invasion of the Spanish conquerors. However, the prolonged turbulence of the conquest, aggravated by epidemics and depopulation processes, caused the deterioration of road, irrigation, and cultivation systems in many areas of the Andean territories.

On the other hand, the viceregal policy of introducing large-scale mining manifested itself dramatically in silver mining in Potosí, an industry that emerged as the epicenter of large continuous movements of forced and free Indigenous workers, as well as goods. This process led in the surrounding provinces to deforestation and other environmental effects. The appearance of mega-mining during the colonial regime marked an acceleration point in the Anthropocene, with its collateral effects of excessive land and water use, deforestation, and pollution.

Mainly in the northern Andes and the eastern foothills, the colonial exploitation of gold deposits, which often relied on enslaved Afro-descendant workers, accompanied silver mining. Whereas the extraction of precious metals was crucial during the colonial era, the second half of this period witnessed economic diversification in many parts of the Andes. Although the wars of independence in the nineteenth century brought about political and social changes, the exploitation of primary resources remained the main economic base of the new Andean republics. In Bolivia and Peru, the decline of mining during the wars was followed by a process of recovery and transformation, driven by foreign investment, industrialization in the Global North, and the introduction of machinery powered by steam and electricity in many mining sites. Overall, trends toward intensification and expansion of mining operations have continued into the twenty-first century in response to growing global demand for a variety of metallic and non-metallic minerals.

In all the countries of the region, the rise of the oil industry, especially during the last five decades, represents a parallel intensification process in the extraction of subsoil resources. The mining, oil, and gas industries, dominated in many cases by transnational corporations, have been responsible both for severe ecological degradation in many areas of operation and for the production of socioenvironmental conflicts. At the same time, agricultural industrialization has had diverse impacts on the Andean region since the second half of the nineteenth century. These include cacao plantations in Ecuador, coffee plantations in Colombia, cotton and sugarcane plantations in Peru, and the unrestrained exploitation of seabird guano off the Peruvian coast, followed later by nitrates, to promote the development of intensive agricultural systems in the North, especially in Great Britain and the United States. This transfer of resources marks a profound metabolic rupture in Andean ecosystems.

The agrarian reforms of the 1960s and 1970s mainly caused a modernization of the agrarian structure, including the introduction of the agrochemical packages of the Green Revolution. With the implementation of neoliberal policies that began in the 1980s, the orientation towards exports intensified, giving rise to new agroindustries, such as the expansion of African oil palm, especially in Colombia and Ecuador. This was alongside the more traditional monocultures of coffee and bananas, which have produced a great deal of deforestation.

In the coastal valleys of Peru, the industrial-scale cultivation of a variety of agricultural products for external markets contributes to the worsening of the water deficit faced by many communities. Local or regional conflicts over water and other vital resources are intertwined with the impact of anthropogenic climate change at the trans-Andean level, driving, among other things, the retreat of Andean glaciers.

Despite a long history of colonialism and its profound legacies, many Indigenous and Afro-descendant communities have succeeded in defending and rebuilding high degrees of cultural and territorial autonomy. Nowadays, especially in Ecuador, Bolivia, and southern Colombia, Indigenous movements constitute a considerable political force, sometimes manifesting as resistance to extractive projects or as new forms of care for the natural environment. These forms of care are also expressed in the concept of Buen Vivir.

Although all the countries of the Andean region defined themselves as multicultural or even plurinational in the 1990s and countries such as Ecuador and Bolivia incorporated rights of nature into their constitutions, extractivism deepened. Today, the various socioenvironmental conflicts in the Anthropocene era are at the center of fundamental debates about the future of the Andean region. These conflicts are also manifested on a global scale, as seen in the Bolivian-Chilean-Argentine highlands, which is becoming a new pole of rare earth metals extraction, especially lithium, to support the Green Deal and the CO_2-neutral industries and transportation of the Global North.

Amazon

The Amazon is a region defined by its belonging or proximity to the Amazon River basin, which crosses nine nation-states: Brazil, Colombia, Peru, Bolivia, Ecuador, Venezuela, and the three Guianas. Each of these nations has different trajectories in their relationship with the forest, both quantitatively and qualitatively. In Brazil, the Amazon is connected to the Cerrado and the Northeast through a history of migration since the end of the nineteenth century, linked to activities such as rubber extraction, mining, livestock farming, and logging. The Amazon has also been a supposed ecological paradise to which the victims of drought and the inequalities of the plantation system were encouraged to flee and settle. In the north, the Amazon River system is connected to the Orinoco, the third largest river in Latin America. Across the Atlantic, the Orinoco River system was an important entry point for extractive economic activities in the Amazon, such as the exploitation of rubber, the felling of native trees, livestock farming, and mining. Being a difficult-to-access area for the European colonizer, the otherness of Amazonian nature has been the source of numerous myths and cultural representations that have served to justify its exploitation or conservation, given that it is the largest rainforest reserve on the planet with a great diversity of biomes.

Although the concept of the Amazon has served to exemplify the notion of nature in its most "pristine" state, it is actually a historically constructed concept. At the beginning of colonization, it was not spoken of as a totality. Rather, it was established sociohistorically in the mid-nineteenth century, as until then, the Amazon only referred to the river and the river system associated with it. European knowledge of the area was gradually recorded in the cartography of the sixteenth and seventeenth centuries, showing imaginaries built on the idea of an exotic and exuberant Eden, as threatening as it was paradisiacal.

Despite the predominant image of a "virgin" jungle, the Amazon region is cultural. It has been transformed by humans for around 10,000 years. Indigenous and certain mestizo populations are important actors, even though forest biodiversity is the result of millions of years of evolutionary processes prior to human presence. During the colonial period, among European and Creole travelers and settlers, the predominant idea was that of a "green hell," the scene of the great drama of man against a wild and unhealthy nature full of dangers arising from its flora, fauna, climate, and human groups, associated above all with the idea of the cannibal. Over the centuries, various projects coexisted or alternated such as the conquest of the jungle, its exploitation, or its occupation, later moving to a conservation discourse framed by the idea of the region as a global natural heritage beyond the protection managed by specific political entities.

In the countries of the Amazon, this region has generally not been a geopolitical center, but rather a territory in a certain limbo, considered to be a reserve for the

future. The predominance of national structures as determinants of public policies, whether of colonization, exploitation, or conservation, does not take into account the fact that non-human forms of life and many human populations do not always live according to the assumptions of Western structures. Animals, plants, and rivers experience and renew their existence through cycles and movements that do not consider borders. However, the actions that each nation does or does not implement in the jungle may determine whether the life of these beings on its borders is viable. Both official policies and the demands of social movements are becoming important in the continuous construction of a territory in which the Anthropocene – apparently less visible here than in more urbanized places – is constantly maintained as a structuring principle. This is evidenced by the numerous interventions carried out in the Amazon since the first half of the twentieth century. From that point on, an increasingly extractive economy with varying intensities broke out. In addition to the extraction of natural resources, the expansion of nation-states entailed the occupation of land for agriculture and livestock, as well as the development of large infrastructure projects. By the 1970s, there was already flagrant harassment of the jungle, marked by the invasion of the territory. There were slight variations in the implementation of the occupation projects according to the historical processes of each country.

In many Amazonian areas, the second half of the century was also characterized by the incursion of religious missions, first Catholic and then Protestant, whose presence had strong impacts on the organization of the native peoples, both in the management of resources and in their relations with the environment. In the twenty-first century, the growing political role of evangelical churches and their representatives has been supportive of right-wing factions with little willingness to stop environmental devastation. Instead, they have come into open conflict with environmental and land defense movements. The case of Brazil during the administration of Jair Bolsonaro, when the destruction of the Amazon rainforest increased alarmingly, exemplifies this alignment of forces and the threat it poses to the region. Given the key role of the Amazon in global ecology, the ease with which governments, ultimately transitory, are able to trigger environmental crises that impact their countries and the entire planet is worrying.

In contrast to this bleak landscape, several projects emerge that amalgamate multi- and transdisciplinary perspectives with the purpose of recovering or generating ways of inhabiting the Amazon in a sustainable manner. Although the region has become a testing ground for a new Green Economy, the weight of extractive capitalism, represented by mining and oil exploitation, among others, remains overwhelming. In addition, harmful practices such as clear-cutting, livestock farming, and other archaic predatory economic forms persist.

It is worth noting, however, a change in approach that considers biodiversity not only in terms of biological diversity and physical environment, such as waters and

soils, but also in relation to sociodiversity. The latter is perceived as an element that must necessarily be integrated into conservation actions. In this context, non-dualistic thinking acquires relevance when reflecting on the Anthropocene, stressing the need to not separate nature and culture. Instead of erecting visions based on the ancient myth of a "virgin" jungle in which the human being is simply a hindrance – an idea that has been used more to displace Indigenous and peasant communities than to curb large-scale exploitation –, one must consider that the challenge lies in building conditions favorable to ecological balance. Indigenous and traditional worldviews, revitalized by current generations, offer ways to rethink the relationship between the human and natural worlds.

Mesoamerica

We propose to include the Central American Isthmus and Mexico in a new notion that we call Greater Mesoamerica. The conceptualization of Mesoamerica, presented by Paul Kirchhoff in 1960 and originally published in 1943, has been very useful because of its specificity, making it possible to distinguish a given area in geographical and cultural terms. Mesoamerica has solved problems associated with unclear concepts, such as Middle-America, used in the handbooks of the 1960s, whose translation into Spanish was never clear. In addition, it geologically identifies Mexico as part of North America, while also being part of Latin America. However, Kirchhoff's definition omits northern Mexico and part of southern Central America, leading us to propose a more inclusive notion.

In this volume, we will consider Greater Mesoamerica the geographical and socioenvironmental space that encompasses the entire Mexican territory, the five Central American nations that formed the Captaincy General of Guatemala (Guatemala, Honduras, El Salvador, Nicaragua, and Costa Rica), as well as the present-day Belize and Panama. Greater Mesoamerica, as we conceive it here, does not intend to analytically homogenize the biocultural diversity that characterizes this region; rather, we start from the premise that, despite this diversity, historical processes have taken place that present parallels in the field of socioenvironmental relations, differentiating it from other Latin American territories.

In ecological and socioenvironmental terms, the subregions of Mexico and the Central American Isthmus have peculiarities and interrelationships that we must highlight. Mexico is a megadiverse country thanks to its geographical position, connecting North America with Central America, and its strategic location between two oceans: the Pacific and the Atlantic. This allows for the conjunction of nearctic and neotropic vegetation in that territory. Mexico ranks first in terms of reptile diversity in the world. Half of the country is desert, and more than 50 percent of its national surface has a rugged topography with hills and mountains. Most of the territory ex-

periences severe droughts, and the availability of water is mainly in the south-southeast.

This is clearly a geographical Vavilov center, defined as the place of origin of domesticated plant species of great economic importance. Led by corn, the dietary basis of the region, these species include chili, tomato, pumpkin, cacao, amaranth, and others that form part of the world's food heritage. Mexico has more than 20 biocultural regions, where language and culture are combined with natural biological species, generating broad and diverse knowledge systems. Mexican cuisine, in recognition of this biocultural richness, has been declared an Intangible Cultural Heritage by UNESCO. However, this wealth is under threat and requires urgent protection measures.

Central America stands out as the only region in the world with both an intercontinental and an interoceanic position. This isthmus links North America with South America, separating the Pacific Ocean from the Caribbean Sea. It extends from Tehuantepec in southern Mexico to the Atrato Valley in northeastern Colombia. Formed 3 to 4 million years ago in the Pliocene, the isthmus has been a bridge for North-South movement for about 10 to 12 thousand years. Its unique location gives it a variety of contrasting landscapes, including mountain ranges, intermountain valleys (altiplano), hillsides, and coasts. The region is characterized by its climatic diversity. Tropical and subtropical climates predominate, but microclimates abound.

There is a great contrast between the mountainous areas – composed of hills, mountains, volcanoes, and plateaus – and the slopes. This climatic diversity is reflected in the region's natural richness. Its diverse life zones host forests that range from the very humid, humid, and rainy to the dry. The isthmic condition of Central America explains the presence of flora and fauna from North and South America. Until Nicaragua, the vegetation is nearctic, and from the south of Costa Rica, the vegetation becomes neotropic. The combination of species in these regions explains the vast biodiversity of this subregion.

Greater Mesoamerica clearly covers a period that precedes the beginning of the genealogy of the Anthropocene, which, from this project's perspective, stems largely from the European invasion. However, we will limit the period of study in these handbooks starting with the considered territories' conquest, that is, the colonial period, based on the logic of the intensification of exploitation processes. Therefore, the concept of Mesoamerica present in the contributions of these handbooks must be understood from a broad geographical, cultural, and socioenvironmental sense, as stated above. It is, then, an operational concept that does not ignore the diffuse and subtle nature of inter- and intraregional divisions, nor does it ignore the socially constructed nature of any spatial delimitation, especially – although not exclusively – when it comes to socioenvironmental relations.

Caribbean

The Caribbean, whose core was delineated by different groups of various-sized islands, is characterized by the territorial interaction between these insular and maritime spaces, as well as the surrounding coastal areas in the Gulf of Mexico. This is known as the Circum-Caribbean, and we include it in our conception of what we call the Greater Caribbean, which also includes the Atlantic coast of northern Latin America with Colombia, Venezuela, and the Guianas. It was the first region "discovered" by Christopher Columbus. The island of Hispaniola (currently the Dominican Republic and Haiti), in particular, became the geopolitical epicenter of the Spanish and other European powers. It was called "the gateway to the Americas," at least until the mainland (*Tierra Firme*) – with more promise – was discovered and began to be conquered.

From the perspective of the Anthropocene's genealogy, the Caribbean is a particularly vulnerable region in relation to climate change in historical times, i.e., the colonial imaginaries of "primitive climate engineering," and also to anthropogenic climate change since the Great Acceleration. First, the Caribbean archipelago has been especially exposed to weather extremes such as hurricanes, droughts, and extreme rainfall, as well as to geological extremes such as volcanic eruptions. Second, these small island ecosystems were extremely sensitive to disturbances, such as large-scale deforestation undertaken by colonizers to create sugar plantations.

The Caribbean is a point of confluence between various geographical areas of the American continent, located in the middle part of the continent in much of the Atlantic Ocean. This has allowed large territories of the Caribbean to become gateways, both by sea and by land, for the migrations of people from European countries and the American continent itself. In addition, the Caribbean was the first region in the Americas to experience migrations of flora and fauna, especially with the arrival of Spanish inhabitants who introduced new livestock species and various agricultural products. The anthropogenic change caused by the European arrival was, to a large extent, related to the introduction of pathogens, causing the massive death of Indigenous populations and the abandonment of land cultivation in different Caribbean regions.

It is no accident that, until today, the Caribbean is recognized globally as a large tropical and mountainous area contrasted with coastal activities. It brings together vast territories with a wealth of terrestrial and maritime biodiversity that, for centuries, have been a meeting point for migrants from Europe, America, Asia, and Africa. The migratory diasporas to and from the Caribbean had such intense periods that we can say the region has provided conditions for complex and conflicting *mestizaje*.

After European colonization and the beginning of the transatlantic slave trade, the extractive plantation industries, which exploited the labor of large numbers

of enslaved Africans, gave rise to highly stratified and socially vulnerable societies in this geographically fragile environment of small islands. From this perspective, there are numerous analogies and a shared history of forced migration, racial stratification, and systematic ecological exploitation as in the Brazilian Northeast. Both regions, of roughly the same demographic size, are fundamental nexuses of the Afro-Atlantic world and constitute spaces of ecological circulation that are paradigmatic for the colonial plantation system, in addition to its enduring legacy in the creation of the Anthropocene. The northernmost part of Northeastern Brazil, that is, states such as Ceará and Rio Grande do Norte, are sometimes included in classifications of the Caribbean.

During the colonial period, the Caribbean was one of the most important markets for people exploited by the international slave trade, financed by European economic powers. To a large extent, current migrations from the Caribbean are due to very complex processes of the anthropocenic degradation of territories and popular settlements, as well as to the violent penetration of criminal groups that have forced large sectors of the civilian population to take refuge in neighboring countries or seek migratory routes to the United States.

Since the conquest, violence and political instability shape the Caribbean region. At the end of the eighteenth century, Haiti was the epicenter of the first major revolt of people freeing themselves from the yoke of slavery in America. Since then, the conditions of slavery and labor exploitation have been intolerable for large sectors of the civilian population. However, at the same time, the Caribbean has been a space of great transformation and anthropocenic resilience, despite extractivist policies focused on land use changes, the exploitation of aquifers, the introduction of non-endemic fauna and flora, the extraction of oil, clandestine logging of forests, and the extraction of minerals. Countries such as Cuba, Haiti, Barbados, and the Bahamas are just a few examples of nations that have experienced dramatic transformations with great effects on their inhabitants due to the extractive policies implemented from colonial periods until today.

In anthropocenic terms, Indigenous and Afro-descendant communities have been especially affected due to the occupation of their ancestral territories and the implementation of industrial-scale monocultures. Paradigmatic examples of this are bananas, cacao, and coffee, products with great global demand that are grown using labor under precarious conditions, often equivalent to slavery. Another manifestation of anthropocenic devastation in the Caribbean is sugarcane, which has resulted in extensive deforestation to grow tubers imported from the Philippines, depleting water reserves due to intensive water use.

In addition, the mining of precious metals such as gold and silver has been a significant factor of anthropocenic devastation. Land use and the pollution of rivers with toxic substances, such as mercury and cyanide, have seriously affected the natural environment. Copper mining since the nineteenth century and nickel mining in

the twentieth century have had a global impact and have wreaked havoc on diverse ecosystems. These activities have also profoundly transformed the region's cultural forms and traditions.

In short, the Anthropocene has had a significant impact on the Caribbean region, especially from the nineteenth century to the present, due to abusive and uncontrolled extractive policies in populations that have suffered a long history of systematic impunity, corruption, government abuses, discrimination, and endemic racism. In addition, the phenomenon of mass tourism in the twentieth century has affected the natural resources and biodiversity of jungles, mountains, and beaches through the international sale of land and property to European and North American foreigners. Finally, we wish to emphasize that, given the historical legacy of colonialism, slavery, and continued economic dependence on European powers – even after political independence – together with anthropogenic climate change, these small island states remain vulnerable. However, creative regional solutions are emerging to address the climate crisis, especially in the form of specifically and innovatively structured disaster insurance programs.

Land Use

The CALAS-handbook volume on *The Anthropocene as a Multiple Crisis* that you have in your hands focuses on the topic of land use in Latin America during the Anthropocene. The central metaphors in the imaginary of land use in Latin America have been the dual myths of virgin land to conquer and of "El Dorado" to exploit. These images are essential for understanding the genealogy of the Anthropocene in the region, from the Conquest to the present day. It is recognized that *homo sapiens* has always altered its habitats, even before colonization and the crisis of the world capitalist system. Prior to the arrival of the Europeans, there were already massive land alterations in agricultural systems, such as the urbanization of Mesoamerica and the Andes or Amazonian agroforestry. However, it is necessary to overcome a simplistic and homogenizing vision of the region's environments and social life before the arrival of Europeans.

The image of "El Dorado" does not take into account the diversity of the continent's ecological regions, which include large tropical forests and high mountains, as well as semi-arid areas, savannas, mangroves, and wetlands. The image of Indians, a typical colonial construction, was intended to simplistically unify a great diversity of societies and forms of land use. The conquest of Latin America is considered to be the engine of the first major global acceleration in the transformation of land use, strongly influencing the formation of the Anthropocene that began in 1950. This encounter of Europeans with the multiple realities of the continent marked the beginning of what is known as globalization and the constitution of the

technosphere of modernity. This process connected previously unconnected worlds, creating a global economy and a sociocultural circulation that linked human societies from all continents. It was also paradoxical, producing great suffering and historic constructions of fundamental importance. All the great transformations that followed, including industrial revolutions and modernity, cannot be separated from the consequences of this encounter and the establishment of the extensive colonial system that it produced.

The intention of this volume is to enrich contemporary debates about the Anthropocene, which seek to understand the formation of the globalized capitalist world's technosphere in Latin America from critical perspectives in the social sciences and the humanities. For this purpose, we focus on social appropriation and land use, based on the transformations of matter, social practices, their political and legal regulations, as well as the imaginaries of territories considered virgin. The very concept of virgin or empty territories is intrinsically related to the dynamics of colonization, deriving in part from the significant demographic decline of Indigenous populations. This decline was more intense in some regions than in others, due to violent conflicts and epidemiological shocks caused by the introduction of pathogens unknown to the immune system of native populations.

Understanding this whole process implies, therefore, studying and understanding spatial conflicts over land use in all the dimensions mentioned above. Various actors are involved in these conflicts, driven by the dynamics of colonization, spatial appropriation, and commodification of the Earth. In studying these long-standing conflicts between Indigenous groups and methods of colonization, we have taken into account the logics and territorial knowledge of people of African descent, peasants, and environmental movements in the early twenty-first century. Far from presenting a static cartography of land use, we seek to investigate the dynamics and numerous appropriations of borders, as well as other historical transformations present in this use.

Under this conceptual framework, we have focused on six fields of research with respect to land use. These fields are not strictly separated but rather overlap and articulate in branched paths. The first area of interest in this volume of the handbook is that of the transformations of vacant lands. The term "wasteland" in its various uses – from the Argentine Desert, the Sertão of Brazil, or the "green hell" of the jungle – is problematic due to its anthropocentric connotations of uselessness, regardless of its ecosystemic importance, similar to wetlands. The imaginary of land use and the possibility of expanding its usefulness has been fundamental to national narratives. Here, we also include parts of the land considered "second-grade wastelands" or those whose uselessness is due to overexploitation, such as areas of desertification or industrial landfills.

Next, we explore three fields that encompass all land use activities directly or explicitly related to the biosphere. This includes land use activities and systems based

on the direct extraction of flora and fauna, such as the extraction of wood, fruits (like palm), fish, and animals through hunting. Another large focus is that of the fields that transform the land (crops). We approach agriculture from the emergence of plantations and *latifundismo* (large-scale land ownership) through to the impacts of industrial agriculture, the Green Revolution, and transgenics to Afro-descendant and Indigenous-peasant agriculture and agroecology.

In the context of silviculture, we explore the related laws and the formation of protected areas, as well as the emergence of forest plantations and the process of deforestation. Similarly, we analyze the impacts of breeding, including the introduction of new species such as sheep, goat, and cow or "more effective" grasses. A fundamental factor for thinking about changes in land use on the continent since the European conquests is related to ecological macrofactors, including the great capacity for the spread of exotic species of flora and fauna in the region that were functional to the socioeconomic model of colonialism and had no natural containment barriers in local ecosystems.

Finally, we explore the dimensions of the technosphere related to urbanization and infrastructure processes. Currently, Latin America is one of the most urbanized regions in the world, significantly impacting the socioenvironmental metabolism of different regions, the impermeability of the ground, and climate change, among others. In terms of infrastructure, roads and the use of hydroelectric energy stand out.

Final Words

We proudly present this volume as part of a series of handbooks that have carried out the pioneering task of approaching the Anthropocene from a specific regional perspective. Its realization has been made possible thanks to the dedicated work of a team of 20 editors and more than 70 authors of diverse disciplines from various regions of Latin America, the United States, and Europe.

For two and a half years, we have met at editorial conferences and workshops at CALAS headquarters in Guadalajara, Buenos Aires, Quito, and San José de Costa Rica, as well as at various virtual editorial conferences. These meetings have led to lively and, at times, controversial debates. Now, we present to you the product of this fruitful international and interdisciplinary collaboration.

We have made a significant contribution by approaching the planetary scale of the Anthropocene from a regional perspective. We have shown what the Anthropocene can mean in its socioenvironmental and sociotechnical dimensions, as well as in a long-term perspective. Assuming a perspective from Latin America involves turning to existing debates and problems related to multiple socioenvironmental conflicts, which require critical perspectives from the social sciences and the hu-

manities. With our work, we hope to have promoted the debate on the Anthropocene from critical Latin American perspectives and to have provided inspiration for perspectives on confronting the multiple crises in the Anthropocene. Last but not least, we hope to serve as an example for other regional perspectives on the planetary in relation to the Anthropocene, especially from the Global South.

Translated by Eric Rummelhoff and revised by Luisa R. Ellermeier.

Colonial Period

Source: Fernando Efrén Sandoval (2021).

Introduction: Land Use in Colonial Latin America in the Anthropocene History

José Augusto Pádua, Olaf Kaltmeier, María Fernanda López Sandoval and Adrián Gustavo Zarrilli

The arrival of Europeans to what is now called the Americas, beginning in the fifteenth century, was undoubtedly one of the most crucial events in the history of mankind. This displacement of populations marked the beginning of the consolidation of a global system that was able to connect the regional systems that were forming, with different levels of scope and intensity, in different areas of the planet. For the first time, it opened the possibility of integrating societies from all continents into the same planetary historical narrative, both in objective and subjective terms, opening space for the future establishment of a multi-civilizational order (Sharman 2019). In other words, a large global network was being built that would connect the different circuits of exchanges and domination – at the political, economic, ecological, and cultural levels – and would be implanted in different parts of the world (McNeill and McNeill 2003).

Of course, the formation of this global network was not limited exclusively to relations between Europe and America. From the fifteenth century onwards, European sea crossings were initially directed towards Africa and Asia, occupying a unique position in mobility from the Atlantic Ocean. However, European dominance in interoceanic navigation did not guarantee the conquest of new territories or the hegemony of the old continent. The incursion of Europeans into the areas of commercial and cultural exchange in the Indian and Pacific Oceans was relatively weak in the first centuries. Territorial acquisitions were quite limited and almost always depended on favored relationships with local aristocracies. European economic participation was thus limited to the commercial sphere, without significantly modifying local production relations (Chadhuri 1991).

The historical context in the Americas, of course, was very different. In these regions, Europeans conquered vast territories and subdued different native societies that were differentiated by their demographic dimensions and technological knowledge. The key point in the differentiation with contact and conquest processes in other regions, in terms of land use, was the establishment of economic activities beyond the commercial sphere, i.e., the European conquerors did not limit them-

selves to commodifying goods or natural resources based on local economic traditions. They also established their own productive dynamics, such as plantations and mining extraction, which produced radical changes in environments and territories. At the same time, they profoundly modified the regional and local logics of spatial and territorial management with the establishment of material and symbolic landmarks of their domination, such as cities, fortresses, haciendas, and churches. In the Amazon, for example, the religious missions were essential in the process of socioeconomic territorialization and in the control of the Indigenous populations disintegrated by the conquest. The environmental consequences of these transformations have undoubtedly had profound impacts. Deforestation and the loss of natural vegetation cover increased with the consolidation of colonial rule; the introduction of exotic species of fauna and flora, cattle ranching, and the expansion of monocultures caused, among other dynamics, profound changes in the structure and functioning of ecosystems, as well as the impoverishment of soils. Mining, with the use of galleries and pits, has become a dynamic of systematic landscape degradation and pollution, especially through the use of mercury. The European conquest of the Americas marked the beginning of what can now be identified as an environmental and civilizational crisis.

The colonization of the Americas was, consequently, much more intense and radical than that which took place in Africa and Asia until the nineteenth century. The appropriation of land, populations, and natural wealth occurred on a much larger scale, generating a substantial transformation also in the social and economic destiny of Europe. Thus, everything that happened subsequently in European history, including the industrial transformation of its economy from the eighteenth century onward and its domination of international geopolitics between the mid-nineteenth and mid-twentieth centuries, is linked to the colonization of the Americas. It is precisely this phenomenon and its consequences in Latin America, in the specific context of land use changes in the region and their impacts on the Anthropocene's genealogy, that will be analyzed in the five chapters of this section.

It is worth remembering that pre-Columbian societies were not a "new world," as defined by colonial ideology, but rather another old world. Nevertheless, it can be said that America acquired the label of "new world" when it was radically transformed by the impacts of the European conquest (Miller 2007). Contrary to the homogenizing, superficial, and misleading concept of "Indians," there was the notable presence of very diverse societies in social and cultural terms. These ranged from hunter-gatherers to agricultural villages that dominated most of the territory, as well as states or empires with a marked social stratification. All this human life, however, was isolated from what was happening on the other continents. Even though the American populations came from the same migrations of *Homo sapiens* that left present-day Africa tens of thousands of years ago and shared macro conditions on the same planet Earth, the societies that developed in the Americas charted their

own destinies and interacted with a diversity of ecological systems, each with its own uniqueness (Watson 2013).

A central element of these environmental and social changes, which occurred throughout the region, was the introduction of pathological microorganisms unknown to the immune systems of the local population, an event that had an enormous impact on human life. The specificities of pre-Columbian history help us to understand the magnitude of this epidemiological shock. On the one hand, Indigenous societies, for example, did not practice large-scale cattle raising, the activity that originated most of the diseases brought by the colonial conquest. In fact, there were few medium-sized animals in the local ecosystems to facilitate livestock activities. Europeans introduced oxen, horses, sheep, and many other exotic animals into today's Americas, which subsequently had enormous economic and environmental repercussions.

On the other hand, densely populated areas, favorable to the spread of epidemics, were relatively limited. The average standard of health of the pre-Columbian peoples was, therefore, better than that of the colonizing societies. In addition, this epidemiological shock cannot be isolated from the violence and abuses against local populations that marked the tragedy of colonization. But the impact of this shock was colossal, producing a differential that helps explain the scale of the territorial conquest, which was even greater. In addition to the direct deaths and waves of epidemics – which did not occur automatically or homogeneously, but differed in time and space –, the Indigenous economies and cultures were dismantled, and the stability of those societies was lost. In addition, the loss of population in some regions led to the inability to sustain sophisticated agroecological systems due to the lack of labor. The result of this process was a demographic decline of about 90 percent in just over a hundred years. It was as a result of this depopulation that much of the occupation of territories during the colony took place (Cook 1998).

The documentation of the time reveals that colonial rule was not only defined by economics, but also manifested itself in the cultural dimension. However, above all, colonial rule was marked by the control of power. This control took place at various scales, both at the macro geopolitical level, for example, in the competition between European states to become powers; and at the local level, insofar as the European elites became masters of the life and death of the inhabitants in the regions where they settled. The spread of Catholicism, in turn, intertwined religion, culture, social status, and power, thus contributing to European domination.

Undoubtedly, the search for material wealth was always present, substantially conditioning the other goals of colonization. In the context of the time, the search for precious metals was the main economic objective. In places where gold or silver reserves existed, such as Mesoamerica and the Andes, the creation of mining enclaves took center stage and produced significant social and environmental impacts. In addition to their direct impacts, such as the degradation of the local land-

scape and mercury contamination, these mining areas – whose main regional nucleus was Potosí (Machado Aráoz 2020) – became a sepulcher for Indigenous bodies, forced to work in terrible conditions through legal impositions or explicit violence. The mines also demanded a large amount of timber for economic and urban infrastructure works, which was acquired through the destruction of extensive areas of forest. The geography of supply to the mining enclaves was sweeping. For example, in the Southern Cone, much of the economy was oriented to the production and supply of food and pack animals for Potosí. Something similar occurred in Mesoamerica, where both the mining enclaves and the networks of cities and roads that were created to consolidate the territorial domain of colonization caused intense deforestation, accelerating the forceful expansion of production centers for supply.

The social and environmental impact of colonialism also extended to the exploitation of the organic world in all conquered areas. In the first instance, this was not only through the cultivation of exotic plants and the breeding of domesticated animals, but also through the extraction of non-domesticated species of native flora and fauna. Colonialism was imposed on the geography of Latin America. Land concessions played a key role through legal instruments such as grants and sesmarías by state authorities; thus, private ownership of land spread in the form of latifundios, haciendas, or ranches dominated by Europeans. These institutions of territorial and population control coexisted in a tense and oppressive way with the subordinate Indigenous communal agriculture, which was weakening over time.

A historically significant milestone was the invention of agricultural commodities, i.e., export-oriented agriculture through plantations and slave labor. The commercial extraction of certain trees and wild animals was too limited and irregular to consolidate and economically compensate the colonial extractive companies. Thus, in some regions where mining did not exist, an alternative was created through large-scale monocultures of agricultural products, which could generate wealth through their export to the markets of Eurasia and Africa. The plantation model was established mainly in regions with tropical and subtropical climates, where products that were not widely grown in Europe could be cultivated, gaining markets thanks to their exoticism. An example of this was cane sugar, whose large-scale production in northeastern Brazil (Rogers 2010) and the Caribbean (Funes Monzote 2008) revolutionized European food consumption. The plantation model produced a great deal of deforestation, since it relied on soil fertility obtained from the burning of forest biomass, which, although ephemeral, generated more production than in bare soils that were subsequently impoverished and eroded. The plantations were not limited to sugar cane. In the Caribbean, one of the central areas for the plantation model, crops such as coffee and tobacco, among others, were also developed. In other regions, in a more localized manner, plantations expanded where there were adequate ecological and social conditions; for example, in Amazon, where high river flows, intense rainfall cycles, and flooding made large-

scale occupation difficult, plantations were present that cultivated cocoa and sugarcane on medium-sized properties, which generated relatively modest exports. In addition, the plantations, along with mining, were essential for the development of a perverse but highly lucrative trade that brought some 12 million African slaves to the Americas, of whom about 2 million died crossing the Atlantic Ocean (Klein 2010).

However, the colonial rural economy was not limited to plantations. It was also oriented towards production for local and regional supply, either through agriculture or livestock farming. In this context, another historical and ecological process of global dimension took place: the massive introduction of exotic species by colonizers. It is worth mentioning that several native species were used to supply colonial societies, as was the case with maize, potatoes, beans, and cassava (Soluri 2018). It should also be recognized that Andean camelid breeding, for example, was maintained for wool extraction. The local biota was also used for extractive processes at different scales. This was the case of the factories in the Amazon, which extracted products such as cocoa, copaiba oil, and sarsaparilla from the forests without necessarily appropriating the land (Chambouleyron 2010). They also searched the rivers and beaches for manatee meat and turtle eggs. Something similar happened with yerba mate extracted from the forests of the Southern Cone, a plant that, like cocoa in the Amazon, later became a privileged crop with high agricultural commercial value.

However, as mentioned above, much of the colonists' rural economy was based on the introduction and production of exotic plants and animals. Some of the plants that were cultivated in the plantations have been mentioned above; to these are added, for example, wheat in the Southern Cone and barley in the Andes. However, undoubtedly, the introduction of exotic animal husbandry, especially cattle, horses, sheep, and goats, was the productive dynamic that spread throughout Latin America and caused significant changes in land use and severe environmental impacts, such as loss of natural cover, soil compaction due to overgrazing, and also social and cultural changes (Ausdal and Wilcox 2018). These exotic species generally benefited from the absence of enemies in local ecosystems, multiplying according to the pattern of "ecological invasions." This is exemplified by the demographic explosion of wild horses and bighorn cattle in the Pampa of the Southern Cone or of wild pigs in some Caribbean islands. In any case, this process of diffusion and global exchange of biodiversity – which was not unidirectional, since some plants and animals from the Americas also spread to other continents – profoundly transformed the planetary ecology.

In short, the colonial process in Latin America, in its broadest and most structural features, must be considered an essential factor both in the global history of European capitalism and in the planetary macro-transformation that is now identified as the Anthropocene. Examples of these transformations can be seen in certain

elements of the European industrial revolution, which led to the dominance of fossil fuels as a global energy source that continues to this day. For example, organizational learning in industrial production came, to some extent, from the segmented and complex production design of the sugar mills. Metals extracted from the region, especially gold from Brazil in the eighteenth century, also contributed to the bank capitalization that helped finance these industrial revolutions. The plantations inaugurated a model of agriculture that employed large-scale monocultures and the massive use of machines, oil, and water instead of human slaves – which to this day dominates large-scale commercial agriculture under the name of agribusiness. It is no coincidence that one of the names associated with the Anthropocene is the Plantationocene. Moreover, what would have become of Europe's demographic development without the introduction of American foods such as the potato? On the other hand, beverages such as sweetened coffee, which has been described as one of the "soft drugs" of modernity (Sahlins 1994), are essential as stimulants for the bodies of workers subjected to the rhythms of contemporary industrial and digital production.

But the colonial history of Latin America was not only shaped by the domination of patterns of production, consumption, territorialization, and ecological exploitation that marked the formation of the Anthropocene. It is also a history of resistance, of the resilience of alternative cosmovisions with Indigenous foundations and tributaries of complex cultural mixtures. These inspire today the search for worldviews that can oppose the ecologically suicidal path followed by a large part of humanity. It is also a history of subsistence-oriented forms of production and the *buen vivir* of communities that, despite being marginalized, have managed to survive and today inspire the search for healthier and more sustainable ways of relating to the Earth. Latin America is a macro-region of great ecological wealth, with vast biomes and ecosystems, essential for the environmental and climatic balance of the planet. These biomes and ecosystems have survived centuries of unbridled exploitation, often thanks to the efforts of Indigenous, Afro-descendant and mestizo communities that have fought to conserve their habitats. In other words, Latin America, which cannot be understood without lucidly discussing its colonial history, is a fundamental space both for the formation of the Anthropocene and for the search for a future that can effectively confront its multiple crises.

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Land Use in the Southern Cone in the Colonial Period

Colonial Spanish America between the 19º and 34º South Latitude

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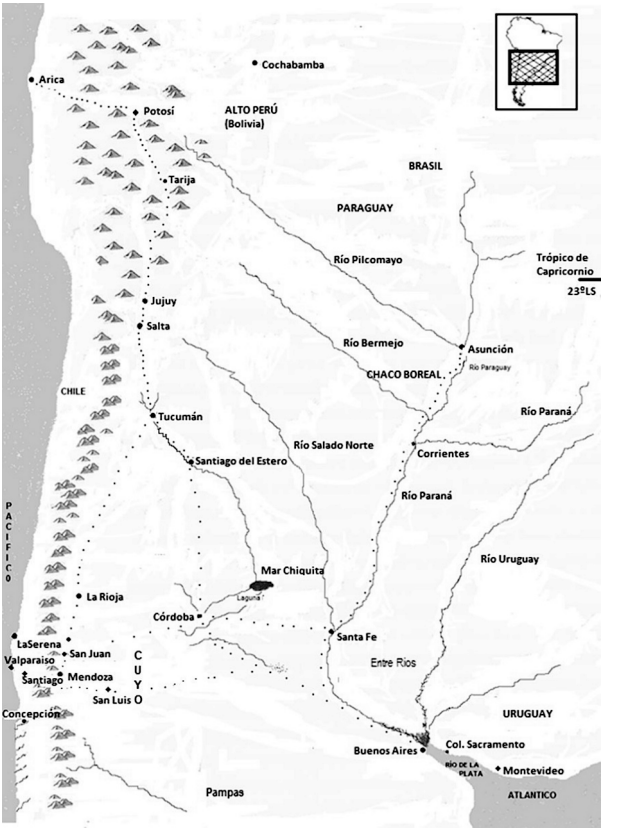
Under the Habsburg regime (sixteenth and seventeenth centuries), the territories of present-day Argentina, Bolivia, Chile, Paraguay, and Uruguay located approximately between the 19° and 34° south latitude (SL) (Fig. 1) were part of the Viceroyalty of Peru. The administrative reorganization of the Bourbons in the eighteenth century brought Cuyo, Upper Peru (now Bolivia) and present-day Paraguay and Uruguay under the jurisdiction of the Viceroyalty of the Río de la Plata, founded in 1776. In the territorial strip between 19° and 34° SL, the populations located around 31° formed the southernmost periphery of Spanish America, since Patagonia remained uninhabited by Europeans, as did most of southern Chile after the Great Araucanian Rebellion at the end of the sixteenth century. There was an unsuccessful attempt to establish populations in the Strait of Magellan around the end of the sixteenth century, but they succumbed to difficult environmental conditions, lack of food, and disease. From the seventeenth century onwards, the frontier with the Indigenous was militarized on the banks of the Biobío River and the main Spanish settlement was Concepción (36°LS). The indigenous domain began south of 35° SL on both slopes of the Andes and in the lands designated as *Trapalanda* or *Magallanica*. Spanish incursions were driven by accounts of the existence of immensely wealthy populations. The legend of the "City of the Caesars," for example, referred to a fabulous kingdom in some southern confine, with abundant gold and silver, governed by whites ("caesars") with docile and helpful natives.

Fig. 1: Study Area, Main Towns, and Colonial Routes



Source: Author's own elaboration.

The reconstruction of the development of land use in this territorial strip follows three interrelated variables: population, strategic natural resources, and location of both populations and resources. Colonial sources have limitations, temporal interruptions, and information gaps, but they allow us to reconstruct land use change related to the Anthropocene as a multiple crisis. The change in land use during the colonial centuries has had consequences that are associated today with the Anthropocene. For this reason, Wendt (2016) considers the colonial period as an early phase or proto-Anthropocene. Voosen (2022) understands the Anthropocene as an "event," which is an informal term used by Earth System Science researchers to express gradual changes that affected the entire planet: from those that have occurred over millions of years to those caused by the impact of an asteroid. The colonial period would

be an event that altered land use throughout the continent, in a decisive way with cumulative consequences.

The structure of the argument considers historical data following three variables that modified land use. It deals with demographic changes, strategic natural resources, and the location of both populations and resources. The population variable involves the sixteenth century and first half of the seventeenth century with the advance of Europeans and the demographic collapse of the indigenous population. The main reason for the collapse – though not the only one – was the introduction of pathogens to which the native peoples lacked immunity. Diseases such as smallpox, measles, typhoid, influenza, pneumonia, and angina, among others, caused an abrupt demographic change. This changed the use of the soil by rearranging access to energy, starting with access to food and the incorporation of germplasm together with domesticated animals.

In addition to the resources needed to sustain human populations, strategic resources such as gold, silver and mercury were added, as well as soils suitable for haciendas producing exportable goods such as sugar or cotton. Thus, the location of populations and resources linked productive spaces with land and sea routes. Finally, the crown had strategic considerations for the defense of its possessions, explaining the location of populations and land use.

Demographic Change

Native population figures for the entire American continent before 1492 are tentative. It is estimated that the collapse of the indigenous population went from about 61 million to 54 million (Nunn and Quian 2010: 165–166) to only about 6 million by 1650. Beyond precise numbers, death from virulent diseases was a common experience of Amerindians (Pietschmann 2002; Elliott 2006; Bailyn 2012). Ironically, this favored the preservation of environments from what would have been an early overexploitation by the economic interests of the newcomers along with the huge increase in population as Europeans joined the natives (Dore 2000: 7). In relation to land use, the collapse of the native population explains the dizzying occupation of fertile lands by the conquistadors. This chapter begins with two examples in different environments. Along the coast and in the valleys of the Peruvian *Sierra*, the sugar or cotton hacienda was easily built (Noejovich et al. 2020). At the same time, in the high altitudes of the Uco-Xaurúa valley in Cuyo, on the route from Buenos Aires to Santiago de Chile, the archaeological record indicates an important pre-Hispanic occupation that, by 1630, had diminished to the point of allowing the appropriation of land suitable for fattening cattle and horses from Paraguay and the pampas destined for the markets on the other side of the Andes. In Uco-Xaurúa, the animals wintered before crossing the mountain range through the Portillo de Piuquenes pass

and, once in Santiago de Chile, the slaughtered cattle were exported as a secondary product (jerky, tallow, and hides) through the port of Valparaíso to Alto Perú and Lima, from where Peruvian sugar and European goods were brought. Tallow for the manufacture of candles constituted the first item of export from Valparaíso to Peru during the entire seventeenth century and amounted to some 30,000 quintals annually (Carrillo de Ojeda 1659: 17); as one head of cattle yields one quintal of tallow, this export volume demonstrates the importance of this interregional network. This exchange circuit had an impact on land use in Cuyo.

In the mid-seventeenth century, the main landowners – by purchase, barter, or donations – in the Cuyo oases were the Jesuits until their expulsion in 1767. They put into circulation wine, cattle, sugar, and yerba mate (*Ilex paraguayensis*) from Paraguay to Chile and Peru through their missions, colleges, and estancias in Santa Fe and Córdoba. The circuit also changed land use in Paraguay, where it encouraged the cultivation of yerba mate, which grew wild in the Sierra de Mbaracayú in Gayra and was harvested in the jungle. While this was the only way to access yerba mate, the consumer market remained limited, but by 1610 the Jesuits were able to manage its cultivation and thus ensured the commercialization of the caminí variety: *caminí* meaning "cultivated" or not harvested from the bush and grown in the wild. Once the plantations were organized within their missions, they maintained their productive and commercial monopoly (Gascón 2007).

The Indigenous demographic catastrophe was compensated by the forced migration of Africans to work in the cotton, cocoa, sugar, tobacco, indigo, and coffee plantations. This had a transformative effect on land use, both geographically and temporally. The hacienda brought clearing, leveling, plowing, drainage, and irrigation, with cumulative consequences that mark the initial moment of the Anthropocene in our continent. In the subtropical region of Argentina, cotton farming began in Santiago del Estero in 1555 with seeds brought from Chile. The cotton hacienda grew because textiles were used to pay Indian tribute (Garavaglia 1986). The dyes came from local plants because the spinners and weavers were Indigenous. Occasionally, indigo from Central America introduced via Lima and Santiago de Chile was used. It was not until the eighteenth century that there was a local venture to produce indigo, with slave labor purchased in Brazil. There were cotton plantations in Paraguay, which was a net exporter to Santa Fe and the Río de la Plata. Cotton, along with wine, sugar, honey and yerba mate, went down the Paraná River to the port of Santa Fe. In the seventeenth century, yerba mate alone accounted for between 20,000 and 25,000 arrobas per year (an arroba is equivalent to 11,340 kilograms). Santa Fe was designated "*puerto preciso*" since 1662 for tax collection purposes, controlling the movement of people and goods, articulating Paraguay, Chile, and the Río de la Plata.

The flow of resources from Paraguay to Chile covered part of the demand of the professional army of the Araucanía stationed on the banks of the Biobío River after

the native rebellion of 1598–1599. With 2,000 places, it counted on allied Araucanian Indians, who could double the number of soldiers (Quiroga 1979: 36). In this early historical moment, the variable of the location of the populations reveals itself as crucial because Spain's decision to station a professional army was due to the defense of the South Sea after the irruption of Francis Drake in 1579 on the Peruvian coasts. The Araucanian revolt at the end of 1598 offered Spain's enemies in Europe the possibility of gaining local allies, so the Junta de Guerra instructed the Paraguayan Jesuits to send military-trained and armed Guarani natives to the Araucanian frontier. In 1608, some 200 Guarani arrived in Chile to whom the priests began to send yerba mate and tobacco from Paraguay every year. Before long, Paraguay was sending cattle and horses to the army, boosting land use with natural pastures along the route (Gascón 2007).

In this context, the evolution of land use in the Argentine pampas is related to location. The main population at the beginning of the seventeenth century was Buenos Aires, which claimed exclusive use of the route opened by Fray Francisco de Vitoria in 1584, linking Brazil with Tucumán and Buenos Aires. As an Atlantic port, it allowed the entry of Africans from Guinea and Angola that served the demanding Alto Peruvian mining industry. Faced with the impossibility of exercising effective control, in 1594, the crown closed this route, but four years later a dispensation allowed Buenos Aires to export flour, jerky, and fat; the license was renewed, cementing a land use aimed at extracting and producing resources for export. The Bourbon opening of the ports with the Free Trade Regulations maintained the use of the Pampean soil for agriculture and livestock with large exportable surplus (Garavaglia and Gelman 1995; Amaral 1998; Moraes 2020).

Elsewhere, changes in colonial land use show the impact not only of new crops but also of colonial know-how. Moxos in the Bolivian Chiquitanía was known for its cocoa plantation (*Theobroma cacao*) which was exported, along with sugar, to Peruvian markets. Through traders in Lima, Chiquitano cocoa reached Chile and the Río de la Plata. Its processing required care and its export was done in crates made of dry boards, caulked with tar and lined with hairless cowhides. In 1788, twenty years after the expulsion of the Company, a royal official did not mention cocoa as a profitable resource, but rather aimed to increase the yield of the sugar hacienda for export to Cochabamba and the commercial exploitation of palm oil (coconut oil or *motacú*) described as a very efficient fuel for lighting (Santamaría 1986).

Cochabamba's location as a nexus between the Altiplano and the jungle made it an ideal hub from the pre-Columbian era to the time of Spanish conquest. Maintaining this ancestral location allowed Spaniards exchanges of complementary natural resources. The same legend of the discovery of the Potosí ore veins involved Cochabamba as a trading post. Legend has it that the Porco Indians, carrying food to the Altiplano from Cochabamba, when a ram escaped, followed it to a cave where Diego Wallpa, in order to take shelter from the cold of the night, lit a fire that melted

the metal found on the surface (Jiménez de la Espada 1965: 172). Originally called Villa Real de Oropeza, Cochabamba had been founded in 1571 by orders of Viceroy Francisco de Toledo (1515–1582) to feed a Potosí that was becoming a population center with more inhabitants than London at that time. But located at 4,000 meters above sea level, Potosí depended on external supplies, and in 1603, it was already importing 50,000 bushels of corn and more than 90,000 bushels of wheat annually, mostly from Cochabamba (a bushel here is equivalent to 65 kilograms). The figures point to the land use changes that had to be made to reach these production volumes. The number of bushels of corn, on the other hand, testifies that the labor force was Indigenous, mostly dedicated to mining via the *mita* and the *yanaconazgo* labor systems. The collapse of the native population and the reluctance to work in the harsh conditions of Cerro Rico de Potosí, prompted the introduction of African slaves who also served on the haciendas. With the African population came the tropical diseases of malaria and malaria whose spread was, in turn, associated with the environmental conditions derived from the cultivation of sugar cane. Parvovirus and hepatitis B also arrived from Africa. As cumulative effects in the long term, demographic change is associated with the distribution of blood groups and endemic diseases. Thus, today there are entire populations of indigenous Peruvians with Group 0 (71 percent) and there are populations susceptible to a strain of malaria, depending on whether or not they have the Duffy antigen, whose production is related to blood groups (Carmona 2006; McManus, Taravella and Henn 2017).

Potosí had its extractive peak between 1580 and 1620 and declined around 1690 when the viceroyality authorities tried to increase mineral extraction in other deposits such as Lipes and Oruro. At its peak, Potosí produced more than 42 percent of the world's silver, so Viceroy Toledo claimed that, together with the mercury mine of Huancavelica – which allowed the processing of silver through amalgamation or "quicksilver" – both mines were not only the wheels of the viceroyalty's economy but of the entire royal treasury. Potosí had an overwhelming human and environmental cost. Contact with mercury quickly deteriorated the health of the workers and environmental contamination reached its most critical colonial moment in 1626 when the San Idelfonso dam with the pollutants from the quicksilver process collapsed. It killed 4,000 people and carried an estimated 19 tons of mercury into waterways, causing pollution that reached the Río de la Plata through the Pilcomayo River, a tributary of the Paraná River (Gioda et al. 2002). As primary energy (food and firewood) and consumer goods were imported, Potosí impacted land use on a regional scale. By 1630, livestock was supplied from the Argentine pampas and pack animals were imported from Tucumán (Assadourian 1973). At the beginning, the pack animals had been llamas (*Lama glama*). But as they can only tolerate about 25 kilos, they were replaced by mules bred in Tucumán. The populations of Jujuy and Salta orbited around the Alto Peruvian mining industry, according to an eyewitness, since the 100 residents of San Salvador de Jujuy were muleteers (Vázquez de Espinosa 1948: 622).

This caravan traffic had a pre-Hispanic tradition on both sides of the Andes (Rivera 1995; Sanhuenza 1992; Hidalgo 2004, Quesada and Lema 2011; Conti and Sica 2011). In Salta, the mule fair was held between February and March and the Spanish need for corrals and pastureland met with the indigenous activities in the Calchaquí valleys. Spanish wars against various Kakana-speaking tribes during the seventeenth century had varied causes, although the second Calchaquí uprising (1630 and 1647) coincided with the consolidation of the use of the land for pasture. In the eyes of the natives, the booming activity of the Spaniards put them in danger because it made it difficult to access the carob trees (*Prosopis sp*). From its pods a flour is extracted for bread and, in periods of drought, it is the only wild fruit in abundance, which is why the Indigenous called its pods "*frutos de hambre*" (fruits of hunger).

Another long-lasting impact was the spread of now endemic diseases such as *fascioliasis* (named as *saguaype* by the Guarani, meaning "flat worm"), an herbivore parasite (Mera and Sierra et al. 2007). Another is sheep mange (*carache*) that in 1549 arrived in Santiago de Chile (founded in 1541) from Peru. The town council of Santiago had all the animals killed to prevent the spread of the disease, since it was known that in 1541 scabies in Peru had affected both cattle and natives. In addition, scabies had jumped the species barrier (spillover). It spread to the four American camelids: the llama and the alpaca, which are domestic, and the vicuña and the guanaco, which are wild. The dangerous anthrax was first recorded in 1590 in cattle in Buenos Aires (Noseda 2001).

Another impact was on resources whose management was contained in the field of indigenous knowledge. An example of this was that the Indigenous were the best carpenters in Tucumán during the colonial era, for they knew as much about wood as about native trees. This knowledge was appreciated because in Tucumán they repaired the wagons that were only good for a couple of round trips between Jujuy and Buenos Aires. In Tucumán they used lapacho wood (*Handroanthus impetiginosus*) which grows on the eastern slopes of the Aconquija sierras. The chronicler Fray Diego de Ocaña (1565–1608) recorded that its wood was the dominant resource for carpentry of both carts and furniture, although the wealthier preferred cedar furniture. Activities related to carpentry help Indians to pay their tribute dues, since the individuals entrusted with this job not only worked in the carpentry shops but were also in charge of felling and transporting the wood from the native forests to the city. Although deforestation progressed slowly because it took place in the months without rain (winter) and the export of hardwoods was a luxury that few could afford, in a century and a half more than 2,000 hectares of the Aconquija foothills were affected (Noli 2001: 12). Likewise, goods for ship repair were exported from Tucumán to Buenos Aires, such as tar for caulking, iron, and cabuya (*Fourcroya andina* and *F. occidentalis*), which is a plant that produces good fibers for braiding ropes and sails (Gentile 2009).

The Jesuits of Tucumán adapted the use of the land, investing in haciendas to produce wheat and sugar, maintain the breeding and fattening of cattle, textile mills, carpentry, and cheese making. They had capital, enjoyed tax exemptions, and cooperated among their various regional possessions (Andrien 2020: 78). The most important property in Tucumán was Tafí del Valle purchased in 1670. The expulsion of 1767 freed more than 400,000 hectares of the best pastureland for civilians, where the breeding of cows and goats was maintained for the production of a type of cheese called *tafinisto*.

Changes in Land Use from an Indigenous Perspective

The Indigenous contributed with labor when they could not do so in goods, incorporating environments and adapting land use to internal and external requirements. For example, in arid areas of Chile's Norte Chico (La Serena-Coquimbo), where water is scarce, Indian tribute was authorized on mining labor instead of agricultural products. Also, further north, in Tarapacá, mining work was dominant from the first *encomienda* given to Lucas Martínez Vegazo, with more than 1,500 tributary Indians. Half a century later, the viceroy promoted viticulture and the export of wine to the Alto Peruvian markets in order to generate income and allow the indigenous tribute to be paid in goods. As viticulture is appropriate for an arid region, most production was concentrated in irrigated pockets such as Pica, which produced up to 375,000 liters of wine annually (Urbina 2007).

For the natives, sheep and goats were a common form of payment for their services. Sheep had the advantage of providing wool, which natives could then use to pay their due tribute with textiles. Sheep grazing modified land use with long-lasting impacts, to start with, it in some way explains the relocation of the four native camelid species. In the paleontological and archaeological record, Andean camelids have been widespread since the end of the Pleistocene and were prized for their meat and milk, wool and hides, and their tendons and bones were used to make tools. Even today they are a source of energy as their dried droppings are used for cooking. Unlike the sheep introduced by Europeans and whose environmental impacts have been assessed as predominantly negative (Hunter 2009; Melville 1994; Weber 2005), American camelids do not erode grazing fields, are less selective in the consumption of natural grasses, and the cleft lip of the upper jaw together with a dental buckle allows them to cut grasses rather than uproot them. In addition, the anatomical arrangement of its four limbs and its toes with pads on the soles cause less soil erosion. The Incas protected the vicuña because of the quality of its fibers. Being a wild animal, it must be hunted for shearing and the indigenous people had a procedure – *chaku* – still in use today in the Andean communities authorized to shear vicuñas. During the colonial period, there were slaughters of up to 80,000 vicuñas

per year in Peru and northern Chile. In 1776, a quantity equivalent to the production of 20,000 animals in hides was exported through the port of Buenos Aires. According to a report of export figures for an average year, between 1792 and 1796, 18,402 pounds of vicuña wool was shipped to Spain against some 5,000 pounds combined for alpaca and sheep wool (Bliss 1952). One estimate indicates that, between 1663 and 1853, the equivalent of 1,572,000 vicuñas must have been killed to obtain the wool that left Buenos Aires for European markets (Laker et al. 2006).

The transfer of European livestock to native societies continued its transformative course and having multiple impacts in the long term. In the short term and throughout the continent, the symbiosis between the Indian and the horse was decisive. In an anecdote told by the major chronicler of the Indies, Antonio de Herrera y Tordesillas (1549–1626), his faithful Indian servant told him that the three most important contributions of Spain to native society were chickens because they provided good food daily, candles because they prolonged daylight at night, and horses because they made it possible to travel long distances quickly and comfortably. Similarly, when the explorer Count de La Perouse arrived in southern Chile in 1786, he concluded that the horse had transformed the Indian into a formidable warrior, like "the old Asian Tartars", nomadic, dressing with their skins, consuming their milk and meat, and with their ancestral practices modified forever (1798: 25).

It was not only the horse that had transformed the societies of the Araucanía. The allied Indians had been receiving sheep and goats as payment for their labor for the Spaniards and were raised alongside dogs and farm animals. All of this activity modified land use, although it is difficult to conclude on a single assessment of the impact on the environments. For example, by the end of the eighteenth century in Chiloé, sheep excrement had contributed to fertilizing the soil and this benefit had been so tangible in improving agricultural production that the indigenous people rarely killed a sheep or a goat for consumption (González de Agüeros 1788). But, at the same time, this behavior, which protected the sheep for its wool and manure, had neglected the traditional camelid, and since the eighteenth century, the existence of llamas in Chiloé has not been recorded. In northwestern Argentina, competition for pastures with introduced livestock caused native Andean camelids to migrate to the Puna (Mata de López 2005: 49). On another island – Juan Fernández at 33° – the Spaniards introduced dogs to hunt the goats that they themselves had previously introduced. This was in an attempt to deprive the pirates crossing the Strait of Magellan from finding food there. In the end, the goats evaded the dogs, taking refuge in the steeper places, so that both the population of goats and the population of maroon dogs increased (Juan and Ulloa 1748). Similarly, in the seventeenth century, rabbits were introduced into southern Chile to provide meat and fur, but two centuries later they were a pest that had displaced the native fox (Gallini 2020: 191).

In southern Buenos Aires, the expansion of sheep explains transformations in land use by the natives, since sheep had allowed for beneficial commercial deals

by the eighteenth century. The Hispanic-Creole bought textiles, ostrich feathers, leather, wood carvings, and tools for saddles from the natives (Mandrini 2006). As payment was made with wine and spirits, it has been decried as a trade that caused more problems than benefits (Sánchez Labrador 1936: 40, 164, 165, 175, 177). The town council of Buenos Aires in its session of September 7, 1747 had rejected a request to excommunicate those who paid the Pampas Indians with alcoholic beverages. According to the ecclesiastical chapter, wine was "harmful to the bodies," but the civilians replied that it was not harmful as was the case with the novo-Hispanic pulque, that if it was not sold the Pampas still stole it from the caravans and, finally, that if this was a valid argument, then those who sold wine to those who got drunk in *pulperías* should also be excommunicated; that is, a varied population that included whites, blacks, and mulattos (Archivo General de la Nación 1931: 292–297). At the same time, but in the opposite direction, a governor in Chile considered that it was necessary to stop buying ponchos and textiles from the Indians but sell them a lot of wine and spirits in order to take away their cattle, leave them without resources and complete the task of subjugating them (Alioto and Gimenez 2010). Finally, and as a caveat with respect to the information in the sources, documents from the second half of the eighteenth century indicate that the Indians of southern Mendoza exchanged goods (textiles, salt, tar, and gypsum) for food and not for alcoholic beverages (Gascón and Ots 2020). This same behavior was recorded for the Indians of Valdivia in 1766, who bought indigo, apples, pears, corn, barley, wheat, cattle, and sheep (León 1991: 105).

The size of the sheep herds of natives was proportional to the role their weavings had acquired as a passport, along with salt, to trade with the Spanish-Creole. This was the case for the Pehuenche, meaning "people of the pehuén" or "of the seed of the Araucaria-tree." They were collectors of Araucaria seeds for their food, supplemented by guanaco hunting. In 1774, the Pehuenche had an estimated 2,000 sheep around Campanario Hill, and by 1780, an estimated 1,114 sheep were reported in contrast to about 100 horses, 200 goats, and 17 dairy cows. Seven years later, an expedition to that area took more than 3,000 sheep from them. By this same date, these natives had obtained, through selection and crossbreeding with goats, a strong and long-haired sheep similar to the "pampas sheep," which was a hybrid achieved by natives of southern Buenos Aires and was highly valued in the nineteenth century to improve merino wool (Cattáneo 2008: 196). This pastoral process changed land use with the occupation of niches with pastures in different places and at different altitudes.

Land Use for Food and Commerce

The colonists' consumption implied permanent productive changes because European racist ideologies explained the physical differences between human groups based on the types of diets. So, they intended to continue with their food traditions and preserve themselves from any unwanted physical or mental transformation (Earle 2010). Likewise, an exportable surplus was required for trade. As a result, colonial agriculture and livestock farming forever changed land use in close relation to the globalization of both consumption and diets. The "Columbian Exchange" (Crosby 1972) introduced alfalfa, wheat, barley, chickpeas, lentils, lettuce, onions, cabbage, apricots, figs, lemons, oranges, bananas, cherries, melons, watermelons, pears, apples, quinces, peaches and pomegranates, among others into America. Family orchards provided food, although fruit trees could be more valuable for their firewood, as was the case in Buenos Aires where peach trees were planted for that purpose. But where climatic conditions permitted, the orchards with their fruit trees generated food and provided income to other markets by drying fruits and vegetables in the sun (Lacoste et al. 2011). Along with dried fruits, beans, chickpeas, and lentils had secured markets as the basic ingredients of soups and stews for land and sea travel.

European crops spread when soil and climatic conditions permitted, although there were exceptions. Olive trees and vines were planted in all the colonies because of the Mediterranean culinary tradition and because, together with wheat for flour, wine, and oil were central to the rites of Catholic worship. There were other considerations, as in wine, which had medicinal use and was a safer beverage for human consumption during travel than the water that could be found in the lagoons along the caravan routes. This explains the cultivation of vines in unsuitable areas such as Paraguay; and in fact, it was wine and not yerba mate that opened the trade route along the Paraná to Santa Fe, where vineyards were also planted shortly after its foundation. Unluckily, ants and aphids wiped out the vines prompting settlers to source from Paraguay (Gascón 2017: 453). In the minutes of the town council of Cordoba in 1601, the price of Paraguayan wine is recorded as higher than that of wine from Cuyo (Archivo Municipal de Cordoba 1882: 326) and a will from Buenos Aires noted both olive trees and vines in the orchards of the early seventeenth century (Lima 2019).

Native communities accepted vegetables for human consumption without replacing what they continued to obtain from hunting and gathering. In the case of cereals, there was complementary relationship between the wheat crop (*Triticum spp.*) and corn *(Zea mays)* because wheat has better resistance to cold and is a winter-spring crop, while corn has a summer-autumn cycle. Therefore, if the corn crop fails due to natural disasters or agricultural pests, there is still the possibility to find sustenance from wheat. In temperate zones, wheat was harvested between December

and January, and corn could be sown immediately, which, together with squash and beans, were harvested after April and up to June. In the Araucanía, this complementary relationship even accompanied the war strategy of the Indigenous rebels. In 1610, a royal official reported that the rebellious Indians were growing some corn near the trails where the Spanish soldiers would pass during the summer campaign, but the placement was only to tempt them to destroy that crop and return to the barracks believing that they had caused serious damage. However, the truth was that the crops that fed the Indians were at higher elevations suitable for wheat and far from the eyes of the Spaniards. Lentils, despite their versatility, were not cultivated because the Araucanians believed them to be the germs of smallpox, which they called "the Spanish disease." In 1561, they accused the governor of having brought the disease to exterminate them and, in 1611, there was a rebellion when a bag of lentils brought by the governor for consumption broke and exposed its contents. Rumors quickly spread among the Indians that the official's intention was to spread smallpox to kill them (Gascón 2007).

The Spaniards, for their part, appreciated the potential of a few native foods, principally the potato (*Solanum tuberosum*) when, in Potosí, the *chuño* – dehydrated potato – proved to be the staple food of *mitayos* who preserved it in good condition for long periods before stewing it (McNeill 1999: 70). Potatoes from the Altiplano have accompanied the squash (or "zapallo" from the Quechua *zapallu*), peanuts (*Arachis hypogaea*) native to Bolivia and northwestern Argentina, and the Peruvian tomato (*Solanum lycopersicum*). Cinchona (*Cinchona officinalis*) was considered the most important medicinal plant overseas during the eighteenth century. Among the tropical fruits, pineapple (*Ananas comosus*) has been known since Columbus' second voyage and, because of its resemblance to the cone of the pine tree, was called "piña," the word *ananá* is Guarani and means "big fruit."

One of the most extensive and long-lasting transformations in land use in much of the Americas and the Caribbean was due to the introduction of sugarcane. In our area, the poles were Peru and Paraguay, where after the expulsion of the Compañía, production was maintained sparsely in some of the northern towns (Wilde 2001). Promoted by the Bourbon reforms to activate the economy, in 1790 the importation of Cuban sugar was authorized through the ports of Montevideo and Buenos Aires. As payment, Buenos Aires exported some 70,000 quintals (a quintal was equivalent to approximately 100 kilograms.) of tasajo (salted meat) to Cuba, compared to the little more than 2,000 quintals destined for all the peninsular ports (Silva 2020: 29). Tucumán began to produce sugar for export and in Córdoba, from 1790 onwards, Cuban sugar replaced Peruvian sugar and led to an increase in the export of tasajo to Cuba, as had been the case a decade earlier. This new commercial circuit with the Caribbean modified the use of the soil since the production of tasajo required cattle and salt: both resources abundant in native territories or close to them. It is understood that Bourbon officials strove to maintain good relations with the Indians (Lev-

aggi 2002; Roulet 2004; Rustán 2013; Pérez Zavala et al. 2017). In 1790, for example, a treaty with the Pampas guaranteed tranquility on the route to the Salinas Grandes, located 600 km south of the port and under the jurisdiction of the *cabildo* (colonial municipal administration). Since 1716, the cabildo supervised the caravans and the natives offered their services for salt extraction and loading. They also traded textiles, feathers, and furs (Vollweiler 2018).

In Chile, progress had been made towards differential and complementary land use. While in Rancagua Quillota, Aconcagua, and Melipilla cereals were planted for local consumption and export to Peru, cattle grazed mostly in the Maule region (Archivo Nacional de Chile n.d.: f. 99). Both for local consumption and for export, beef, pork, and fish required salt imported from Peru. The demand for salt was high because it was also used as a mordant in dyes and for cheese making. Santiago harvested salt in the coastal lagoon of Rapel which, in the native language, means "black clay". And, indeed, it was a dark salt and unattractive for use in food (Lizárraga 1602: 269). Imported salt from Peru was expensive, so the option was sea salt (Ramón and Larraín 1982) or imports from Argentina. Since the seventeenth century, the Indians had been taking salt from Neuquén across the Andes to Chillán (36°SL) to supply themselves with cereals, in a symmetrical exchange since a bag of salt was equivalent to a bag of wheat (Rosales 1877: 325). Some traders from Santiago avoided intermediaries and crossed the mountain range themselves in search of salt from the south of Mendoza, generating conflicts with the natives who counted on this salt as the main resource for their exchanges. Therefore, when the colonial authorities failed to stop those who crossed the Andes to enter the salt flats, it was the Pehuenche themselves who organized the defense of this resource. The most important episode occurred in 1769 and is known as the Pehuenche rebellion, because it hastened the arguments in favor of the foundation of the fort of San Carlos (Xaurúa), which was ordered the following year (1770). The rebellion involved the natives seizing some 500 mules coming from Chile to harvest salt from southern Mendoza to prevent the theft of their precious resource (Gascón and Ots 2020).

Location, Resources, and Imperial Strategy

Since Philip II, foundations were to be made where conditions of sustainability such as healthy air and soil; fertility for food production; and sufficient pasture, water, and firewood were met (Centro de Estudios Políticos y Constitucionales 1998: 14–15). This explains why the descriptions sent to the crown presented positive information on the locations. One finds this in the founding act of Santa Fe in 1573 where it notes that the site had "water, firewood, pastures, fisheries, hunting, land, and estancias for neighbors," but the difficulties were so evident that in 1650 it was moved some 80 kilometers to the south (Areces 2021). Decisive in both occupation and land use were

practical considerations such as extractive activities, the presence of natives or imperial defense. Mining, as this chapter has noted, was the activity with the greatest impact on land use in the first centuries of colonialism and what determined human settlement in a place with such difficult environmental conditions as Potosí, where resources for food and daily life were scarce. By consuming large amounts of water and energy, mining in Upper Peru modified the surrounding tropical and subtropical zones, because firewood and charcoal were extracted from the Chiquitano country to maintain the smelters as the availability of altiplanic shrub species with caloric power, such as yareta (*Azorella compacta)*, ichu (*Stipa ichu*) and jarilla (*Adesmia atacamensis*), collected by natives as mita was surpassed (Zagalsky 2014).

Likewise, the forests along the shipping routes were affected by extractive practices. In the Valdivian forest eco-region (40°- 43°SL), species such as the hazel (*Gevuina avellana*) and the Patagonian larch (*Fitzroya cupressoides*) were locally harvested timber and were the main export item from Chiloé to Peru for civil constructions and for the Guayaquil shipyards (Urbina 2011). The crown considered the Patagonian larch to be a strategic input because they are large, rot-resistant trees, which were used to repair ships once they had crossed the Strait of Magellan. There are records of logging in 1567 to harvest the hardwood of the luma (*Amomyrtus luma)* in the palisades of the forts of the Araucanía. Firewood and timber for mining, construction, and agricultural and livestock production reduced the xerophytic forests of carob and chañar (*Geoffroea decoricans*) in Chile (Iglesias Zúñiga 2005), in Mendoza (Prieto 1989) and in Córdoba, where there were lawsuits in the eighteenth century to guarantee community access to the forests from which firewood could still be extracted (Tell 2008). In Buenos Aires, the scarcity of trees is present in the very term "pampa," which in Quechua means "plain or flat land without trees." Its 40 million hectares are grasslands and only the ombú (*Phytolacca dioica)*, because of its size and appearance, looks like a tree, but it is not a tree and therefore does not produce wood. Since 1590, the Buenos Aires town council took measures to regulate the extraction of trees for firewood and timber from the Paraná River delta. It prohibited the cutting of willows, demanded that wagons arriving from other places bring their own loads of firewood and controlled how much firewood the ships took out before leaving the port of Buenos Aires. The low construction quality of the properties made of straw, cane, and raw clay is explained by the limitations of fuel to feed the kilns for firing ceramics (Gascón 2011: 86–87).

The demand for firewood and timber increased when the population of Buenos Aires reached 40,000 in the second half of the eighteenth century. The inhabitants of the port required goods supplied by the surrounding horticulturalists and by small and medium-sized livestock producers and farmers (Gelman 2012). Interest arose in the virgin areas of the Boreal Chaco and the Bermejo River, where valuable resources, from timber to pearls, were supposed to be found. And within this same territorial expansion, lands were occupied in Entre Ríos and Uruguay (Djenderedjian 2003) and

Santa Fe reinforced its frontier with the natives of the Chaco (Suarez and Tornay 2003: 548). Some of these local trends were amalgamated with the interests of the crown which, in response to the foundation in 1680 of the Portuguese Colonia de Sacramento across from Buenos Aires to introduce contraband, had founded the fort of San Felipe de Montevideo between 1724 and 1730. Its inhabitants were given land for their livelihood to the point that the export of tasajo to the Cuban sugar haciendas became the main change in land use in the eighteenth century.

Both the Araucanía and the Río de la Plata were strategic areas in the imperial defensive scheme in the south of Spanish America. When Buenos Aires was abandoned after its first foundation in 1536, its inhabitants moved up the Paraná and founded Asunción del Paraguay in 1537. Certainly, these Spaniards were closer to Potosí and close to the route that Alejo García had used in 1524 to go from the Atlantic coast at Santa Catalina Island (27°LS) to the foothills of Alto Perú. It was a pre-Columbian route called *Peabiro,* and that Ulrico Schmidl (1510–1580) knew because he participated in the foundations of Buenos Aires and Asunción. He himself would use it in 1554 to embark and return to Germany (Lütge 2017: 50). However, by depopulating the entrance to the Río de la Plata and establishing a population nucleus in Asunción that cut off the *Peabiro*, the crown opened up a new front of insecurity; something that was clearly seen in 1578 when Francis Drake was able to spend a couple of weeks in what was left of Buenos Aires, preparing to continue south and head for the Pacific. As this chapter has stated, in 1579 he comfortably plundered the mighty galleon *Nuestra Señora de la Concepción* before it entered Panama with its rich cargo, mostly of gold and silver. Just one year later, in 1580, the fort of Buenos Aires was founded for the second time. Beyond the consideration of promoting the exchange between populations in the Paraná axis and thus "opening doors up to the land" (Barriera 2013), it is certain that there was an imperial component in terms of the need to protect the Hispanic-American south end. In 1580 an expedition from Spain arrived in the recently refounded Buenos Aires with the final objective of fortifying the Strait of Magellan. General Alonso de Sotomayor disembarked in Buenos Aires, determined to reach Santiago de Chile by land. Sotomayor opened the imperial route that linked Buenos Aires with Santiago de Chile, following a military objective that avoided the most dangerous stretch of navigation from Spain to the Pacific, which was to cross the Strait of Magellan. In this route with military and defensive aims, Buenos Aires remained as a strategic port for the disembarkation of aid, while Córdoba and Mendoza were to provide the supply for the troops (Gascón 2007).

The Bourbons, for their part, strengthened the Río de la Plata to continue with the care of Uruguay and the pampas (Néspolo 2012, Fradkin 2014). In Bourbon Cordoba, the southern border with the Indians was strengthened from the second half of the eighteenth century because it was the route used by the caravans. The governor intendant, Marqués de Sobremonte (1745–1827), decided that its protection would be articulated with that provided by the fort of San Carlos in Xaurúa and that

it would be financed with some of the taxes paid by all the people of Cordoba (Punta 2001). Thus, the location of the populations due to the demands of the imperial defense organized the use of the land, even if it was ultimately limited to the environmental conditions, as has been pointed out. A final example of optimization and a complementary relationship is the Jesuit estancia La Toma in Catamarca in northwestern Argentina. Although promising, the priests discarded cotton production in order to prioritize the use of water in the cultivation of corn, which they complemented with vineyards for brandy, because corn needs irrigation in winter, when the grape vines do not (De la Fuente 1988).

Conclusion

The colonial centuries started processes that today are incorporated into the debates on the very concept of the Anthropocene. The colonial period was an initial time of land use changes whose consequences reach into the present. For this reason, Wendt considers the colonial as a proto-Anthropocene while Voosen has proposed investigating the Anthropocene as an event. Colonialism as an event changed land use throughout the continent and in a decisive way.

Indeed, the colonial event on the American continent modified the demographic base, introducing crops and animals, reorienting commercial exchanges and favoring the placement of new populations. These spawned profound changes in populations, flora and fauna, with previously unknown diseases affecting humans and animals and a reorientation of the flow of trade in goods at the regional and international levels. The Anthropocene cannot consider, therefore, only the antecedents for Europe such as the Industrial Revolution. What has happened in the Americas since the sixteenth century shows decisive changes in land use that initiated processes whose consequences are still present. In other words, the colonial period was a profound and irreversible alteration of the demographic base, perhaps equivalent to the arrival of the first settlers at the end of the Pleistocene and the beginning of the Holocene.

If one follows the stratigraphic record, after the sixteenth century we find irreversible changes in the fossil record of our continent. The pollen of new plants and the bones of new animals introduced from Europe appear together with fossil evidence of a native fauna of camelids displaced by the irruption of competitors. One can find urban organizations without continuity with those carried out until then by the natives at the end of the Pleistocene as well as also new materials and minerals such as mercury for mining. Therefore, understanding the Anthropocene as a multiple crisis implies relating colonial land use, as one sees for the territorial strip between 19° and 34° SL, with irreversible and cumulative changes in the long term in

reference to population, resources, and location of both population and resources, following certain environmental and imperial requirements and limitations.

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Land Use in the Andes in the Colonial Period

María Luisa Soux

The scientific concept of the Anthropocene is still under construction and entails a new way of understanding the impact of humans on the biosphere. Currently, signs such as the increase in the planet's average temperature and alterations in the functioning of ecosystems lead us to reflect on the consequences of human activities on the environment. Thus, the use of fossil fuels or the conversion of natural habitats into agricultural land has had a negative impact on the biosphere, resulting in the loss of biodiversity or global warming. This impact is not only a current problem but has been occurring throughout the world's long history. It is from this perspective that this article seeks to unravel the impact that European colonization had on the Andean region.

The Andean space crosses a vast territory from the páramos and valleys of Colombia and the western region of Venezuela to the desert and high mountains of northern Chile and Argentina, with an approximate length of 7,000 kilometers. The vast belt of the Andes Mountains has shaped the life of human beings for thousands of years, from the arrival of the first *homo sapiens* dedicated to hunting and gathering to the more than fifty million citizens living in the region today. Historically, it can be noted that the mountain range and its western and eastern slopes were the cradle of some of the most important cultures of the continent, which can be illustrated in the traces of the route that remains to this day of the so-called *Qapac Ñan* or royal road of the Incas.

Geographic space, transformed into territory by human action, occurs at different scales and largely explains the characteristics of each society through a triple command of territory: as the basis of livelihood, as the foundation of social organization, and as the support of hegemony (Soux 2012). This paper will analyze the first perspective, addressing the changes and permanence in the social use of land during the colonial period, taking into account the context of the Andean region from what is now Colombia to northern Argentina and Chile.

The starting point will be the land use situation prior to the arrival of the Spaniards in the region, using the geographic-ecological classification of Carl Troll (1980) and Olivier Dollfus (1981); later, the impact of the conquest will be described and analyzed not only in relation to the change of concepts and practices on land

ownership and use, but also to the maintenance of forms of social organization that allowed the preservation of Andean forms of food resource use. The third part of this chapter will focus on the analysis of the ecological articulation between the use of Andean products and the introduction of new agricultural and livestock resources; finally, the changes produced in land use in the new regions "colonized" in the eighteenth century in the foothills will be addressed.

The Andean Space in History: Geosystems and Cultures

Before addressing the issue of changes and permanence in land use during the colonial period, it is important to understand the ecological characteristics of the native cultures that experienced these changes. For this purpose, this chapter takes into account the study by Olivier Dollfus who, in his book *El reto del espacio andino* (1981), classifies the geosystems present in the intertropical region, a perspective essential for understanding the issue of land use. The geosystem or geographic system is understood here as the combination of a *géome*, i.e. a fragment of the earth's surface, and a biocenosis, i.e. the set of living communities that occupy it and on which anthropic action exerts its effects. For example, a geosystem could be the puna or high-altitude grass steppe. Dollfus, like Carl Troll (1980), divides the Andes into two ecologically distinct regions: the equatorial Andes and the tropical Andes. The former are located in what is now northern Ecuador, Colombia, and western Venezuela, and the latter are located south of the equator in what is now Ecuador, Peru, Bolivia, and the north of Chile and Argentina. In this vast area, defined as the intertropical Andes, the geosystems depend on factors such as latitude, altitude, or thermal gradient and the slope on which they are located in relation to the mountain range.

In general, the equatorial Andes are characterized by large valleys with altitudes ranging from around 1,000 meters above sea level, such as the Cauca valley, to almost 3,000 meters above sea level, such as the Hunza valley. While various sierras range in altitude from 700 to more than 5,000 meters, there is a narrow cordillera about 250 km wide with volcanoes of up to 6,000 meters above sea level in Ecuador. In the latter region, an arid western slope and a humid eastern slope begin to differentiate. The tropical Andes are characterized by a wide mountain range with peaks of more than 6,000 meters above sea level surrounding a plateau or Altiplano. There is also a marked contrast between the western desert slope and the eastern jungle slope.

In these large regions, marked by latitude, altitude can be added, which is fundamental in determining the climate. In the equatorial Andes, there is an archipelago model made up of mountain ranges and valleys of different altitudes, generating a diversity of landscapes ranging from cold páramo geosystems to warm valleys. In contrast, cold steppe geosystems cover almost half of the surface in the tropical Andes. These characteristics were important at the time of European colonization,

which had to adapt to the specific ecological conditions. The main characteristic of the entire region is verticality. With the exception of the great high plateau and the bottom of the valleys or basins, the rest of the territory is long slopes, some of them very steep, where runoffs and erosion are common. These valleys, except those that were extremely wet or dry, were transformed from very early on for the agriculture of corn and other plants. To prevent runoff, techniques such as the construction of agricultural terraces were developed.

In the tropical Andes, the geosystems influenced by altitude are known as ecological floors and assume specific names that in some cases identify the people who lived in them. Among the cold geosystems are the *puna* and the *suni*. The first was used by hunter/gatherers and later by camelid herders and farmers, although the latter had to adapt to frost and poor soil fertility. The *suni* (Quechua) or *taypi* (Aymara) is the intermediate strip between the puna and the temperate geosystems; it is found on the shores of Lake Titicaca or in the "headwaters" of the valley; the exploitation of both was ancient, varied, and intensive. At a lower altitude and with a temperate climate is the densely populated *Quechua* floor, where the Quechua-speaking Inca culture developed; on this floor, the land was adapted through the construction of terraces. Below the Quechua floor are the *yunca* or yungas floors, dry on the western slope and humid on the eastern slope; these geosystems vary from warm to hot and were used by the native peoples for the extraction of timber and certain specific products such as coca, yucca, and medicinal plants. In the dry yungas, a great variety of chili peppers and peanuts were cultivated during the pre-Hispanic period. The final geosystem is the Pacific coast desert. Of the coastal ecosystems, the most populated since pre-Hispanic times were the irrigated valleys, where cultures such as Lima, Paracas, and Mochica flourished, characterized by the use of complex irrigation systems and an organized use of water.

These were, broadly speaking, the landscapes that Europeans encountered upon their arrival in the Andean area. The production possibilities in the different ecological levels and geosystems were taken advantage of by these men who, in turn, brought their own agricultural and livestock culture. Over the next three hundred years, there was an articulation between the Andean cultures and the new colonizers, which gave rise to new forms of land use, the adaptation of new plants and animals, and new forms of property, ultimately giving rise to a new rural culture.

The Impact of the Conquest and Changes in Land Ownership

There are several elements to take into account when analyzing the impact of the arrival of the Spanish army in the Andes region in relation to land ownership and use. These include the following:

- The demographic impact on the Indigenous population that left large territories practically unpopulated.
- The dismantling of the forms of control and domination of the population by the Incas and other hegemonic groups.
- The difference in the ways of life and control of space between the native peoples and the European newcomers.

Regarding the demographic impact and the emptying of the territory, the importance of regional studies due to the impossibility of carrying out general studies should be noted. Thus, for example, according to Kalmanovitz (2015), the Spanish conquest in the region of Colombia was devastating for the Indigenous peoples. The population around 1535 to 1540 stood at about 3 to 4 million. Twenty-five years later, this figure fell to an approximate 1,260,000. Moreover, this crisis lasted until the seventeenth century in some regions such as Tunja, where Muisca communities lived.

Tab. 1: Demographic Decline in New Granada. 1535 and 1560

Region	**1535–1540**	**1560**
Atlantic Coast	500,000	60,000
Valle del Cauca	1,200,000	160,000
Upper Magdalena	300,000	120,000
Magdalena Slope	400,000	180,000
Central Highlands	1,200,000	400,000
Southern Highlands	400,000	140,000
Marginal areas (Llanos, Chocó)	200,000	200,000
Total	**4,000,000**	**1,260,000**

Source: Kalmanovitz (2015).

In relation to the territory previously occupied by the Tahuantinsuyo, it has been possible to establish that, based on the Inca imperial *quipus*, the number of inhabitants would have been approximately ten million at the time of the Cajamarca encounter. Thirty years later, the demographic situation was as follows:

Tab. 2: Population in the Viceroyalty of Peru by Province in the Sixteenth Century

Province	**1561**	**1586**	**1591**
Quito	240,670	118,141	24,380
Cuenca	1,472		
Zamora	11,222	8,100	685
Loja	9,495	16,000	2,849
Jaen	10,000	11,397	2,654
Puerto Viejo	2,297	4,102	1,253
J. Salinas		40,000	
J. Moyobamba		3,993	678
Piura	16,617	12,818	3,537
Guayaquil	4,742	7,355	2,198
Trujillo	215,000	79,670	17,597
Chachapoyas	58,397	40,311	7,045
Huánuco	118,470		18,089
Los Reyes	99,601		30,708
Jauja	17,248		
Huamanga	112,520	153,495	26,054
Arequipa	201,830	93,975	19,794
Cuzco	267,000	400,075	74,977
La Paz	150,655	131,189	27,837
Charcas/La Plata/Potosí	232,800	144,436	31,671
Chucuito	81,698	17,779	13,364
TOTAL	**1,851,734**	**1,282,836**	**305,406**

Source: Author's own elaboration based on Contreras (2020: 545).

Throughout the Andean region, the Spanish Crown planned visits to contrast and update information. In relation to resources, visits such as those of Huánuco (1562), Chucuito (1567), or the general visit of the Viceroy Toledo (1570) sought, in addition to demographic numbers, information regarding the "number and amount of land planted with corn, potatoes, quinoa, cotton, or other products, and the number and type of livestock; in short, all the information necessary to establish the tax quota as a whole" (Cook 2002: 18).

According to Mamani, the visits, which could be general or particular, also served to define the territorial space "since delimiting the properties to be owned by Spaniards and Indians contributed to the separation between the Republic of

Spaniards and the Republic of Indians" (2012: 71). The causes of the demographic crisis have been varied; in addition to Indigenous exploitation, Nicolás Sánchez Albornoz (2015) emphasizes the issue of diseases and points out that the first smallpox epidemic in Peru occurred in 1524–1526 before the arrival of the Spaniards; typhus followed in 1546, influenza in 1558–1559, the plague in the following two years, and the great epidemic of 1585–1591 in which smallpox, measles, typhus, and influenza were intertwined.

From the present interest in land use, the importance of these early visits to the ancient Inca territory to carry out a policy of land appropriation and the consolidation of private forms of property can be noted. In the case of the Andes, the demographic decline in part allowed the establishment of policies such as the reduction into villages and the consolidation of haciendas or *chácaras* stemming from the idea of the existence of vacant lands. In the case of present-day Colombia, according to Urrego Mesa (2014), the impact depended on the demographic density. Thus, the highlands with a high-density and fundamentally agrarian population were settled primarily by agricultural units. This region was in the process of social hierarchization and had a political organization based on chiefdoms sustained by tribute. In contrast, the lower and warmer lands with less population developed livestock activities.

From the social point of view, the Spanish conquistadors, who brought with them other ways of thinking about property and work, modified the life of the region's native inhabitants, either by establishing new forms of land tenure or by modifying the meaning of others that were maintained. For example, Nathan Wachtel (1976) points out what the dismantling of the Inca political and social system entailed and how the principle of reciprocity was disrupted. Thus, although the legal fiction maintained a pact system with the King and his representatives through tribute payments in exchange for the possession and ownership of the land, the lands of the Sun, the Inca, and the community were rethought as royal lands, belonging to the king as sovereign, given as a gracious concession from the Crown to the Indigenous tributaries.

Royal Lands, Grants, Reductions, and Compositions

In order to understand changes in land use and land tenure, it is important to distinguish three forms of land control. The first is the control of the territory, which manifested in seizing possession of territories in the king's name, thus creating a relationship between the sovereign and the subject. The second was population control, as seen in the encomienda, which placed the Indigenous population in a dependent relationship, delivering a tribute (in labor, goods, or money) in exchange for evangelization. Although it was not directly related to land use, it did embody a

form of usufruct of Indigenous labor in favor of the encomenderos. Finally, a third form of control was that of the land, in the sense of ownership of its use. In many cases, the encomienda and land ownership were intertwined because, although laws prohibited encomenderos from having a farm near where they had their encomendado (entrusted) Indians, in practice, encomenderos acquired nearby lands through grants and took their encomendado Indians to work on them (Soux 2012: 33).

At the same time, it is important to establish the legal relationship between the king's dominion over the territory and land ownership. According to the legislation, the *tierras realengas*, which had been consolidated in Castile as the king's own, both as lord and monarch, were also recognized in America. As Juan de Solórzano y Pereira noted in his work *Política Indiana*, all lands, waters, mountains, and pastures were considered to be the king's "outside of the lands, meadows, pastures, mountains, and waters that by particular grace and mercy are granted to the cities, towns, or places of the Indies or to other communities or individuals" (Bonifaz 1956: 162). Thus, land ownership was conceived as a gracious concession by the Crown or the King.

From these gracious concessions arose the concept of grants (*mercedes*), which are considered to be the Spaniards' first form of private land ownership. The grant was a cession (*entrega*) of land by the King to the conquerors or those who requested it, either for life or in perpetuity. The property acquired in this way was established with the occupation by the beneficiary, which shows, precisely, the existing relationship between territorial domain and the conformation of a private and individual property, whether in the form of a hacienda or *estancia* (Glave 2014).

There is no general study on the expansion of grants in the Andean area, although data from Peru, Charcas, Quito, and New Granada show that this gracious transfer of land had taken place since the sixteenth century and affected royal lands in regions of agriculture and livestock where it was feasible to introduce plants and animals of European origin. The grants also characteristically accompanied a process of border expansion, as was the case in Valledupar (Colombia) with the expansion of cattle ranching, which lasted until the eighteenth century (Sánchez Mejía 2012).

In the case of Charcas and Peru, grants were exclusive to the sixteenth century and were generally found in areas close to the cities where farms were established. However, in places such as the yungas of La Paz or Cuzco, large extensions were given as grants. In the region of Quito, for its part, land grants were more widespread; between 1583 and 1587, a total of 264 grants were awarded. According to Donato A. Gonzáles, "as the encomienda became scarce as recompense after 1550, land constituted the most useful reward. It is from this perspective that the grant was the first mechanism for accessing land ownership" (1998: 198).

The cession of grants led to a series of abuses committed especially by the *cabildos*. The Viceroy Toledo responded to this by establishing that the ownership of these lands, which had previously been Indigenous property, should be consolidated through a *visita de tierras* (land visit). In compliance with this, beginning in 1580, vis-

itas de tierras were carried out throughout the viceroyalty. This was a two-pronged approach; on the one hand, land was divided in favor of the Spaniards to consolidate their property; on the other hand, it was distributed at the request of the Indigenous communities through their authorities. In both cases, titles were given out, thus settling the issue of land ownership.

With the visitas de tierras there were also abuses by the conquistadors who exploited, on the one hand, the decrease in the Indigenous population and the existence of vacant lands and, on the other hand, the reduction of the Indigenous population into Indian villages, which entailed the concentration of the dispersed population and, therefore, more vacant lands. In this way, the visit, through the act of distribution, recognized the Indigenous people's ownership of their lands, but only those that were considered in production; the rest was given, through a composition of lands, to the Spaniards who requested them. This could lead to lawsuits, as in the case of the Siporo hacienda (Potosí) between Diego de Robles Cornejo, who argued that the lands were vacant (*baldías*), and the Potobamba Indians, who demonstrated that the lands were part of their *ayllu* (Crespo et al. 1984).

The visitas de tierras took place throughout the seventeenth century and even up to the beginning of the eighteenth century, with characteristics that differed depending on the region. In this way, for example, the visit of Geronimo Luis de Cabrera to the Altiplano region north of Titicaca in the mid-seventeenth century resulted in the return of lands to the communities and *ayllus*, whereas Juan Bravo del Rivero's visit at the beginning of the eighteenth century, covering more or less the same area, served to consolidate new haciendas to the communities' detriment.

With regard to the lands owned by Spaniards or Creoles, it is important to point out that the lands given in grants were used for both livestock to supply the cities' meat production and agriculture to diversify production with cereals and other products. In some cases, the cattle ranches gradually gave way to larger estates and farms owned by small landowners, as was the case in Yamparaez, Bolivia (Escobari 1995) or the broad Colombian valleys. In these haciendas, depending on the region and production, different forms of labor were employed: slave, servile or *yanaconaje*, free wage labor, or peonage. Production could be managed directly by the owners or by third parties, either through leasing or sharecropping.

Finally, it is important to note that the above were not the only forms of land appropriation or cession in the Andes, since, as Karen Spalding points out, the purchase and sale of land and leasing were also common forms that eventually also led to the development of individual properties. In these transactions, the Indigenous people were not left out, especially the *curacas* or *caciques*, who entered the land market at an early stage; the colonial authorities themselves also took part, taking advantage of their power to appropriate the most productive lands (Spalding 1970).

In one form or another, it can be concluded, on the one hand, that the changes and permanencies in the issue of land ownership were directed towards the consoli-

dation of private and individual property, either through grants, land compositions, or the appropriation of vacant lands. On the other hand, the property of Indigenous communities was recognized through *revisitas de tierra*, although the extent of their land was usually reduced, generally losing the scattered lands that they had in other ecological floors.

Technological Changes and New Products

Changes in land ownership and tenure were accompanied by other technical and economic processes that profoundly modified land use and landscape in the Andean regions. In this regard, two aspects will be taken into account: the modification of agricultural technologies and the introduction of new products. Both had an impact on the relationship between humans and their habitat, causing changes that affected the inhabitants of the Andean region both positively and negatively.

One of the first elements to consider in relation to pre-Hispanic and colonial production strategies was the expanded use of different ecological floors, known in John Murra's studies as the "vertical control of ecological floors," a strategy that existed in various forms and dimensions. In this regard, while Murra sees in this system a strategy of social organization and control (Murra 1975), the German anthropologist Jürgen Golte (1987) emphasizes the strategic character of the vertical geography's rational use, which for the author would explain its permanence over time. Indeed, vertical control continues to this day in the communities of various regions of the Puna Andes, such as northern Potosí and some communities in Cuzco; however, it should be noted that this strategy was limited by the colonial system. Thus, numerous cases are known in which the valley lands, mainly maize producers and dependents of the highland lordships, were given in grants or *composicion* to the conquistadors and their families, breaking the vertical articulation and the use of products from other ecological floors. In this way, for example, the Lupaca lordship lost land in the valleys of Moquegua (Murra 1975). The Carangas lordship also lost part of his territory on the western slope of the Codpa valley (Hidalgo, Castro, and Gonzáles 2004), although he maintained and even expanded his lands in the valleys near Potosí (Medinacelli 2010). These changes occurred most strongly in valleys that were shared by several ethnic groups and lordships, such as Cochabamba (Larson 2017, Jackson and Gordillo 1993). As a result, the highland communities lost part of their corn-producing land.

A different case was that of the Mantaro Valley, today one of the most productive regions of Peru. The valley was populated by the Huancas. This group suffered through the Inca conquest during the time of Pachacutec, which would explain the early alliance of the native inhabitants with the Spanish conquerors. According to Bonilla (2010), "perhaps this explains the hospitality that the Spaniards found in the

valley, which together with the characteristics of the dry and temperate climate, typical of the Quechua region, led them to settle in a hamlet in 1533 that the Huancas called Hatum Xauxa and that the Spaniards called Jauja" (232). This city was the first capital of the viceroyalty before the foundation of Lima. In this case, production was fundamentally colonial and, as in Cochabamba, adapted to European products. *Mestizaje* was common. Among the products are some of pre-Hispanic origin and others of European origin: potatoes, corn, onions, beans, wheat, barley, oats, cabbage, squash, lettuce, carrots, peas, and others. Fruit trees were also important, both native and imported, such as tumbo, sour cherry, apple, peach, fig, and plum trees.

A central element in agricultural and livestock activity is water, which constitutes "the axis of the system, the thread that builds the networks of interconnection" (Rodríguez Gallo 2019). From the valleys and savannahs of Bogotá, in the Colombian Andes, to the narrow valleys of the Peruvian coast and the slopes of the yungas region, water was and is fundamental for the emergence of productive activities and the construction of the landscape. Throughout the long history, the forms of water use were diverse: from the use of *camellones* in the Bogotá savannah, *sukakollus*, *waru warus,* camellones, and *qochas* in the Titicaca region, and camellones in the Moxos savannahs to the use of advanced irrigation technologies in the Pacific coast valleys. The use of water allowed the development of great cultures such as the Muisca, Paracas, Nazca, Huari, or Tiwanaku, which were exploited by the Incas and, later, by the colonial system itself. Despite this, Spanish landowners and ranchers did not develop new irrigation systems or new water use techniques. On the contrary, they stopped using some of the previous ones, which were only rediscovered in the twentieth century.

In relation to the regulation of water use, both pre-Hispanic cultures and Spanish norms considered water as a common good that should be used for the benefit of all. In spite of this, the ideal norm was not always complied with. The old customs of water shifts or *mitas* and communal work, such as the construction and repair of irrigation ditches, were modified by the presence of landowners who sought to take advantage of their position to break the balance between common and individual use (Bustamante et al. n.d.: 21).

In the case of the valleys of the western slopes of Peru, the colonial system took advantage of the great advances of the native cultures, reusing water intakes, camellones, irrigation ditches, and dams. Despite this, it is important to point out that the landowning power sought to take advantage of some of these customs. For example, there were lawsuits regarding water use and mitas in which the new owners sought to increase their time of use to the detriment of others. Something similar happened in the region of Tunja, Colombia where, in 1592, the Indians complained to the authorities, stating "that we are in possession and ownership of all the waters, springs, and streams that pass and go through our lands with which we have irrigated our farms, and as the said individuals have interfered with us, they have dispossessed

us of said waters and the irrigation ditches that we made with our hands" (AGN, RB, T.3, f.348r. cited by Mora Pacheco 2012).

Another change, this time in agricultural techniques, was the implementation of the use of the Roman plow and the tilling of soils. Previously, the land was prepared for agriculture with the "foot plow" or *chaquitaclla*. The use of this implement, described by chroniclers and drawn by Guamán Poma de Ayala himself, was common throughout the Andean area and was adapted to the diverse ecological conditions.

In the colonial period, the *chaquitaclla* was replaced by the Roman plow pulled by a team of oxen. This change involved not only the use of animal power, but also the construction of furrows and a different movement of the soil. While possible in flat lands and rich soils, it was difficult to replicate in hilly terrain or in poor soils near the agricultural altitude limit, most of which are located on the slopes of the mountain range. There is no specific study on the use of the Roman plow and the yoke that analyzes their environmental impact in the colonial period. However, current studies on new technologies for soil tillage show that it is not possible to use the plow at high altitudes and on sloping terrain, such that even today, the *chaquitaclla* is still used.

Finally, it is important to analyze the impact that the "importation" of new European annual and perennial plants had on agriculture in the Andes. Among the former are some forage plants, including barley; cereals, such as wheat and oats; leguminous plants, such as beans and peas; and vegetables, such as carrots and onions. The latter include stone and citrus fruit trees, as well as grapevines. Finally, it is important to note that sugarcane was adapted to the warmer regions.

In relation to the annual varieties, each plant adapted to the Andean regions according to its characteristics, becoming part, in some cases, of the ancient systems of crop rotation and rest periods. Thus, for example, in the Altiplano, barley, beans, and peas were added to potatoes and other Andean tubers in the crop rotation of individual (*sayañas*) and common plots (*aynoqas*), generally following the succession of potato-barley-legume and several years of rest or fallow. In other areas, alfalfa was introduced as a perennial alternative for feeding the new livestock.

With characteristics similar to the Castilian plateau, the dry valleys of the eastern and western slopes of the Andes from the savannah of Bogotá or the Tunja region in Colombia to the dry valleys of southern Charcas and Salta were the first to be used for the adaptation of European varieties. Consequently, they were also the first to be transformed into individualized lands. In these valleys, wheat was sown throughout the Andes as a fundamental product for the production of bread. Fruit trees, vines, and olive trees were also planted, depending on the characteristics of each species. Despite an initial ban on importing perennial species, by the end of the sixteenth century, they had become established and were thriving. In some regions, the new products displaced traditional crops and in others they coexisted with pre-Hispanic crops, especially corn – essential in the Indigenous diet – and chili peppers – im-

portant in regional cuisine. The cultivation of some of the European products was intensive in the irrigated valleys near the cities and on the coast, where vines, sugar cane and fruit trees were planted to supply a wide region with wine, brandy and nuts. This was the case, for example, in the regions of Pisco and Moquegua, today in Peru, which not only exported wine and liquor to the rest of Peru but also chili peppers, jams, and other processed products.

In the same way, some new products, such as sugarcane, initially displaced coca production in a few regions of the eastern humid valleys or yungas, as occurred in the yungas of the Peri River of La Paz. The same was true of grape vines in the Mizque valley in Cochabamba, an area close to the ecoregions populated by unconquered peoples, such as the Chiriguanos or Chunchos (Barragán 1994).

It can be concluded that the colonial system took advantage of the advances made by the native peoples in relation to land use, water use, and adaptation to a vertical geography, adding some variants such as the plow. However, there were changes in land use with the transformation of much of the richest land into individual properties. Said transformation automatically modified the rhythm of land use and the ecological balance, resulting in the desertification and erosion of the most fragile lands, as occurred, for example, in the valleys near the new colonial cities.

The New Livestock Farming

Unlike in Mesoamerica, the raising of large domesticated animals, such as the llama and alpaca, was fundamental to the economy and social organization in the Andes. Both camelid species were domesticated from wild species such as the guanaco and the vicuña. According to Hahn, quoted by Troll (1980), the area in which the llama and alpaca are used as domestic animals is smaller than the natural distribution area of the camelids; thus, llama breeding was confined to the Peruvian cultural area, while alpaca breeding was limited exclusively to southern Peru and the Peruvian-Bolivian circumlacustrine Altiplano. For the author, the presence of the llama in regions such as the highlands of Chile and Ecuador at the time of the conquest was due to its relocation during the Inca period. In one form or another, both species are typical of the dry puna steppes of the tropical Andes. Troll establishes four uses for these animals:

- Wool. Alpaca wool, which made finer fabrics, proved more important than llama wool, which was used in coarser fabrics and ropes. This is not to forget vicuña wool, which was the most valued, hunted or trapped using the *chaqu* technique.

- Cargo. This was exclusive to llamas. Although they lacked a large carrying capacity, this could be compensated by large herds, their frugal diet, their resistance to cold, and adaptation to high altitudes.
- Manure (or *takia*), used as fertilizer and as fuel in places where there was no firewood such as the Altiplano. Its use was fundamental in mines, such as Potosí, and Andean cities until the twentieth century.
- Meat, the least important but fundamental in times of crisis. Drying it makes *chalona*, an important food in the Andean inhabitants' diet.

There is no reliable data on the number of heads of each of the four groups of camelids that lived in the Andean area at the time of the conquest; however, it is possible to get an idea through secondary data. According to Lamo (2011), in the case of vicuñas, for example, there is talk of *chacus* (herds) of more than 30,000 vicuñas, which implies that the number of heads was much higher; in the same way, there are colonial records of the authorities' concern about the death of about 80,000 vicuñas annually. The data on guanacos are even scarcer, although the study of the pastures where these animals grazed gives an approximate number of between 30 and 50 million heads.

The domesticated llamas and alpacas that were of such social and symbolic economic utility for the Andean culture immediately caught the attention of the conquistadors who called them "rams of the earth" as a form of cultural transference. In this way, llamas accompanied the advance of the new inhabitants through the puna lands and both species of camelids were included in the tribute to the *encomenderos* and the Crown; this would explain the fact that the Lupaca lordship, on the banks of the Titicaca, the richest due to its large camelid herds, was entrusted (*encomendado*) directly to the Crown. Regarding the number of llamas at the time of the conquest, there is no specific data. Nevertheless, it is important to note that a single Lupaca cacique, Don Juan Alanoca, owned a herd of 50,000 rams in 1571. In the same way, the payment of tribute in the territory of the Huancas reveals the great number of camelids at that time, according to the following table:

Tab. 3: Tribute in Huanca Camelids

Years	**Parcialidad**	**Tribute**
1533–1544	Huancas de Hatum Saya	58,673 llamas and alpacas
1533	Saya Urin Huanca	514,656 animals*
1534–44	Saya Urin Huanca	27,958 llamas and alpacas

* Amount delivered for the rescue of Atahuallpa
Source: Guerrero Lara (1986).

Much of the value of camelids was due to the fact that their breeding was deeply intertwined with the practices and rationality of Andean organization (Golte 1987). This organization included the articulation of community breeding, the control of various ecological floors, and a system of reciprocity with other ethnic groups. For this reason, the colonial system did not substantially modify the issue of camelid herd ownership. Rather, these herds became a substantial part of the pact established with the highland ayllus, either through the payment of tribute, their contribution to road travel, or the transfer of goods. As Luis Miguel Glave has shown in his book *Trajinantes* (1989), much of the colonial trade was done with llamas; some caciques even enriched themselves by taking advantage of this trade. In the same way, according to Ximena Medinacelli (2010), the Carangas took advantage of the control they had over their llamas to obtain new lands near Potosí, where they grazed their herds that carried products such as *taquia* (camelid dung used for fuel) and salt to Cerro Rico.

Alpacas are not pack animals and their greatest value is wool. Despite this, the herds were also kept in the hands of the high-altitude herders under communal control, because the main interest of the Spaniards was not to appropriate the animals but to take advantage of the tribute in textiles and the use of Indigenous labor, both in the *mita* of Potosí and in the silver mines of the region. Thus, according to Assadourian who analyzes the visit to Chucuito of Garci Diez de San Miguel in 1567:

> Chucuito was also to provide 1,000 dresses per year. On average, it took each weaver two months to make a garment. The contract was established between the encomendero and the traditional chief of the village. The Spaniard gave the *kuraka* two pesos for each dress, which he then sold at a much higher price to the Indians of Potosí. The Andean social structure, the role of ethnic authority, and traditional forms of exchange served to support colonial pressures, creating interfaces between one system and the other (Del Pozo-Vergnes 2004).

According to Christiana Borchart de Moreno, who studies the region of the Audiencia de Quito, the Incas brought camelids as part of the state-owned livestock to support the wars. Thus, the first Spaniards who arrived could still see large herds, and the encomenderos' tributes were established. For several communities, this tribute was in pieces of *cumbi*, i.e., quality wool fabrics. The highest density of animals was located in the highlands of Chimborazo. However, the herds were disappearing rapidly, mainly due to the violence of the conquest, natural disasters, and, from 1580 onwards, their slaughter as a way of fighting idolatry (Borchart 1995: 165).

The decline in the number of camelid livestock was due to several factors, including the slaughter of adults and young for meat, the use of camelids in the Potosí mines as pack animals, the obligation of the Spanish to sell camelids and introduce

sheep, and, finally, the great scabies plague of 1544–46 that depleted the Altiplano population.

In all the puna and páramo, the "Castilian sheep" were introduced early, and, apparently, the pastures, watering hole, and bofedales where the camelids fed became shared. However, it was in the higher altitude lands where reserves of alpaca finally settled, while the llamas remained in the more arid regions of the central and southern Altiplano. Sheep were introduced as early as the 1530s, albeit sporadically, and it was not until around 1550 that the first permanent flocks were established.

The environmental impact of their introduction has not yet been analyzed, and positions remain divergent. While for Del Pozo (2004), who works in the Puno region, the introduction of sheep did not pose major problems because the Indigenous population quickly understood the multiple advantages of this type of animal, for Borchart (1995), in the Quito region, sheep breeding was directly connected to the Spanish neighbors, which would entail the distribution of land, the establishment of *obrajes* (textile workshops), and, therefore, a fundamental change in property and production relations.

Analyzing both positions, two different types of strategy can be seen: on the one hand, the authorization of the Indigenous people to raise sheep from Castile with the objective of maintaining the textile tribute and establishing obrajes (Salas de Coloma 1995); on the other, the importation of sheep in lower altitude lands that had lost their agricultural quality. Both strategies occurred in different regions of the Andes. It is important to point out that, as has been demonstrated in specialized studies, the shape of the hooves and the grazing process is different between camelids and sheep. Thus, it is very possible that the expansion of sheep farming has affected the watering places and wetlands of camelids. There are no archaeobotanical or archeoecological studies that allow us to confirm the degree of degradation of these soils due to sheep farming.

The importation of pigs apparently occurred prior to the importation of sheep, mainly because of their great energetic value and their fundamental role in the conquistadors' diet. In spite of this, the data on their breeding in the Andes are limited. Both Francisco Pizarro in Peru and Sebastián de Benalcázar in Quito and New Granada took large herds on their first trips and these were distributed in the first encomiendas, leaving their care in the hands of the Indians. According to the author:

> From the end of the 1530s, the lands immediately surrounding the first Peruvian establishments were filled with pigs, producing better bacon and pork legs in the highlands than in Spain itself. [...] In Quito, the multiplication was so rampant that, in 1538, the Cabildo ended up prohibiting the residents from having more than ten head of pigs for their food. Certainly, a few years after the end of the conquest – in 1541 –, the city [Quito] already had enough livestock to provide Gon-

> zalo Pizarro with the nearly 3,000 pigs he took on his expedition to the Cinnamon Country (Del Río 1996: 23).

In the most arid lands, such as those inhabited by the Uru Chipaya in the Poopó region (Bolivia), the cession of herds to the Indigenous peoples meant the possibility of articulating their production with other economic activities of colonial origin such as sheep breeding and some pre-Hispanic activities such as flamingo hunting, fishing and the gathering of totora (Wachtel 2022: 157). This experience shows us that raising pigs was a positive option for the poorest native peoples due to the animal's reproductive capacity and adaptability to extreme conditions. In some cases, however, these peoples' method of raising the pigs destroyed bofedales, transforming them into mud flats.

Cattle were raised extensively, especially in the valleys and savannahs of the equatorial Andes, becoming the basis of the economy in regions such as the Colombian savannah and other open valleys of the Andes. In marginal regions, such as the pampas of Río de la Plata and the Moxos and Chuiquitos regions, cattle breeding was central to the leather industry. Although the sources indicate the early arrival of the first cattle, it can also be said that their extensive breeding was largely due to the advance of the colonization frontier. For this reason, production grew mainly during the eighteenth century in new regions of colonization, many of which were subject to the missionary system.

In relation to the breeding of equines, although their areas of development are in regions outside the Andean space, it is important to take into account their presence due to the permanent trade in the cities that employed them and the use of horses and mules in transportation. Thus, for example, the Jesuit estancias established in Córdoba (today Argentina) were the main breeding grounds for horses and mules, which were essential for colonial trade and commerce. Cattle on Jesuit ranches were classified into rodeo cattle (*ganado de rodeo*), oxen, horses, mares, foals, mules, donkeys, and sheep (Cuervo 2014). At the time of the expulsion of the Society of Jesus, more than one million head of cattle, horses, mules, and sheep were found.

In the highlands and valleys of the Andean region, livestock raising was more an initiative of the peasants themselves, who generally had a few specimens to support their agricultural work and food. Nevertheless, it is important to mention their breeding because it modified certain practices. Thus, the use of the Roman plow required the use of oxen, and the transportation of products required the use of donkeys and mules. In this way, the ownership of some of these animals became a sign of wealth in the Indigenous communities.

In relation to the impact on ecosystems, although there are no specific studies, it can be pointed out that, just as in the case of pigs, cattle raising destabilized the fragility of wetlands and other humid terrains near rivers and lakes. Complaints can

be found attesting to the way in which cows trampled the flooded lands, destroying its productive capacity.

The Impact of Colonial Mining on the Landscape and the Environment

Mining was a fundamental activity in the colonial economy of the Andes. Large populations formed around the mining centers of Potosí and Huancavelica. At the beginning of the seventeenth century, 150,000 inhabitants lived in the former, making it one of the most populated urban centers in the world. This is not to develop a history of mining but to focus on establishing the impact that these activities had on the environment. Three aspects will be taken into account: water use and pollution, energy use, and air pollution.

In relation to water, its use was indispensable for the processing of both silver in Potosí and quicksilver in Huancavelica. In Potosi, the technological change from the *guayra* system to amalgamation led to the establishment of numerous ore processing mills and the intensive use of water for the movement of large hydraulic mills or for the actual process of ore separation using mercury. For this purpose, a complex of lagoons was built in the upper part of the Villa to supply water to the mills through an artificial river called the Rivera. The passage of water through the various mills and through the city itself produced a process of water contamination that came from four sources: the mines, domestic consumption, processing, and the effect of the great hydraulic catastrophe of the San Ildefonso lagoon (Serrano 2005). In the first case, the water that came from the pits was already contaminated by the mineral; meanwhile, the more than one hundred thousand inhabitants of the Villa Imperial added waste of all kinds to the Rivera itself. This was in addition to the water used in the mills, especially those originating from the mercury separation process. Finally, Serrano describes the impact of a specific environmental event, namely the flooding suffered by the Villa and the mines due to the collapse of the San Ildefonso or Karikari dam, which practically destroyed the city and the mills. According to Claudia López Pardo (2010), the waters coming from the mines were called "copajira waters," acidic waters that contained dissolved salts and metals such as copper, lead, arsenic, etc. On the other hand, those coming out of the mills carried mercury and other chemicals such as copper, iron, lead, and tin. It is logical to think that, in the case of Huancavelica, the main mining center producing quicksilver or mercury, water contamination was directly related to the toxicity of the ore extracted and processed.

In the case of Colombia, alluvial gold mining was carried out in an artisanal manner until practically the eighteenth century. Using very simple instruments and tools, such as pans and rods, the metal could be extracted. This does not mean, however, that there was no environmental impact, since the course of the rivers

was affected by the continuous activity of Indigenous miners and slaves. Those who worked the gold deposits, known as *mazamorreros* or *barrequeros*, worked either individually or in groups (Lenis 2020). Many were slaves, while others were free laborers. The names of the various jobs are still used today.

In relation to the energy issue, it is known that mining's environmental impact was very large. In the early years of production in Potosí, the use of the *guayra* technique entailed the intensive use of firewood from plants such as the thola or yareta. This resulted in large high slopes gradually losing their vegetation cover. The later use of amalgamation maintained the need for the use of energy sources mainly for metal smelting. For this purpose, taquia or llama excrement was used. In this way, traditional camelid herding was linked to mining activities. According to Chumpitaz (2015), the same occurred in Huancavelica. Here, firewood was scarce, with its nearest source about three to four leagues away (around 22 kilometers). Thus, the fuel for the ovens, especially the jabeca ovens that consumed large quantities of firewood, was supplied by taquia, cow dung, yareta (*azorella sp.*), and *champa* (a kind of peat formed by the species *Distichia muscoides* that grows around 4,500 meters in swampy areas without moss).

Finally, it is important to note the impact on health and the environment of air pollution in mining areas. The rarefied and acidic air in the pits and the use of mercury in the amalgamation process caused the death of thousands of mine workers, both *mitayos* (laborers in the Mita system) and free workers. This problem caused the Crown to exempt the mitayos affected by mercury from going back to the mita. In the case of Huancavelica, being a quicksilver mine, the impact was even more direct, such that the mitayos and other workers considered being sent to the quicksilver mines a death sentence.

The Export Market, Plantation Systems, and Cinchona Extraction

By the eighteenth century, two hundred years after the arrival of the Spaniards in America, the Andean spaces had already undergone major transformations due to the impact of new production logics. It is in these already modified landscapes that new forms of agricultural production emerged during the eighteenth century, mainly dedicated to the export market. On the coasts of Peru, in the valleys of Colombia and in other regions near the coast or with tropical climates, plantations arose that were distinguished from previous forms of exploitation by their extensive production and the key role of slave labor; in addition, it introduced or deepened the exploitation of new products, the main ones being sugarcane, grapevines, and tobacco (Chocano 2010: 59). This new production system generated the expansion of large estates, many of them belonging to religious orders or elite families, some of them ennobled.

Unlike traditional haciendas, the plantation production system required more capital, machinery for processing, and a large labor force. Due to their relationship with the export market, the plantations specialized in certain products, tending towards monoculture, while the labor force was mostly enslaved. In order to save transportation costs and to be able to enter the world market, plantations were established near ports or along an important river route. The environmental impact of the plantations was also great: soils were commonly depleted due to monoculture, so the plantations had to constantly expand the agricultural frontier.

From a different dimension, the eighteenth century saw the emergence of another economic activity, that of cinchona extraction. Tradition has it that cinchona bark or husk was discovered during the eighteenth century in the region of Loja (Ecuador), although it is logical to think that it was already known and used by the Andean peoples many years before. The use of cinchona and its active ingredient, quinine, as a remedy against malaria, was fundamental at a time when new explorers were entering the tropical lands of Asia and Africa, hence its extraction became an increasingly important economic activity, especially in certain parts of the jungle, such as Loja, Popayán, Lambayeque, or Apolobamba. In the case of Loja, the specificity of its location and the difficulty of its extraction made cinchona the new gold for many adventurers who, individually or in groups of laborers, went to extremely difficult areas to extract the bark. "As there is no cinchona forest in the wild, the laborer has to prospect vast areas. He usually sets out alone and collects bark for a day. He repeats this operation again for three or four months" (Petitjean and Saint-Geours 1998). The next stages, which had to be carefully controlled, were its drying, packing, and transportation to a port on the Pacific and from there to Cadiz.

The most important region for this industry was Loja, where the extraction of cascarilla or quina caused a short-lived economic boom. As with tobacco, the Bourbon State sought to control the extraction of cinchona from Loja, establishing a virtual monopoly on its export through regular officially directed shipments; however, this regulation caused either problems shortages or excess accumulation in the Cadiz market. However, the demands of the market, the difficulties of extraction and processing, and the overexploitation of the trees exhausted the region and new and more inhospitable areas had to be harvested.

The environmental impact of the extraction of cinchona meant the rapid deterioration of the forest in the producing areas. The forests were ravaged without the thought of conserving or, at the very least, replacing the trees; in the long run, this entailed the continuous movement of the exploitation frontier that would continue until the end of the nineteenth century in the different nation-states.

Conclusions

This study seeks to analyze the transformations in land use as a consequence of European colonization and their impact on the environment. In general terms, it is shown that the processes, trajectories, and intensities of territorial transformation have varied greatly in the different regions of the Andean space, depending on the demographic density of each region, its fragility, and the diverse implementation of modifications and adaptations. In this sense, despite the changes brought about by colonization with the implementation of new forms of work organization, changes in land ownership, extensive population movements, and the introduction of new agricultural and livestock products, in most of the territory, the adaptation to pre-Hispanic forms of cultivation and raising of livestock prevailed. Thus, for example, European products were added to the pre-Hispanic crop rotation systems, and community forms of production organization were maintained in practice, in which the European and Creole settlers were often involved.

In the same way, the land compositions maintained two ways of conceptualizing land ownership. On the one hand, they conformed haciendas for the use and ownership of the Creole or Spanish population. On the other hand, however, the revisitas de tierra consolidated the property of the old ayllus that had become communities. Finally, the raising of new animals was also linked in some regions to the ancient camelid herding. Despite these forms of adaptation, there is no doubt that changes in land use occurred with the consequent environmental impact. Thus, the weakening of the old Inca state control led to the desertion of farmland, and the construction of camellones and terraces was abandoned; the planting of some crops of European origin, such as wheat, led to the displacement of others of higher caloric and energy value, such as corn; and the planting of fruit trees of European origin led to the emergence of privately-owned orchards in the outskirts of the cities. In terms of livestock, the raising of European origin animals such as sheep, pigs, and cows destroyed part of the fragile Andean pastures and bofedales that were used for raising camelids.

With regard to the areas of occupation, the most densely populated areas of the Andes largely maintained their population and social and economic organization. Instead, it was the marginal regions or those recently colonized by the great Andean cultures, such as the Incas and the Muiscas, that underwent the greatest changes during the advance of European colonization. This change has been greater in the foothills of the Cordillera towards the Amazonian lowlands, where the demographic impact of the conquest was more profound. It was there that missionary systems, large plantations, and extensive cattle ranches arose. This has occurred, for example, in the sub-humid and humid forests of the Colombian Andes and in the savannah lands of the Beni, which suffered a great demographic decline in the sixteenth century, leaving the great hydraulic culture that had developed in the region in ruins.

Mining, the economic foundation of the colonial exploitation system, also led to the degradation of spaces, either by the excessive exploitation of firewood as a source of energy or water pollution. Finally, in the eighteenth century, two new forms of exploitation emerged. The first was the plantation that produced products such as cotton or sugarcane, emerging mainly in the warmer regions facing the Amazon or on the Pacific and Caribbean coasts. The other was the extractive exploitation of cinchona in the jungle. Both affected ecosystems, especially due to their expansive nature and constant broadening of the agricultural frontier. In conclusion, the impact of Spanish colonization in the Andean area was great. Although the systems of social organization and Indigenous agricultural and cattle raising practices were able to survive, the resulting landscapes at the beginning of the nineteenth century after three centuries of colonial domination were already very different. Erosion, the destruction of pastures, the expansion of the agricultural and cattle-raising frontier, and water pollution were already a reality in the Andean areas.

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Land Use in the Amazon in the Colonial Period

Rafael Chambouleyron and Pablo Ibáñez-Bonillo

The debate about the relationship between humanity and nature has been extensively developed through archeology for the period before the arrival of Europeans in the Amazon; likewise, this subject has also been the subject of study for ethnohistorians and anthropologists who, in different locations of the greater Amazon region, have studied the multiple relationships between Indigenous societies and the environments they inhabit. This debate, in fact, formed the backbone of research on Amazonian Indigenous peoples throughout the twentieth century, giving rise to conflicting hypotheses about their ability to adapt or transform the tropical landscape. From the most conservative perspectives, the Amazon was held to be one of the most inhospitable places on the planet and generally incompatible with the development of civilizations (Steward 1948; Meggers 1971). People in this part of the world suffered adapting to its soil and wet climate, making survival an accomplishment.

However, sufficient scientific evidence has accumulated in recent decades to overcome these initial paradigms (Myers 1992; Faust 1999; Mann 2006). Today, scholarship accepts that the Amazon is indeed a challenging and complex place, but this is, in part, thanks to the action of human groups who, throughout the centuries, were able to take advantage of forests and rivers to increase its performance and habitability (Heckenberger and Neves 2009; Schaan 2008–2009; Roosevelt 2013; Clement et al. 2015). Thus, before the Europeans' landing, native societies shaped the Amazon region (both on riverbanks and the interior) in a long process of observation, learning, trial, and error that has only begun to be understood. This includes a wide variety of workarounds: anthropic forests created by groups that practiced seasonal extractivism; deposits of fertile black soil thanks to the undecipherable alchemy of organic waste; elevated platforms to cope with river floods; savannas opened with controlled fires (Erickson 2008; Schaan 2004; Franco Moraes et al. 2019). These are among a long list of creative responses that contribute to the understanding that, first, the Amazon was neither in the past nor present a virgin and natural place but rather a historical and social one (Heckenberger et al. 2003; Hecht et al. 2014), as also suggested by the first European chronicles of the sixteenth century (Wilkinson 2016; Porro 2020); second, that human action prior

to the arrival of Europeans had profound influences on the way they colonized the region; and finally, that European conquest and colonization brought with it new forms of relationship with nature, as well as a series of changes in the scale and form of land exploitation with the introduction of more systematic agriculture and metal tools (Shepard Jr. et al. 2020; Neves 2013; Denevan 1992a).

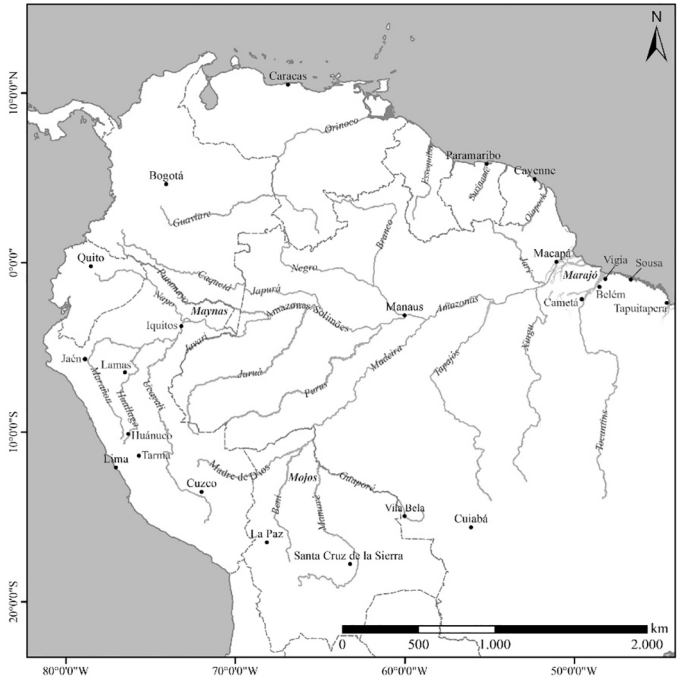
These fruitful discussions on socio-environmental relations, which have helped to make our perception of the Amazon more complex and diverse, contrast the more minor interest shown by historians, at least for the colonial period (the sixteenth to early nineteenth centuries). Two reasons help to grasp how little historians have contributed to these debates beyond some valuable exceptions (Cleary 2001). On the one hand, topics related to environmental history for the Amazon in the long term have been traditionally developed by anthropologists or archaeologists in a disciplinary trend that has complicated the dialogue with other thematic currents of historiography. These disciplines have emphasized the diversity of Amazonian ecosystems (overcoming old simplifying stereotypes) and their complex historical relationship with Indigenous peoples. On the other hand, colonial Amazonian historiography is still under construction, lacking many of the hallmark contributions that exist for other regions, such as the history of its economy, internal markets, or exchange circuits. Eluded by different national historiographic traditions that perceive the Amazon as a peripheral and marginal space to the respective Latin American republics, the history of the colonial Amazon still requires the attention of generations of historians who, through their work, can improve our knowledge of the region's past. Despite this, through the literature produced on adaptation to the environment and its transformation in the colonial period, it is possible to reflect on the perception of various impacts on the environment and the solutions imagined (and applied), the varied uses of the land, as well as on the different narratives and perspectives that the imposing Amazon region provoked in the mindset of the European conquerors and colonizers.

This chapter deals with all these issues and is divided into five thematic and chronological sections. The first of these addresses, in point of fact, the varied colonial representations of the Amazonian space from the first voyages of discovery in the sixteenth century. The second section analyzes the colonization projects of the Iberian monarchies, through which they tried to control and exploit the Amazon territory during the colonial period. These projects were especially numerous and original in the eighteenth century, coinciding with the Enlightenment reforms attempted throughout the continent, which are discussed in the third section of this text. In the fourth section, the chronological progression is abandoned to address the different modes of exploitation experienced in the region in order to, finally, close the text with some considerations about the environmental impacts caused by colonial land use.

Representations of the Conquest

One of the historical features of the Amazon region is its late (and precarious) incorporation into the Iberian colonial realms. The absence of mineral riches, difficulties in exploring tropical forests, and diseases, among other reasons, discouraged the recognition and colonization of these spaces. Thus, since the sixteenth century, several expeditions had entered the region (without much success). Only in the seventeenth century were ambitious attempts to control the Amazon regions by the different European empires. Thus, the Amazon remained a considerably unknown region for soldiers and settlers living in colonial cities, usually near the Atlantic or Pacific coast. And much more still for the metropolitan societies of Europe.

Fig. 1: The Amazon Region



Source: LAIG/UFPA and authors.

This remoteness provoked several legends and stereotypes, fueled by a few chronicles of European explorers, some Indigenous myths, and medieval Europe's predictions. Such a set of representations marked the historical development of these lands and continues to guide the global perception of the Amazon, represented

as a natural space, wild, not yet domesticated, and hiding wonderful treasures that must be revealed. Perhaps the most important of these legends, at least in the early colonial period, was that of El Dorado, which, in its different versions (Paititi, the kingdom of Moxos, among others), acted as a magnet for the conquerors. From the main cities of Spanish America, such as Cuzco or Quito (see Fig. 1), groups of men set out in search of unlikely fortunes associated with the recent conquests of Peru, which had been generous in silver and gold (Bayle 1943; Levillier 1976; Gil 1989; Livi Bacci 2007).

Their repeated failures known in Europe thanks to several chronicles, constituted the material with which Europeans forged the colonial representations of the region. These were evocations that oscillated from the earliest times between two stereotypical poles: on the one hand, the Amazon was imagined as a space of opulence and possibilities, a repository of wealth, food, and treasures that were offered to the most ambitious conquerors (Ugarte 2009). On the other, however, harsh physical and climatic conditions, as well as resistance from Indigenous peoples (numerous and threatening), seemed to doom attempts to seize these resources. The Amazon was, therefore, paradise and hell at the same time, an ambivalence that endured throughout the colonial period and, to this day, persists in the multitude of representations of the region (Gondim 1994; Pizarro 2009; Slater 2015).

Thus, the powerful image of the El Dorado and other legends influenced Spanish explorations during the sixteenth century and also exerted its influence on the Portuguese, who settled in the Amazon only in 1616 as part of an Iberian campaign of occupation of the territory. From then on, Portuguese representations of the Amazon arose, becoming much more numerous from the 1640s onwards, after the restoration of the Portuguese crown and the end of the Iberian union between the crowns of Portugal and Castile (1580–1640). The search for metals and precious stones in the Portuguese Amazon was also a constant throughout the seventeenth and eighteenth centuries, but the stories mainly focused on plant riches (Cardoso 2015). A relationship with the East was established here, echoing the glorious days of the Portuguese empire with the spice trade. Thus, the region was called "Eastern Peru" by Captain Simão Estácio da Silveira in 1624 because of an alleged abundance of cloves, fruits from the East, and cinnamon, products that had also attracted the interest of the Spanish conquistadors (Silveira 1624).

The subsequent discovery of tree bark with a similar smell and taste to Eastern cloves largely confirmed these early representations. Although the so-called *cravo do Maranhão* was a different plant, the Portuguese crown saw in the product a substitute for the famous spice and the possibility of resuming its place in the trade of these types of goods. The inability to cultivate the tree, however, ruined their hopes. In any case, the existence of a clear substitute for oriental products led the crown and government officials to seek new goods that might be of commercial interest. To this is added the existence of vast native cacao orchards along the Amazon River and

in several of its tributaries, which is possibly the result of centuries-old anthropic action.

In this context, Portuguese writings begin to represent the Amazon region as a territory full of potential from the point of view of economic exploitation. It was hardly an almost mythical projection, such as El Dorado, but a way to conceive of Amazonian nature as a source of possible wealth that was the responsibility of the Portuguese to reveal (with the indispensable help of the Indigenous people). Not without reason, the verb *discover* becomes frequent in the reports of officials to the court. The role of Indigenous people here was fundamental, as rowers and guides: the holders of geographical knowledge often codified in rituals and mythical narratives (Hill 2011).

Beyond more or less realistic speculation, the truth is that Europeans tried to turn these lands into productive spaces, establishing various forms of economic organization. From the end of the seventeenth century and throughout the colonial period, the economy of the Amazon, both Spanish and Portuguese, was based on the exploitation of several of these forest goods, mainly cocoa (also cultivated), *cravo do Maranhão* (clove bark), sarsaparilla, copaiba oil, as well as fruits, barks, roots, and resins obtained by extraction in the vast Amazon continent. These extractivist activities reported benefits thanks to the enslaved or semi-enslaved labor of Indigenous populations.

Colonization Projects: Missions and Cities (Seventeenth Century)

This model of exploitation, however, did not guarantee the colonization of the territory and, consequently, its effective occupation, at least for the traditional patterns of occupation in the Americas. This was not a minor issue in these vast regions with still indefinite borders over which the major European powers contended. That is why both Spanish and Portuguese colonizers attempted to establish themselves permanently through the foundation of cities. In the case of Hispanic America, this founding impulse had accompanied reconnaissance expeditions since the sixteenth century in the form of capitulations signed between the crown and the conquistadors, who undertook founding new cities in the lowlands. In this manner, several cities came to be founded, especially in the eastern region of Quito, but also in other transitional zones between the Andes and the Amazon (Moyobamba, Santa Cruz de la Sierra, etc., and in the Orinoco River as well (see Fig. 1). However, many of these settlements succumbed within a few years to some factors, including the lack of communications or the hostility of Indigenous peoples (Taylor 1999).

Better luck befell the Portuguese settlements of the seventeenth century, especially the city of Santa Maria de Belém do Grão-Pará, the leading Portuguese position in the Amazon, founded in 1616. Belém, as it was known, became the great city of the

colonial Iberian Amazon, thanks to its strategic position at the mouth of the Amazon River, becoming the central axis of communication for the region. In its shadow, other small towns (*vilas*) established in private captaincies (later incorporated into the crown in the mid-eighteenth century) sprouted, such as Cametá, Sousa, Vigia (in the captaincy of Pará), and Tapuitapera (in the captaincy of Maranhão). However, the number of towns and cities remained small during much of the colonial period, due to both the absence of a founding initiative and challenging environmental conditions.

Also, in the vicinity of Belém, properties for inhabitants of the city and religious orders were gradually established. Located on the banks of the rivers, they cultivated sugar cane, beans, cocoa (from the end of the seventeenth century), and, foremost of all, cassava, the "daily bread" of the land, as a Jesuit missionary wrote (Daniel 2004). The Portuguese crown recognized possession of land and began distributing titles (*sesmarias*) to those who had already occupied or asked for new land from the end of the seventeenth century. In any case, no extensive holdings were established in the colonial Amazon, although available land was abundant.

Thus, at least until the mid-eighteenth century, large landowners in the Portuguese Amazon were not necessarily owners of large tracts but instead of medium-sized properties scattered throughout various parts of the territory, each with its specialization (cattle, sugar, cocoa). This entailed a particular relationship between the rural world and the city since the properties of the inhabitants of Belém were located some distance away from it (and sometimes a considerably long way). The mobility of the colonial population is a fundamental aspect of the Amazonian world, which is evident from the recurrent movement of landowners between the city and their land or between the city and the *sertões* (hinterland), where forest products were collected, Indigenous people were enslaved, and Indians sent to the mission villages (Sommer 2005).

While living alongside the whites' properties, a type of property without legal titles became established little by little in the Amazonian world, close to the towns and cities, cultivated generally by Indians, mestizos, and Maroons. From these cases, the historiography discusses the emergence of an Amazonian peasantry (Acevedo Marin 2000; Costa 2019), an elusive category still today in socio-historical analysis, due, among other factors, to the particularities of land uses in the region (Nugent 2002; Adams et al 2009; Harris 2010). In the documents of the late seventeenth and mid-eighteenth centuries, these small growers appear in a fragmentary form. However, a census for the 1770s and 1780s makes their presence clear. In the village of Cametá, on the Tocantins River, for example, next to several white owners, several individuals designated as "mamelucos" or "índios" also appear, who live off the cultivation of cacao – "*vive do seu cacoal*" – or the cultivation of manioc and other goods – "*vive da sua roça*" – often indicating the use of family labor (Arquivo Histórico Ultramarino 1785).

The use of land by individuals (in the form of haciendas, for example) who took advantage of forced Indigenous labor, through encomiendas and other labor relations, also occurred in the Spanish Amazon. These farms were generally concentrated in the region of the *montaña*, or high forest, near Andean cities in places like Jaén de Bracamoros, Huánuco, Tarma, or Lamas. Among the products exploited were tobacco, sugar cane, bananas, sweet potatoes, chili, and, especially, coca, which from its origin in the wet valleys, exerted a powerful cultural influence within the Andean cosmos in the era before the Spanish conquest. The impact and extent of these initiatives must still be systematically studied, although the scarcity of sources makes the work difficult (Santos Granero 1985; Santos Granero 1992). The presence of Andean and Spanish settlers was less significant in the lowlands, where the agricultural use of land by individuals was more limited. Instead, it is worth noting the relevance of religious missions of different orders that have operated in these regions since the beginning of the seventeenth century.

Religious orders such as the Jesuits, Franciscans, Carmelites, Mercedarians, Dominicans, and Augustinians arranged the Indigenous populations in reductions that would facilitate their governance and conversion, both for the Spanish and Portuguese Amazon. Thus, until the mid-eighteenth century, the colonial occupation of part of the Amazonian territory was, in fact, eminently missionary. The establishment and management of these mission villages resulted from negotiations between the missionaries and their neophytes (Arenz 2014; Carvalho 2015), who, in most cases, chose the locations where they wanted to install the missions. These were founded on the banks of the main navigable rivers, usually near their confluence with the Amazon. River navigation was the primary means of transport in the Amazon. Living near rivers allowed communication with other missions, fishing, agriculture, trade, and gathering on nearby lands. This does not mean that Indigenous people did not open and use land roads. However, their contact with the interior occurred rather through rivers and canals (*igarapés*, *igapós*, *furos*), which they maintained and created according to their interests (Raffles 2002). This was a subtle geography that connected riverbanks with inland areas (*terra firme*), thanks to historical patterns of mobility and trade (Whitehead 1993; Zárate Botía 1998).

Negotiations, loans, and hybridizations between the Indigenous and the missionaries can also be observed in the productive activities that they developed (Sweet 1995; Ravena and Acevedo Marin 2013; Chambouleyron, Arenz, and Melo 2020). Indigenous peoples had extensive experience using the land for subsistence, and there are indications of some resource accumulation. The missionaries adapted these local customs while trying to establish more stable agricultural practices in the vicinity of the missions, which ultimately affected the fertility of these lands and altered previous extractive patterns, as appears to have occurred in the Mojos missions in the territory of present-day Bolivia (Block 1994: 58–59). There, as in other mission complexes, the cultivation of native products was combined with the introduction

of new crops, as well as with livestock and some local crafts (textiles, pots, among others), generating a regional economic system (Santamaría 1987). Such systems often overlapped with Indigenous patterns of regional integration (with their routes, products, and trade), such as the one organized around the Cerro de la Sal (Ryden 1962; Varese 1973).

Natural phenomena constantly threatened these activities and put mission continuity at risk. Floods, epidemics, droughts, insect pests, and other more human causes (such as Indigenous rebellions or attacks by other European powers) prompted the recurrent relocation of missions, always searching for new, healthier sites. The mobility of human settlements, their presence often only temporary, was, in fact, one of the characteristics of the colonial Amazon. At the same time, the demography of the missions was also affected by these issues, as well as by the escapes and the continuous visits that the Indigenous people made to their relatives or to their former lands (Carvalho Júnior 2003; Livi Bacci 2012; Roller 2014). This also led to the merger or abandonment of specific missions, and the relentless search for neophytes to repopulate settlements.

Enlightenment Projects (Eighteenth Century)

The European military also established some positions with a greater desire to remain, especially the Portuguese, who dotted the Amazon River with a series of forts from which they intended to control river navigation and which also constituted populated locations. In these forts lived small garrisons of soldiers who had to occasionally move their settlements owing to strategic defense reasons rather than environmental threats. In this sense, one should note that the concentrations of rocks that prevented or hindered navigation in the middle and upper reaches of the rivers (*cachuelas*, *cachoeiras*), as well as the narrowest sections of the channels (*estreitos*), were identified by the Europeans as natural solutions to aid the installation of their positions and defense of their borders (Viana 2021).

These borders, on the other hand, were illusory during the colonial period. Reliance on navigable river courses and dense vegetation cover limited European knowledge of inland regions, and only in the mid-eighteenth century there was a realistic aspiration to acknowledge the integrity of the Amazonian borders and fix their positions. After the signing of the Treaty of Madrid (1750), seizing the momentum of the scientific expeditions that had traveled the region in the first half of the eighteenth century, the two Iberian crowns agreed to send boundary commissions that were to demarcate the territory jointly. These commissions, and those resulting from the later Treaty of San Ildefonso (1777), failed not only because of the tides of European diplomacy but also because of the difficulties of the terrain and to secure provisions in those remote places.

In fact, by the mid-eighteenth century, the Amazon was still a poorly known and poorly managed space for both crowns. The crowns had previously delegated to religious orders the conversion of Indigenous peoples into servants of God and the king, but the result appeared insufficient to them. For this reason, in the context of the Enlightenment reforms and the Jesuits' fall from grace, a series of new colonization projects were developed in the region. In the Portuguese Amazon, these projects included elements such as the prohibition of Indigenous slavery and the secularization of religious villages. The *diretores* took the place of the missionaries. These local administrators were to guard Indigenous freedom in the former missions following the precepts in the ninety-five paragraphs of the so-called *Diretório dos Indios* (Directorate of Indians) (1758).

Many of the Directorate's paragraphs were devoted to promoting two key economic activities: trade and agriculture. Agriculture was perceived as a factor of civilization that was to be adequately stimulated. The directors were to explain to the natives that cultivating the land was a "useful and honest" exercise, examining whether the surrounding land was competent and ensuring that all Indigenous people had access to it. In this way, it was intended to provide the natives with valuable lands to encourage their individual and familial development. In addition, agricultural work would make it possible to deal with a recurring problem: the lack of food and its shortage in colonial markets. To do this, Indigenous people were encouraged to plant cassava (the basis of Amazonian food), as well as beans, corn, rice, and other edible goods (Sampaio 2012; Coelho 2016).

The Directorate also pursued the production of exportable goods. Unlike the plantations that bore fruit elsewhere, such as in the French and Dutch Guianas (Cardoso 1999; Cruz, Hulsman and Gomes 2014; Whitaker 2016), the Iberian Amazon had not yet developed a planting economy of goods such as sugar, cotton, or tobacco, mainly because of difficulties with land and communications. The production of the *vilas* of the Directorate was now to be counted, stored, and sent to the general treasury in the city of Belém, where the natives would be paid for the fruits of their labor. Other products of economic interest, such as so-called "*drogas do sertão*" (cocoa, clove bark, sarsaparilla), turtle fat, salted fish, or various vegetable oils, were brought there.

With these measures, the missions became *vilas* and *lugares* that aspired to settle populations (shunning the usual desertions and previous mobility) and transform land uses. In the same spirit, the foundation of new villages, the opening of new supply routes, and the massive introduction of livestock were also planned to help combat chronic food shortages in the Iberian Amazon. The large-scale insertion of African enslaved people was also promoted, who, until the mid-eighteenth century, had represented a relatively small portion of colonial society.

Authorities adopted similar measures in the Spanish Amazon, most notably after the expulsion of the Jesuits in 1767. A royal charter of 1772 indicated how to man-

age the ancient Jesuit missions of Maynas following the example of the Jesuit missions of Uruguay and Paraná (Goulard 2011; Bastos 2017). In addition, other policies were implemented as part of the Bourbon Reforms to integrate these eastern regions (Lucena Giraldo 1993; Aburto Cotrina 1996; Gómez González 2014). Exploration of the territory, the opening of new roads, the creation of villages, the introduction of livestock, and other measures were tried to improve the governance and exploitation of those lands. The reform plans (especially by Governor Manuel Centurión) for the Province of Guiana, located between the channels of the Orinoco and Amazon rivers, stand out in this era (Lucena Giraldo 1991; Amodio 1995).

These projects reflect the transformative will of the Iberian crowns, which encouraged scientific exploration travels to identify and describe the natural potential of the Amazon (Peralta 2006; Safier 2008; Pataca 2006). In this process, Indigenous knowledge was again fundamental, influencing cartography or botany at the time (Chauca Tapia 2015; Sanjad, Pataca, and Santos 2021). Both crowns, therefore, aspired to give definitive momentum to the region, convinced that will and good governance were sufficient to overcome environmental impacts and constraints. However, their confidence was excessive, and most of the projects implemented in the second half of the eighteenth century failed or at least had a complicated implementation, yielding precarious results.

Land Use

The modes of production and land uses in the colonial Amazonian world, derived from the different colonization projects this chapter has discussed in the previous pages, had uneven environmental implications. One can differentiate between three main land uses: extractivism, agriculture, and livestock.

The first of these was the most representative of the colonial period since it was present since the first expeditions of discovery and conquest. The famous expedition of Gonzalo Pizarro, which would lead to the first European navigation of the Amazon River's course by Francisco de Orellana in 1541–1542, aimed to find the "Country of Cinnamon," a product that did not grow naturally in the Amazon. However, it did encounter another series of goods that, in the three centuries after, have attracted the interest of extractive expeditions from both sides of the border: cocoa, cinchona, clove bark, sarsaparilla, and indigo, in addition to animal products that required hunting and fishing activities: various types of fish (to consume fresh or dried), manatees, turtles (Fiori and Santos 2015), bird feathers, among others. And, of course, wood for the construction of houses and canoes, as well as wood for export (for the production of ships, for example) and resins. In short, a wide variety of materials that did not require cultivation and hardly required mobile harvesting equipment.

Therefore, much of the economic development of the colonial Amazon was based on harvesting the fruits that (naturally or anthropically) grew in the region, taking advantage of the ethnobotanical knowledge of Indigenous peoples, whose complexity scholars revealed in recent decades (Posey 1985; Balee 1994; Pineda Camacho 1999; Rival 2002). However, colonial agents also attempted to domesticate some of these harvestable products. Thus, with certain products there was a mixed exploitation, combining traditional harvesting with the cultivation of certain varieties in small and medium plantations. This controlled planting reduced costs and risks, avoiding the extinction of certain trees and bushes that would have resulted from more abusive extraction. On the other hand, it was based on the idea of agriculture as the ideal way to exploit the region's riches.

Take the case of cocoa and *cravo do Maranhão* (clove bark), the two most important goods for exploitation and export in the Portuguese Amazon region. Throughout the colonial period, mainly up to the late eighteenth century, cocoa was extensively exploited by harvesting of wild fruits in the cacao orchards that existed along some of the major rivers in the region. Despite the importance of cultivation, it seems that much of what was exported was from the harvest of the so-called *cacao bravo* (wild fruits) in the *sertões*. Even so, descriptions of the region since the mid-eighteenth century maintain an image of abundance regarding the native cacao orchards (Sampaio 1825), which may mean that extraction, although intense, did not come to threaten the very existence of cacao trees.

The case of the *cravo do Maranhão* was different. Although the only thing that interested the Portuguese was the bark, workers cut the whole tree to extract it. Not without reason, the Jesuit João Daniel, who lived in the Amazon in the first half of the eighteenth century, had complained that the Portuguese only took advantage of the tree "one time in life," which led to the disappearance of "extensive cravo plants" (Daniel 2004). Many years earlier, in 1686, the king himself acknowledged in a letter to the governor that he feared "with probable certainty of [the cravo's] extinction." Evoking the ancient and devastating experience with the principal wood of the Brazilian Atlantic coast, he warned that "in terms of harvesting [the cravo] it happens the same as brazilwood" (Arquivo Histórico Ultramarino, 1673–1712, f. 52v).

Exploiting the *drogas do sertão* entailed a particular type of land use in the Amazonian world, especially in the Portuguese territory. The vast cacao orchards of the hinterland, strictly speaking, had no owner or proprietor; the same can be said of the clove bark tree or sarsaparilla plucked from the earth. They were exploited by expeditions going to the *sertão*, setting up temporary factories, harvesting the product, and returning to Belém (Pompeu 2021). In this sense, the places of exploitation of Amazonian products were not the domain or particular possession of white people, unlike rubber in the late nineteenth century, for example.

Concerning agricultural practices, they were attempted near the colonial settlements as a way of ensuring the livelihood of their inhabitants. One commodity

proved essential in this subsistence agriculture: cassava. Since well before the European conquest, Indigenous peoples had domesticated cassava and other plants (Clement et al. 2015; Shepard Jr. et al. 2020). Manioc was, in fact, one of the main foods of the colonial Amazon, along with fish, and remained so in the centuries after (to this day). The inhabitants of the missions and cities of the colonial Amazon used cassava as the basis of their diet in its different forms and derivatives (*mandioca puba*, manioc flour, cassava bread). The production of cassava was based on Indigenous techniques in small, scattered plantations, a pattern that remained essentially unchanged during the colonial period.

In addition to cassava, other native products were grown in the colonial Amazon. Agricultural land was also used to cultivate products introduced by Europeans to feed local populations (such as rice) or participate in export networks to the colonial capitals and/or European markets. Among these last goods, the role of rice itself, and marginally sugar (although plantations were less significant than in northeastern Brazil), cotton, and tobacco should be highlighted. These products and their derivatives (e.g., fabrics, cane liquor) also circulated within the Amazon, often serving as a currency for exchange and negotiation with Indigenous groups in a region where metal coins did not circulate regularly until the mid-eighteenth century.

Consequently, agricultural land use existed in the colonial Amazon, both in religious missions and in cities, which were affected by the consequences of such activity. In the more ancient colonial occupation region of the Portuguese Amazon, around Belém, there are fragments in the sources indicating that land use had caused damage to the soils. Some settlers complained that their land was already "*tired*" by years of exploitation. In 1723, for example, in a grant of land to Manuel Ferreira de Morais, the governor declared that the royal treasurer had examined the request of the settler. He stated that his lands "were tired because of the many crops of flour [cassava], cocoa, and tobacco that were grown there" (Arquivo Público do Estado do Pará, 1727, f. 174–174v). While it is true that this could also be a strategy for obtaining more land, there is no doubt that intensified cultivation affected the soils, partly because settlers' land was concentrated on the fertile banks of rivers.

In this sense, the expansion of cultivation did not seem to imply extending to the non-flooded parts of the forest (*terra firme*) but rather the progressive occupation of the lands near the banks of the rivers. Many settlers even asked for land on both banks of the same river, one tract facing the other. To a large extent, one might speculate that, despite the apparent abundance of land, there was not much soil available for cultivation, given the settlers' preference for margins. An interest that may have also to do with the reuse of lands fertilized for centuries by Indigenous peoples (*terras pretas*). In any case, fragments in the land grant letters indicate a saturation of the occupation.

Finally, livestock came to occupy an important place among the various types of land use in the colonial period. The scarcity of large mammals in the region caused

an apparent deficit in hunting and protein, which has occupied anthropologists and ethnohistorians in their debates on Indigenous populations' actions and development capacities (Ferguson 1989; Carneiro 2007). Faced with the same problem, the agents of the Iberian empires encouraged the introduction of livestock (cattle, goats, sheep) from the beginning, hoping that they would constitute a permanent source of food for the colonial population. However, the terrain was not the most appropriate, because of the lack of large areas of land and the presence of predators such as jaguars, among other reasons. To protect livestock, it was necessary to keep herds close to cities, but this caused clashes with agricultural land when they were invaded and trampled by livestock despite fences, as was the case in the village of São José do Macapá at the mouth of the Amazon.

In this context, livestock farming failed in many places, but in others (especially in the savannas or floodplains), succeeded and transformed the cultural patterns of the region. This was the case, for example, in places such as the Marajó archipelago or the Mojos plains and around the city of Santa Cruz de la Sierra, where cattle became the main economic asset but also a means of transportation, the basis of the regional diet and a symbol of cultural identity. In the second half of the eighteenth century, the bishop of Santa Cruz wrote that cattle "is the central and almost the only wealth of the country" since everyone depended on meat for food and tallow for lamps and soap making. However, the difficulty of preserving meat in the tropical climate required killing one animal per day, preserving a portion in salt (*tasajo*), and disposing of much of the rest (Archivo General de Indias, 1772).

Environmental Impacts

It has been shown here how, during the colonial period, the Amazon was a social space with intense agricultural, livestock, and extractive activities that transformed its landscape in a far-reaching process that preceded the arrival of Europeans and that, since the mid-nineteenth century, has entered a new phase due to the speed and scale of the consequent environmental transformation (Cleary 2001). These activities were precursors to new practices and problems that today pose real environmental threats, such as deforestation, the opening of pastureland, or illegal mining. However, during the colonial period discussed here, the main impacts were more related to the natural logics of the Amazon environment itself rather than to the scale of the activities.

Since the arrival of the first explorers at the beginning of the sixteenth century, the tropical climate of the Amazon had been recognized as a factor that would condition the chances of success of missionaries and conquerors. The scorching heat, accompanied by high humidity, caused the food to spoil quickly. However, not only fresh meat or fruit was deteriorated by heat; European objects, such as gunpowder

or steel, were also affected by moisture. The intense rain, seasonally in the lowlands and more commonly in the high jungle (*montaña*) that separated the Andes from the Amazonian riverbed, further complicated matters for Europeans. Floods have been a recurring problem since precolonial times, for which the Indigenous people had developed their solutions, such as burying food or building stilt houses, as the missionary Samuel Fritz observed (Fritz 1992).

Similarly, the floods were also a headache for colonial farmers. Portuguese land donation letters have some interesting information on the impact of flooding on crops. The term *alagadiço* (flooded terrain) appears recurrently in documents. However, sometimes, in a contradictory sense. In 1726, Estevão Geraldes Meireles, for example, complained in his petition that in the square league he had on the Guamá River (known as Guajará), he could not have "other culture than that of cocoa, as he had in it, because the land is *alagadiça* and it cannot produce food crops [*mantimentos*]." In 1731, Claudio Antonio de Almeida, though, said that his lands were "almost all flooded, which does not help the planting cocoa, cassava and other crops" (Arquivo Público do Estado do Pará, 1727, f. 7v-8; Arquivo Público do Estado do Pará, 1731, f. 47–47v).

Flooding also hampered the river communication that had become essential to the colonial Amazon because of the scarcity of land roads (permanently threatened by the surrounding nature) and the existence of large navigable rivers that facilitated human activity and movement, such as the Madeira River (Teixeira 2008; Melo 2022). Europeans developed a river culture in the colonial Amazon with fishing as its primary food supply and canoes as its main means of transport (Ferreira and Viana 2021). For this reason, colonial settlements were concentrated on the banks of major rivers, continuously dealing with the threat of potential flooding, as the overflows of rain and river often altered the profile of the banks, washing away ports, crops, and entire villages.

River communication was somewhat different on the edge of the jungle or the *montaña*, the transition zone between the Andean Mountain ranges and the Amazon, where the peoples of both regions had been meeting since long before the European conquests (Renard-Casevitz, Saignes, and Taylor 1988; Varese 2016). The Spanish raided the lowlands from the Andean highlands and faced a topography much more complicated than that known to the Portuguese. The rivers, with steep descents, rarely offered easy access and required the formation of alternative paths leading to painful crossings. The roads opened on the slopes of the last Andean foothills were precarious and temporary, also affected by rains, landslides, and even earthquakes and the eruptions of Andean volcanoes, as was the case with access roads to the Maynas missions (Cotrina 1996; Espinoza Soriano 2006). Moreover, Europeans and the Indigenous from the Andes who accompanied them were affected by changes in altitude and climate, and tropical diseases to which they were not accustomed.

This, precisely, was another problem that the colonial administrators of the Amazon had to suffer for centuries: tropical diseases with which they learned to coexist without ever knowing their causes and treatments. Amazonian diseases, on the other hand, had fewer consequences on human history in the region compared with diseases brought from the Old World (involuntarily) by Europeans, their livestock, and their African enslaved. These diseases, enhanced by policies of human concentration in missions and villages, devastated Indigenous populations (Denevan 1992b; Santos Granero 1992; Hemming 2009; Livi Bacci 2016; Vieira Junior 2021). To try to mitigate the effects of these recurrent epidemics, the Iberians tried different solutions, such as experimentation with the first "vaccines" against smallpox, both in the missions of the Portuguese Amazon and in the Jesuit missions of Maynas (La Condamine 1745; Espinoza Soriano 2006). Insects, especially mosquitoes, were the main transmitters of local diseases. Nevertheless, they also had other impacts on people's lives, both materially and psychologically. Ants and all kinds of insects ruined food and crops, complicating land use. Therefore, care was taken to avoid the most infested areas and to relocate crops when affected. In several land petitions, Portuguese settlers complained of "*formigueiros*" (anthills) that hindered the cultivation of the land. Finally, it should be noted that not only insects conditioned human activity; other animals of Amazonian fauna also put the existence of colonial crops and livestock at risk. Predators such as jaguars attacked herds and threatened roads.

Conclusions

The main impact of the arrival of Europeans in the Amazon region was, therefore, demographic. Wars, enslavement, and diseases brought by Europeans severely impacted the various Indigenous communities. As for the multiple types of economic exploitation developed during the colonial period, they had various consequences. Some forms of economic activity threatened plant species, such as the *cravo do Maranhão*, the sarsaparilla, and various types of woods (cutting increased markedly in the second half of the eighteenth century), whose exploitation inevitably meant the disappearance of trees and roots. Also, animals were affected, for example, the manatee (*peixe boi*, in Portuguese) and amphibians, such as turtles, widely sought after for domestic consumption.

The development of agricultural activities, however, by all indications, mainly affected the fertile lands near the riverbanks. These spaces saw an increase in the concentration of certain previously non-existent crops, such as cocoa, since they were located near the cities and colonial towns, areas of older occupation, which suffered a more significant impact. Still, the consequences of European colonialism (until the beginning of the nineteenth century) in the vast spaces of the so-called main-

land, between the channels of the main rivers, remain a subject that deserves attention from historians. All seems to indicate that the expansion of economic activities had a less significant environmental impact on these areas (unless demographic, as stated). As for livestock, large herds were located in specific regions of the Amazon, mainly the savannas (*campinas* in Portuguese).

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Land Use in Mesoamerica in the Colonial Period

Narciso Barrera-Bassols and Gerónimo Barrera de la Torre

The transformations of Mesoamerican landscapes during the colonial period were heterogeneous across this region and of varying intensity during the three centuries of colonial rule. Documentary records exist of the consequences of new forms of land use and exploitation of landscape elements. For example, in 1550, the King of Spain received the report of Viceroy Antonio de Mendoza who was concerned about the extensive deforestation that sapped the mountains around Mexico City (Lira 1990). In contrast, the demographic cataclysm (Koch et al. 2019) suffered by the Indigenous peoples of the region resulted in the abandonment of large agricultural areas with the consequent increase in forest cover. This chapter summarizes the various consequences, factors, and actors that reconfigured the geographies of the region and produced environmental changes globally.

For this analysis, this chapter questioned the main consequences and transformations in land use resulting from the imposition of other ways of relating to nature. To begin answering this question, two lines of discussion are taken into account. The first focuses on the impacts and their origins regarding the colonial model as a turning point in Mesoamerican landscapes through three central factors: ownership, population patterns, and labor. The second examines the emergence of an extractivist spatial model and articulation linked to the new forms of relations with nature, that is, the imposition of dualistic ontologies and epistemologies, which underlie the production of these new land-use geographies. In this way, this chapter outlines some of the main axes by which colonial geography consolidated or, in other words, questions how transformations are densified through 300 years of colonial rule.

Despite the fact that these transformations are part of the long-lasting process by which the human species has profoundly impacted the environment, referred to by Crutzen (2002) as a new geological age – the Anthropocene – the perspective in this chapter seeks to expand this analysis by considering how the colonization of America gave access to resources and cheap labor that enabled the Industrial Revolution, originally considered as the beginning of this era (Lewis and Masli 2015; for a discussion on this in the case of Guatemala, Roda 2023). Based on Moore's proposal (2016), this chapter focuses on the reorganization of land uses as part of the assem-

bly of a planetary ecology where capital, power, and nature converge, as well as a cognitive and ontological organization based on nature/society dualism. This chapter argues that the transformations and reconfigurations of Mesoamerican land use geographies are the foundation of a singular and situated capitalist form. The Capitalocene in this region shows the characteristics of unique historical configurations that broaden the understanding of anthropogenic transformations by incorporating questions of differentiation/social stratification and exploitation that escape the original Anthropocene argument. Interweaving both approaches allows a better understanding of how new land-use geographies quickly impacted a complex and long civilizational project that is now considered Mesoamerica (Roda 2023).

Both the territorial extent and the study period make it necessary to synthesize, through a model, the impacts, factors, actors, and narratives that were variable, even contradictory, and complex. Therefore, this chapter focuses on the consequences of colonization in terms of the densification of landscapes' alterations through the arrival and consolidation of colonial power and on the new colonial narratives and worldviews around nature, evidencing at the same time the changes, concerns, tactics of colonial powers around the environmental havoc generated. Among the significant factors considered are the arrival and expansion of livestock, urbanization, forestry, mining, and road reorganization, as well as the change in land tenure and usufruct. Among the actors, this chapter highlights the metropolitan colonial and Creole or Novohispanic governments, landowners, settlers, and Indigenous and African populations, not forgetting the differentiation processes that already existed in Mesoamerica, crucial to understanding new land uses.

The chapter is divided into two sections. The first focuses on the Mesoamerican civilizational process that characterized specific forms of territorial organization and land use, and on which the colonial model prevailed. Thus, a synthetic examination is made of biocultural co-evolution that generated a diversity of landscapes impacted by this model. The second section, divided into two parts, focuses on land use transformations in the region from case studies. The first analyzes the changes in the forms of land ownership and labor imposed by the Spanish crown in relation to the demographic collapse of Indigenous peoples, new settling patterns, as well as the resistance among different sectors of the population to these new territorial organization models. The second part explores the extractivist model from which new geographies of production and geopolitical configurations emerged significantly transforming the region through the overexploitation of forests, soil erosion, monocultures, livestock, and spatial rearrangement around the extraction of landscape elements. The last section of the chapter discusses the land-use change environmental impacts and the colonial model of human-nature relations as part of the Anthropocene discussion and the origin of the Capitalocene in the region.

Mesoamerica: Imprints of the Future of a Region in the Long Term

In order to understand more precisely the dramatic impacts of Spanish colonialism, this chapter approaches, as its main antecedent, the socio-spatial configurations of the civilizational effort that unfolded in a complex way for around 10 thousand years (Withmore and Turner 1992; 2001). This clash, between multiple ways of constructing worlds and of material and biological contexts, referred to as the "microbial unification" of the world (Crosby 1972; Crosby 1976; Crosby 1988; Nun and Qian 2010; Koch et al. 2019), had profound consequences in ontological, epistemological, and material practices on landscapes (López Austin 1980; Crosby 1994).

First, what is meant by Mesoamerica must be defined. This term was first used by Kirchhoff (1943[2002]), to designate a complex cultural area that, due to its historical-cultural singularities, became a long civilizational process in which the flourishing and decay of its various peoples and cultures, deployed independently, but with contacts with each other, allowed the realization of a common cultural (ontological) substrate. Its unwavering core, as López Austin calls it, focused on milpa-maize, had as symbolic references and shared materials the cult of water (León Portilla 1992; Scarborough 2006), land, and religiosity (López Austin 1999), despite the cultural, historical, linguistic, and ecogeographic diversity (López Austin 2001; West and Augelli 1989).

These three symbolic and material references merge, in diversity, common places in Mesoamerican thought. Maize, a *Gramineae* native to this region, and its milpa agricultural complex, along with about 100 other domesticated plants, characterize Mesoamerica as one of the eight domestication areas of plants in the world (Vavilov 1994; González Jácome 2021). In the absence of mammals as a result of climatic changes and hunting during the Pleistocene (Barker 2006), the civilizational effort of the last 5,000 years focused on horticulture, with maize and the maize-bean-squash agronomic triad being the basis of farmers daily practice, their ways of sculpting their landscapes, and their gastronomy (González Jácome 2022). Around this agricultural complex Mesoamerican thought founded its origin myths and ways of organizing daily life (López Austin and López Luján 2001).

Because Mesoamerica is located in the northern limit of the intertropical strip on the continent, the random and irregular rain that sustained the milpa gave rise to ritual practices shared by its peoples. Mother Earth, the giver of life and fertilizer of maize seeds through the benefits of water, led these peoples to develop a polytheistic religious complex to seek their survival and social reproduction. This Mesoamerican biocultural framework allowed the development of complex societies with urban designs, irrigation, and sophisticated mathematical, astronomical, agronomical, and ecological knowledge systems, which translated in their population growth and geographic expansion (Knight 2002). Even though tensions, disputes, and hegemony existed, as is the case of the Mexica and Mayan empires before the impact of con-

quest and colonialism. When the encounter happened, an estimated 25 to 30 million people constituted the population fuse of this civilizational area, according to recent estimates (Koch et al. 2019: 53). By the number of inhabitants before 1519, Mesoamerica is recognized as one of the most populous regions of the world at the time, which corresponded to 40 percent of America's total population, estimated at about 60 million people (Koch et al. 2019: 17).

Land Use at the Time of Conquest

Whitmore and Turner (2001) studies, based on an exhaustive review of the sixteenth century *Relaciones Geográficas* in New Spain, show the great horticultural complexity of this dense and irregularly populated civilizational area, as the result of heterogeneous ways of inhabiting the region (see, for example, the discussion of the "Mayan collapse" during the Mesoamerican Classic, Diamond 2005; Turner 2010; Ford and Nigh 2022), but which, above all, demonstrate a low to medium impact in localized areas (Martín Gabaldón et al. 2021).

The above demographic estimates, together with those of land use, demonstrate that intensive but diversified use characterized much of their landscapes. Although such transformations, based primarily on human work accumulation (labortasking) rather than sophisticated technological implementation (technotasking) (Scarborough et al. 2019: 214–215), in the absence of metals and working animals, resulted in a complex network of agricultural and agroforestry systems that degraded land in specific locations. Thus, the impacts were not densified to consider them an extended and intensive imprint at the arrival of the Spanish. Therefore, it must be stated that this truncated civilizational process did not contribute significantly to the Anthropocene footprint that one sees today. Neither pristine nor wild lands, nor severe environmental degradation prevailed in the early sixteenth century, and this was the human footprint that the conquerors discovered.

Multiple pieces of evidence about the sophistication of these cultivated landscapes confirm the industrious sculpting of the highlands and lowlands of the region. The Mesoamerican space based on the milpa is shaped by sophisticated hydraulic and irrigation systems (Rojas Rabiela et al. 2009; Sandstrom 2019), such as terraced (Donkin, 1979) and promontory agriculture, both in the highlands (Rojas Rabiela 1995; Sanders 1957; Palerm 1973; West and Armillas 1950; Sluyter 1994), and in the tropical lowlands (Denevan 1970; Denevan 1982; Puleston 1978; Siemens 1983; Turner and Harrison 1983; Fisher 2005; Wilken 1987; Sluyter 1994), as well as rainfed or slash and burn agricultural systems (Sluyter 2021; Withmore and Turner 2001), agroforestry systems or forest gardens (Ford and Nigh 2015), and backyard or family gardens (Gonzalez Jácome 2021; Gómez Pompa et al. 1987; Killion 1992). A thousand-years shaping of landscapes that was far from an empty territory or "*Terra Nullius*" (Gómez Pompa and Kaus 1992; Denevan 1992), as it was described to justify its ap-

propriation, and that offered sustenance to the more than 25–30 million people at the time of the encounter. In Mesoamerica, the pre-conquest use of 1.1 hectares *per capita* is calculated (Koch et al. 2019: 18–20), indicating that an estimated 35–40 million hectares were used intensively in agricultural systems (i.e. 35–40 percent of the area of Mesoamerica). However, unlike what would happen after the conquest, the use of this area was based on diversity, as noted above.

Land-use Actors and Transformation Factors

Land, Property, and Labor: Setting and Implementing Crown Policies

This analysis of land use changes during the colonial period draws from two interwoven processes, the "disarticulation and territorial rearticulation" (López Núñez 2009) and the "expansion rings" (Von Wobeser 1980), through which new models of land ownership and use were imposed throughout the region. This new structure was based not only on land grabbing and wealth sharing, but also on the reorganization of population patterns and forms of social control associated with the territorialization of the state. The land-property-work nexus is critical to understanding the environmental impacts and exploitation substrate that initiates a new era in the region. This historical process is a fundamental part of life's transformation on the planet, at the time that capitalism as a system-world commence (Knight 2022; Moore 2003; Wallerstein 2016; Wallerstein 2017), clearing the way for modernity's geographical expansion and environmental changes (such as carbon levels in the atmosphere, Koch et al. 2019) that led to a new anthropogenic era.

Although the result of this long process stretching over three centuries can be generalized today in terms of large productive units formation: the haciendas, and to a lesser extent, the ranchero model of small ownership, which responded to new logics of supply/accumulation (which we analyze in the next section) and of population (urbanization and territorial segregation), it is necessary to consider the multiplicity and diversity of processes and actors that participated. That is why several authors (Assies 2008; López Núñez 2009) mention differentiated patterns, or "agrarian mosaics," which derive from the trajectories and characteristics of each region and its population. In the case of what is now Honduras, the demographic collapse meant that there was almost no local labor to undertake activities such as mining (Gómez 1999).

Regarding the impact of the Spaniards arrival on the landscapes, evidenced in soil erosion, deforestation (as in the Mixteca, Oaxaca), the Mezquital area (Roa López 2022) and Veracruz (Barrera-Bassols 1994) associated with livestock), and droughts or changes in water culture (Enfield and O'Hara 1999, for the case of Michoacán), one

must consider, in parallel, the differentiated regeneration of vegetation in previously occupied areas between the sixteenth and seventeenth centuries.

Thus, the most significant imprint on land use changes of the first two centuries was due to the concomitant depopulation-regeneration-appropriation process. The first and most dramatic was the demographic collapse of native inhabitants, shortly after conquerors and settlers' arrival. This demographic phenomenon, originated by the conquest wars and slavery, intensified with the arrival of disease-causing microbes unknown to the original inhabitants (the "microbial unification of the world," Crosby 1991), due to their relative geographical isolation, among other factors, or what Crosby (1976) calls "*virgin soils*." Since the arrival of Hernán Cortes in Veracruz and during the next 80–100 years, a wave of epidemics dramatically hit the 25–30 million Mesoamerican inhabitants, decimating their population by up to 90 percent (Koch et al. 2019: 15; Lovell 2020: 9–12, 15–17; Zamora 1982; Smith 2017). It is estimated that, by the mid-seventeenth century, only about 2.5-3 million people resided in the region, including a very small number in the Central American isthmus (Koch et al. 2019: 21). The case of the populations of what now constitutes Honduras is representative, the author mentions the community of Naco that went from 10,000 inhabitants to only ten before the end of the sixteenth century (Gómez 1999). This demographic decline constituted 10 percent of the total world population at that time (Koch et al. 2019: 21). This "human emptying" is considered the most serious holocaust in human history (Stannard 1992; Lovell 2020; Smith 2017).

Secondly, the disarticulation-articulation process, proposed in the context of Michoacán, México, by López Núñez (2009) but replicated in different areas of Mesoamerica, as shown in the cases discussed here, allows an understanding of the relationship between population decline and land seizing from the implementation of encomiendas as a form of taxation and acquisition of labor (Eastmond 1998), to the establishment of haciendas as a *summum* of seizing and economic reorganization of the landscape (García Targa 2006). In this sense, changes in land use were supported by new commercial and supply needs for local populations and the extraction economy. Thus, there was a shift from encomiendas, which settlers did not own, to the repartimiento as wage labor imposed for controlling and, ironically, caring for an Indigenous population subjected to exploitation, disease, and war (Assies 2008).

However, the fundamental change was land titling through *mercedes*, compositions or sales through which legal property was given to settlers and Indigenous chieftains. This meant the legalization of the territory's occupation by the state. After 200 years, this land grab (González Dávila 1999), although it granted some security to the Indigenous peoples, resulted in more than half of the agricultural and pastoral lands of the viceroyalty being given to Novo-Hispanic owners, who obtained full legal recognition of these properties. All this contrasts with the un-

certainty around the possession of lands in the hands of Indigenous peoples or republics (Assies 2008: 34–37; Von Wobeser 1980).

The new territorial structure based on property, which aimed at the production of surpluses to be sold and supply the extractive economy, enforced on the landscapes a series of productive units that broke with previous forms of organization. This atomization, as López Núñez (2009) proposes, was based on agricultural and livestock properties of different kinds that divided the landscape into, for example, caballerías with an area of 43 ha., and "*suerte de tierra*" of 10.7 ha., for the former, and "*estancias de ganado mayor*" of 1756 ha. and "*menor*" of 780 ha, for the latter. Even so, the seizing and change of land tenure throughout the sixteenth and seventeenth centuries is linked to new patterns of settlement, congregation, or resettlement, which aimed at greater control over population and labor. Thus, "*espacios ociosos*" (idle spaces), which resulted from population concentration and demographic debacle, were the first to be appropriated by settlers to extend their control over the territory and move forward with the change in land use patterns (Enfield and O'Hara 1999; López Núñez 2009). Von Wobeser (1980), on a regional scale, suggests a similar chronology of disarticulation, expansion, and consolidation, but shows how this process took place in the form of concentric circles starting in the new Spanish villas. Thus, beginning in Mexico City, it spread northward with the expansion of its productive borders to the tropical coasts or lowlands, mainly in the Gulf of Mexico and on the Pacific coasts southward to Oaxaca, Chiapas, and Guatemala and, finally, southeastward in the Yucatan Peninsula.

The land grab was made in parallel with the territorialization of state control over Indigenous populations, based on segregation through two ways of governing the colony. The creation of the spatially and economically separated republics of Spaniards and republics of Indians, which underpinned cultural and territorial segregation, was all for the benefit of the needs and interests of the crown and the viceroyal government (Levaggi 2001). These internal borders allowed the territorial control, through varied and changing jurisdictional rules, to make tribute efficient, tithing for the church, in addition to the control and usufruct of Indigenous labor and political control of subjugated populations. A new geopolitical and geoeconomic configuration, founded on the constitution of these two republics reorganizing the colonial space, was based on a new urban layout and norms of usufruct of their surrounding lands to sustain the Novohispanic economy (Díaz Serrano 2021).

Thus, the Indian republics were the bastion (although diminished) of Indigenous resistance throughout the 300 years of the colonial period (Suñe and Gómez 1986; De Rojas 2011: 195–210). Nevertheless, granting economic and political benefits, as well as usufruct of the land to the Indigenous nobility increased the conflicts between them and the Indigenous-peasant population, in addition to those struggles with the church, the Novo-Hispanic landlords and, to a lesser extent and very localized, with the Black and mulatto populations. In this context, despite everything,

the tradition of human labor (labortasking), remained current, although frankly diminished, and the ways of land use and uses, according to their own and diverse community traditions.

On the other hand, the republics of Spaniards benefited legally by the viceroyalty and by the crown, and responded to the idiosyncrasies of the empire, its conquerors, and settlers, in addition to those of the peninsular Creoles. Its normative logic reproduced Iberian culture based on power, superiority, and colonial frames. Power and the concentration of conquered land constituted the hegemonic basis for the new usufructs of the land, dominated by the need to own, control, and reproduce the Iberian ways of living. From the latter comes the mono-specialization of land uses, their technologization, and a necessary form of expropriation of conquered land assets. It can be argued that the extractivist (technotasking) and statist mentality motivated this rationality in the socioecological reconfiguration of New Spain during the 300 years of colonialism.

Thus, faced with the demographic emptying of the original population in New Spain during the first 60–100 years of colonialism, it was possible to deploy an economy for local supplying and the appropriation of land now in the hands of conquerors and settlers, based on the expropriation of cheap labor. The sudden absence of original labor meant, in principle, agricultural and food production systems breakdown, maintained for centuries because of human labor (labortasking), with consequent environmental degradation processes in specific locations, especially where agricultural systems required labor intensive work (Fisher 2005). This prompted a second historic event, the arrival of slave labor from Africa.

The colonial authorities of New Spain, faced with the demographic holocaust, promoted with the Spanish crown the arrival of slave hands from Africa. Between 1532 and 1640, New Spain was the main importer of African slave labor on the continent. Between 150 and 200 thousand Black slaves arrived in this colony, mainly from West Africa (Castañeda García 2021; Lovejoy 2000; Palmer 1976; Palmer 1993; Palmer 2005). The arrival of these slaves occurred due to the boom in the mining production of silver and gold for the benefit of the Spanish crown, the need to strengthen the public and domestic work in the New Spain cities and, to a lesser extent, although important, in the production of sugar cane and other plantations, including livestock (Montiel 2005). This also inaugurates a new era in which work becomes cheaper and, as will be shown in the next section, nature also becomes cheaper (Moore 2022: 6).

It is also necessary to mention the influx of people from the Philippines who settled in Colima and Guerrero, who played an important role in the trade routes with Asia through the Manila Galleon docking off the coast of Colima and, in terms of land use, in the introduction of coconut palm and coconut distillate, whose plants spread along the Pacific coast. It was not only the introduction of this plant alien to

the Mesoamerican ecosystems, but the knowledge and uses of coconut that to this day are present in the material culture of the region (Machuca 2012).

All the above mentioned would cause, during the three hundred years of the colonial period, a complex network of disputes over land and its uses. However, these tensions worsened at the end of the colonial period in the eighteenth and early nineteenth centuries when the Indigenous population was restored, albeit timidly, and the general population increased in the region. This is also when the hacienda model consolidated. One case is the example of Lake Cuitzeo Basin region in Michoacán, which López Núñez (2009) examines in detail regarding changes in land use reorganization from the sixteenth to the eighteenth century. Her analysis shows how the phase of disarticulation allowed the settlers to take over the area in less than a century and that by the eighteenth century, a new territorial articulation based on the prevalence of three large spatial organizations prevailed: the hacienda, the *pueblos de indios*, and the city. The birth of the hacienda is due to the decline of the population, the new patterns of population (congregations), and the consolidation of property titles that allowed to expand the seized territory, a process in which the church had a significant role in the region and in other parts of Mesoamerica.

In addition to new ownership patterns for agriculture and livestock, the supply economy rearticulated the territories and land uses through new population patterns. Conjointly with the congregations, urbanism served as a tool of power that allowed the deepening of land grab, with the increase in demand for inputs and the concentration of labor, while rearticulating symbolic spaces and imposing new spatial hierarchies. For example, in the case of the Mayan region, García Targa (2006), shows that the foundation of villas, although with many difficulties, formed a pattern of complete settlement with smaller towns and Indigenous villages. This reorganization not only sought to control a population originally organized in scattered patterns, but the objective of the new grids or layouts of the settlements was subjecting the Indigenous to surveillance, imposing new religious and governing patterns. This social and territorial control imposed "new spatial references, [and a] new architectural and visual hierarchy within the settlements" (García Targa 2006: 295). This "struggle against the ancestral" (García Targa 2006: 301) established a new order based on the centralized and reticular layout, a different view of townships that was also evident in the relation with the environment, particularly water.

The most significant example of this ontological difference is the drying process in Mexico City, coupled with the rapid deforestation of the surrounding mountains (Lira 1990). As Montero Rosado et al. (2022) explain, the transformation of the basin hydraulic cycle from the seventeenth century responds to a perception in which the environment is intervened to meet civilizational needs and not an adaptation to existing conditions.

Resistance and Rebellions in the 300 Years of Colonialism in New Spain

As mentioned, the Indigenous population, Afro-descendant people, and other marginalized groups within the racialized structure of the colony were diminished and subjected to a substantial impact on their social fabrics. Even so, multiple and varied resistances were deployed in their territories facing colonial imposition. This not only explains the permanence of cultural and socio-political forms today in Mesoamerica, but the strength with which these resistances and creative pursuits persist today. The purpose is not to highlight the resistance of Indigenous, Afro-descendants, mulattos, mestizos, and Creoles deployed during the 300 years of Novohispanic colonialism but to record that these countercultural manifestations were intense in density and proclamations. Above all, this resulted in the persistence and hybridization of ways of living and using landscapes that were opposed to the disarticulation-articulation-seizing models examined above. The continuity of this "profound" Mesoamerica (Bonfil 1996) also occurred through hidden discourse (Scott 2000) in everyday life, through linguistic, gesture, and practical manifestations that maintained opposition to Spanish rule.

In this sense, these resistances led to various forms of ethnogenesis through multiple processes of cultural – and biological – hybridization as the original populations had a more detailed knowledge of the enemy, its ways of living, controlling, exercising repression, and administering. In this way, *mestizajes* with very different features of resistance were materialized to resist or negotiate (Boccara 2002: 47–82; Pérez Gerardo 2021). Learning the Castilian language, the use of European weapons, riding of horses, and the knowledge about the monotheistic religion and the military strategies of the viceroyalty gave subjugated populations new skills and attitudes, which amalgamated cultural elements alien to their own ways of looking at their worlds. This was a multifarious mestizaje in radical resistance or negotiation, for alliances and understanding, in search of agreement or autonomy. These forms of resistance, which were called "rebellions" by the colonial government to reinforce the imagination of savages without political project, were deployed in the various regions of Mesoamerica and on the northern borders of New Spain.

For example, on the northern border of the viceroyalty, the political struggles were emblematic as evidenced by the wars of the Tepehuans who faced colonial vassalage. Through a millennialist political sense, the population struggled against Catholic missionaries' subjection – particularly Jesuits, but also Franciscans – in a context where religious claims were intertwined with a rejection of forms of plunder and oppression carried out through slavery and the reduction of ancestral territories (Giudicelli 2002:105-138; Giudicelli 2005). Such ample spaces existed where resistance by nomadic and semi-nomadic peoples violently plagued the colonial incursion (Amaya Palacios et al. 2016). The war of the Mixton with the presence of emblematic leaders and their proclamations added to the so-called Chichimeca War in the New Galicia and the New Biscay territories (Barral 1992: 89–106; Hernán-

dez Barrón 2021). Both bloody and violently appeased by the viceroyalty. These signify the new mestizajes or ethnogenesis of its proclaimers, and rather than ethnic struggles developed as a complex of alliances between various oppressed communities and people. The same happened since the seventeenth century in the tropical Huasteca region, in the Gulf of Mexico (Olvera Charles 2016; Escobar Ohmstede 2023). Meanwhile, within the Novo-Hispanic borders, the struggles against lands and territories plundering manifested itself through the safeguarding of ancestral properties through negotiations (Castro 1996). To give an account of these resistances – some sublime and others manifest – some twenty-five Indigenous rebellions are recognized in Guatemala between the sixteenth and eighteenth centuries (Aguja 1976; González 1994; Macleod 1991; Zamora 1982; Zamora 1986: 197–214); and the same is true in Nicaragua and Costa Rica (Guido Martínez 2019; Solorzano Fonseca 1996; Ibarra Rojas 1991). This is also the case in the Mayan area of Chiapas and the Yucatec peninsula and in the present state of Oaxaca (Ruz 1992; Vos 1994; García de León 1997; Esponda Jimeno 1992; Barral 1992: 179–188; López Bárcena 2007).

On the other hand, the resistances and rebellions of Africans who had recently been forcibly relocated in New Spain, from 1528 until 1640 (Reynoso 2005; Velázquez Gutiérrez 2021: 48–60), were the result of oppressive forms of slavery on sugar cane plantations (Naveda 1987; Von Wobeser 1983; Mota Sánchez 2001; Valdepeña 2020), on livestock farms (Sluyter 2004; Barrera-Bassols 1995; Barrera-Bassols 1996), in mining enclaves (Navarrete Gómez 2021), on construction sites, and at the domestic level on haciendas, and in cities (Aguirre Beltrán 1972; Martínez Montiel 2005; Viqueira y Urquiola 1990; Velázquez 2011; Masferrer 2011; Guevara 2011). The escape from these bloody situations, through Maroonism, uprisings, and rebellions, advanced forms of autonomous political leadership (Martínez Montiel 1992; Reynoso Medina 2005; Ngou-Mve 1994). An account of these harrowing life experiences is given by Bernand (2002: 83–84), through which various forms of resistance and fighting are clearly evident.

This scenario was crucial when the Bourbon reforms of the Spanish crown were promulgated in 1776, envisioned to tackle the decline of the Spanish economy, promoted by the wars with England and with Europe, causing a series of changes in the colonial economies following a liberal approach, which were resisted locally (Rocha Aponte 2011). The deepening economic and social crisis due to Bourbon reforms, translated into conditions of poverty among Indigenous people and castes and their consequent indebtedness and loss of lands (Humboldt 1953; Villoro 1986; Cue Cánovas 2007; Miranda Juárez 2009) was linked to the significant population growth during this period. Between 1742 and 1810, that is, in sixty-eight years, the estimated population in New Spain went from 3.3 million to 6.1 million people, doubling its number in less than a century (Brading 1971).

The varied discomfort of a more culturally diverse Novohispanic society, resulting from mestizaje and the emergence of a growing section of its society, namely the Creole persons, gave rise to a growing pro-independence thinking, whose ideology, Creoleism, founded the idea of a republic for Spaniards born in New Spain and their superiority to the rest of the Novohispanic population. This was a period of renewed resistance and rebellion that would come to favor the advent of independent Mexico. During these years, the provinces of Mexico and Oaxaca alone accounted for more than 120 riots, street attacks, and local demonstrations of discontent, allowing Indigenous people to reaffirm their ability to negotiate with the various colonial officials (Ruíz Medrano 2021: 47; Van Young 1992; Van Young 2006).

The implementation of new ownership regimes and population patterns were the pillars of land uses transformation in Mesoamerica, a reconfiguration that benefited the minority of settlers. This section has shown that the mutually constitutive process of disarticulation-articulation was a generalized pattern, albeit with exceptions, that occurred in the central zone from east to west of Mesoamerica, where the most fertile lands and depletion zones were accumulated and which are now categorized as the areas of greatest environmental impact (González-Abraham 2015). The processes outlined here are believed to denote the move towards a land-use organization model that favored accumulation, surpluses, and territorial reorganization based on land ownership and seizing through the dispossession of Indigenous peoples. Thus, in Mesoamerica, the Capitalocene meant an economic reorganization of the landscape, which goes hand in hand with territorial control and without which it would not have taken place. The continuous process of formation of the state, of its territorialization that manifested itself in social and racial centralization and hierarchization, is therefore definitive in the Anthropocene. With the reconfiguration of landscapes, this chapter now looks at the second pillar that underpinned geography's reorganization in this region, the extractivist model, and its systemic and incremental impacts on the process of globalization of the human footprint.

New Productive Geographies: the Extractive Model and New Spatial Configurations

The new land use patterns were based on an organizational model that favored productive enclaves (such as mines, haciendas, and plantations) and economic integration through roads that connected different nodes for supply and commercialization. The rationale behind this land use model was extractivism, that is, the exploitation of landscape elements as commodities for export. This geopolitical and geoeconomic configuration was important so that, towards the end of the eighteenth century, New Spain, with its more than 6 million inhabitants, was Spain's richest colony, granting more than half of the wealth obtained by the Spanish crown of its vast world empire, that is, two thirds of its net income (Brading 1975; Klein 1984). Just

one example, towards the beginning of the nineteenth century, in New Spain silver production accounted for two thirds on a global level (García Guinera 2015).

Thus, the original accumulation process that sustained the colonial economy, with its vicissitudes, throughout the 300 years of the Novohispanic viceroyalty was founded on the implementation of this extractive model. From the disarticulation-articulation process, with changes in land tenure and seizing, this model could be extended with heterogeneous results due to the biocultural diversity of Mesoamerica. In this sense, three aspects are proposed that are key to understanding the shape of new land use patterns: roads and cities, productive enclaves, and dispersed extractive activities. Regarding enclaves, the focus is on haciendas, plantations, and mining, while we place special emphasis on livestock for its role in consolidating extensive haciendas, but also for being one of the biggest, if not the largest, causes of land use patterns changes.

Urban-Rural Rearticulation: Roads and Cities in the Web of New Land Uses

In this reorganization of land uses, the adaptation and expansion of communication routes, superimposed on the networks of Mesoamerican roads, privileging now the articulation between the political center of New Spain – Mexico City – other cities, the mining, agricultural, and livestock enclaves, and the ports of Veracruz, Acapulco, and Campeche, was crucial in exporting goods extracted from the new colonial borders. Nevertheless, territorial expansion was consolidated through stages of appropriation in small and medium properties (ranches) and large haciendas (Von Wobeser 1989). Domestic supply was fundamental to support the extractivist model and the different demographic and economic crises that hit the colony.

The relevance of roads in the conquest of Mesoamerica peoples is evident in the campaign to control the Petén region, in the late seventeenth century that sought to connect the Yucatán region with the Audiencia de Guatemala. As presented in Arias' analysis (2012), it is necessary to denote the different conception of roads by Mayan people, linked to their worldview and structured in terms of their spatiality comprised in the four horizontal headings of the world. Thus, the hierarchy of paths linked to ritualism shows the "symbolic polysemy" that characterized them (Arias 2012: 205). Instead, Spanish roads were imposed not only to connect the aforementioned regions but to "increase trade between both sites and pacify the mountains" as well as break with Mayan territorial and political organization (Arias 2012: 213–215). The roads, which were constructed differently due to the increased traffic and the use of draft animals, were established following supply points (ranches and *estancias*) as nodes and the Royal Road as a structuring axis. The idea of the road reiterates the distinct ways of understanding the environment discussed here and reiterates how Petén remained an illegible space for colonizers, for whom the roads connected empty spaces.

Following the processes of disarticulation-articulation and concentric expansion, one can understand the changes in the valleys of Mexico and Matlatzinco (present-day Mexico State and Mexico City) and Puebla-Tlaxcala valleys and plains. In both regions, the main cities, Mexico City and Puebla, served as nodes within a pattern that reorganized the occupation of urban-rural lands, although the second had a significant role as a bridge in the interoceanic exchange between the port of Veracruz and Mexico City. Following processes similar to those described in eastern Mesoamerica (López Núñez 2009), in the valley of Mexico between 1570 and 1620, seventy-five royal mercedes were awarded, of which 77 percent corresponded to Spaniards, 16 percent to Indigenous nobles, and only 6 percent to Indigenous communities. In the same years, in the valleys of Puebla and Tlaxcala, the rapid occupation of land between 1570 and 1620 was manifested by the sixty royal mercedes granted both in the highlands and in the low and warm lands (Von Wobeser 1989). The former produced cereals such as wheat, maize, and other grains, as well as for livestock farming of various size. The latter produced sugar cane as was the case with Izúcar de Matamoros, south of this enclave (Prem 1978; Prem 1992; Thomson 1978; Tutino 1976; Chance 2003; Dyckerhoff 1990; Gerhard 1993; Howkstra 1993; Martínez 1994; Gibson 1991; Chevalier 1952; Von Wobeser 1983; Von Wobeser 1987; De la Torre 2013).

Thus, a largely dual agricultural occupation pattern was established, i.e. agriculture in Indigenous communities focused on self-sustaining and local market production and agricultural lands occupied by the Iberians were directed to the colonial and interoceanic market. In the case of the viceroyalty center area, that is, the valleys of Mexico and Toluca, Gibson (1964) concludes that the usurpation of the land had the greatest consequences for that society, due to its aggregate character and concomitant with the demographic and cultural impacts derived from the pandemics, since the land represented a way of exploitation for the Spaniards when the tribute and labor decreased. So, by the mid-seventeenth century, two-thirds of the agricultural land in the valley of Mexico belonged to the landowners.

Examples of this region are the Villanueva family (Barrera Gutiérrez, 2017); the Marquesado de Cortés with an area of 11.5 thousand square kilometers and properties scattered discontinuously in the valleys of Mexico, Toluca, Veracruz, Oaxaca, Morelos, Michoacán, and other regions of central New Spain (García Martínez 1969; García Martínez and Ortiz Días 2022; Jarquín Ortega 1994); and the Hacienda Santa Lucia, administered by the Jesuits from 1576 to 1767, which was constituted as a large farm composed of eight haciendas and already by 1739 had two *estancias de ganado mayor*, 178 sites of *estancias de ganado menor* and 170 *caballerías*, occupying an area of 150,000 hectares (Riley 1973; Konrad 1980; Von Wobeser 1989: 60).

Mining and Forestry

Mining enclaves were one of the main nodes in the reconfiguration of land use in Mesoamerica. They not only disrupted and rearticulated the uses of land adjacent to mines but also generated interregional changes, promoting the intensification and densification of modifications, becoming one of the most important agents of biomass consumption (Studnicki-Gizbert and Schecter 2010) and, therefore, of landscape transformation.

Undoubtedly, one of the most important factors in the extraordinary economic growth of New Spain was mining (Klein 1984). Despite this, agriculture and manufacturing, mainly dedicated to domestic supply, were economic triggers for the livelihood of the Novohispanic population from the seventeenth century. Humboldt notes that the annual volume of agricultural production (approximately 29 million pesos) was higher than mining (23 million pesos). Agriculture, which provided work and food to the majority of the local population, was responsible for most of the viceregal product oriented towards the domestic market, except for the export to Europe of commercial dyes, sugar, cotton, seasonings, and species, which accounted for 20 percent of total exports. While mining – gold and silver – was mainly export-oriented, it accounted for up to 80 percent of the total value of exports in peacetime, or, together with other precious metals, two-thirds of world production (Klein 1984).

In this significant relationship between supplying and commercializing, mines played a significant role in the reorganization of intra- and interregional spaces (Brading 1975; Barrera de la Torre 2013; Sánchez-Crispín 1994). Although mining began in the first decades of colonization (Richard 2003), for example, around Mexico City, Guadalajara, Michoacán, and then in Zacatecas, the significant increase in exploitation occurred in the northern areas, i.e. outside Mesoamerica and in the eighteenth century. However, the continuous increase in mining activity in the north resulted in the intensification of multiple activities in Mesoamerica. For example, supplying food and livestock products connected the Bajío area with northern farms such as Zacatecas or Real de Catorce (Gómez Murillo 2020). Mining enclaves had three main consequences in terms of land use and environmental impacts. The first was the reorganization of land use around mining centers in terms of population through congregations and urban tracing (Covarrubias 2019; Blackwell 1976; Brading 1975), as well as the establishment of agricultural, livestock, and *haciendas de beneficio* (smelter). The second was the intensification of supply chains from distant production centers that used roads networks, such as the Camino a Tierra Adentro, hence these enclaves were not isolated "but formed networks of complementary socioeconomic relations, coupled with a relative productive specialization that was integrated through inter- and intraregional exchanges" (Barrera de la Torre 2013: 119).

Finally, one of the most significant landscape transformations due to mining was deforestation. It is considered that between 1558 and 1804, 315,642 km^2 were

deforested for silver mining. However, it was during the seventeenth century, the most important in volume and intensity, that 70 percent of this area (223,765 km²) was cleared (Studnicki-Gizbert and Schecter 2010). These areas close to mining complexes should include land clearing for coal extraction for daily use by the populations and other activities not directly associated with mining, which have been calculated in an area of 76,000 km² (Studnicki-Gizbert and Schecter 2010). The calculation is higher if we associate other types of mining such as copper, which focused on the current state of Michoacán, which increased the population of smaller livestock in the forests, as well as extensive logging (Covarrubias 2019). However, it is important to consider that such deforestation was selective, that is, defined by factors such as proximity to mines and its impact depended on the characteristics of each place (Barrera de la Torre y De la Torre Villalpando 2022). In addition to deforestation, soil contamination has been reported in the surrounding mining areas that have rendered them barren (Avalos-Lozano and Aguilar-Robledo 2017), and air pollution caused by the dissipation of mercury used in the amalgamation process has been calculated, between 1568 and 1816, in 38,882 tons released into the atmosphere (Studnicki-Gizbert and Schecter 2010: 372).

Mining was the main factor in transforming the vegetation cover in Mesoamerica, but it was not the only activity that put significant pressure on forests. Numerous activities such as the distillation of alcohol, *trapiches* (mills) in the processing of sugar, land clearing for livestock, and the construction of cities were highlighted by colonial officials responsible for enforcing related forest conservation laws (Barrera de la Torre and De la Torre Villalpando 2022). These legal instruments were variously implemented and underwent many modifications throughout the colonial period, with regional expressions differentiated because of the diverse Novo-Hispanic geography. During the colonial period, the first steps were taken towards forest plantations, for example, the dye stick on Cozumel Island.

On the other hand, one of the areas of important forest exploitation due to the type and volume of trees required was carried out by the Royal Navy which, in Mesoamerica, focused its exploitation on the mountainous areas of the Gulf of Mexico and the Isthmus of Tehuantepec for the construction of ships, especially for masts (Reicher 2019; Valdez-Bubnov 2012).

Finance and Livestock: Consolidating Land Grabbing in Mesoamerica

Haciendas as a production model for supplying and commercializing reorganized large-scale land use in Mesoamerica. The productive specialization of this type of property, with similar features inherited from feudal Iberian property systems and introduced by settlers (Chevalier 1952; Von Wobeser 1989; Nickel 1978; García Martínez 1994; Florescano 1975; Nickel 1988; Simpson 1952; Semo 1977; Van Young 1981; Menegus 2015) has been characterized by Gisela von Wobeser (1980), according to its productive, sociotechnological, and spatial distribution in the viceroyalty. She

builds on the work of Nickel (1978) to define the characteristics of this productive economic model, whose structural uniqueness was the result of, first: 1) domination or seizing of natural assets (water and land primarily); 2) domination over the labor force (Indigenous and Black primarily); and 3) domination over local and regional markets. And, in the second, the hacienda (a) specialized (according to its geoecological location) in products (technotasking); (b) in the amount of its production; (c) in the origin of capital; (d) in the lease; (d) in the absenteeism of its owners; (e) in the degree of its economic self-sufficiency; (f) in self-consumption; (g) in the division of labor; (h) physical infrastructure; and (i) in agricultural techniques.

Within the great variety of ways in which haciendas manifested this chapter is interested in highlighting some of its characteristics, included in the following table (Table 1), that resulted in the reorganization of land use patterns. It must be considered that the consolidation of this productive model occurs in the eighteenth century, but as we have mentioned, it was part of a concomitant process of disarticulation-rearticulation and concentric expansion in the region.

One of the most significant environmental phenomena since the conquest of New Spain and the colonial period, especially during its first 100 years, was the exceptional arrival of livestock, both large (cows and oxen, horses, mules, and donkeys) and small (pigs, sheep, sheep, and goats), which had explosive population growth, epidemically, in "virgin" territory (*virgin soils)* (Crosby 1976) due to 1) the absence of predatory mammals, massively extinct during the Pleistocene (Crosby 1991; Barker 2006), 2) the emptying of landscapes due to the demographic collapse of the Mesoamerican population, 3) the abundance of food (grasses, forests and jungles, water and salt) (Butzer and Butzer 1993), and 4) the long history of Iberian transhumance (Jordan 1989), and the animals adaptation in the Antilles for almost thirty years, starting in 1492, before its arrival in New Spain (García Martínez 1994; Perezgrovas 2020). Since their arrival and during the sixteenth century, the growth of these herbivores was inversely proportional to the Mesoamerican holocaust, colonizing the landscapes in an accelerated manner, both in the tropical lowlands and in the highlands and mountains (Barrera-Bassols 1995; Aguilar-Robledo 2001). Thus, cattle raising was the main trigger for rural reorganization during the colonial period, as Chevalier (1952) points out, and the consolidation of the hacienda as a socioeconomic model in New Spain.

Tab. 1: Haciendas: Reorganizing Land-Use Patterns

Type of Hacienda	Physical Conditions	Location	Water and Land Requirements	Investment	Type of Infrastructure	Supply and/or Export
Sugar	Tropical lands, mainly in the lowlands, but also in the central highlands	Current state of Morelos, in the center of Veracruz, in Michoacán, Oaxaca, and in enclaves of Jalisco and Puebla. Yucatan Peninsula	High	High	Hydraulic works (aqueducts, canals, ditches, and ships), churches, the factory itself or mills, and trapiches, offices, the hacienda, bedrooms for peonage and the corrals.	For much of the sixteenth century production was exported, but at the end of the century, such exports were banned, and their production was restricted to the demand of the viceroyalty itself
Cereals	Temperate climate of the central and southern highlands of Mesoamerica	Mexico and in the Toluca Valley, around the city of Puebla-Tlaxcala, later in the Bajío and in Oaxaca	High	High	Church, bedrooms for peonage, silage, pens, and company store	Supply for the main cities of New Spain
Livestock	From tropical lowlands, to temperate mountains and semi-desert areas	Lands surrounding the Gulf of Mexico with some enclaves in the Yucatan Peninsula, Chiapas, and all of Central America, and in the central highlands, around the cities of Novohispanica	High	Low		Internal supply of the colony in mines, in construction sites in addition to the export of fur to Spain
Pulquera	Semi-arid areas of the highlands	Surrounding cities of Mexico, Puebla, Queretaro, and Tlaxcala	Low	Low	Hacienda, bedrooms for the peonage, a company store, pulque barrels, and a parish	Supply for the main cities of New Spain.

Source: Authors' own elaboration.

In summary, this unusual ecological phenomenon had important consequences on the occupation of rural and even urban space (Aguilar-Robledo 2001; Chevalier 1952), on land grabbing (García Martínez 1994), on the reorganization of land uses, on forms of property and the agrarian structure (Chevalier 1952; Matesanz 1965), on Novohispanic legislation (Ruiz 1991; Miranda 1944), and on accelerating disputes between farmers, the viceregal government and Indigenous peoples (Melville 1990; García Castro 1999, Matazens 1965: Martinez 1994). The most significant consequence of cattle raising and pastureland expansion in New Spain was its role in the origin of haciendas and *latifundios*, together with the enclaves of sugar and cereals, causing localized ecological degradation, in some cases, severe (Simpson 1952; Von Wobeser 1989; Butzer 1992; Melville 1997; Butzer and Butzer 1997; Brand 1961), and promoting land grabbing, cheap work, and monetary gains.

Due to the transhumance nature of livestock herds (Jordan 1989), measures were required to curb the destruction it caused in urban and rural areas. For example, in the central valleys of Mexico and Toluca, there are records of destruction caused by cattle, mares, and pigs in cornfields and, in general, in agricultural fields and even in the houses of Indigenous peoples since the mid-sixteenth century (García Martínez 1969: 140; Matesanz 1965: 561; Chevalier 1952; Gerhard 1992: 158, Martínez 1992: 263; Perezgrovas 2020: 205). Also, Melville (1990; 1997), demonstrates the socioecological impacts due to the growth of an extensive number of sheep in the Mezquital Valley, north of the current state of Hidalgo, causing the overexploitation of their pastures and generating a severe soil erosion. Although the results of this study have been discussed considering other factors such as droughts (Hunt 2009; Hunt and Sluyter 2011; Sluyter 2015), similar impacts caused by overgrazing in other regions of the state of Hidalgo during the eighteenth century have been noted (Riley 1976: 248). Finally, in 1609, a Dominican friar who visited the town of Cempoala, north of the port of Veracruz, wrote about the effects of cattle. Overgrazing and the excessive use of burning or arson for the regeneration of pastures had degraded the landscape, which the friar described as "lost" (Barrera-Bassols 1995: 57).

Discussion and Conclusions

What has been outlined here, summarizes, in a general, yet still provisional way, what happened in terms of land use changes during the colonial period in Mesoamerica. The Spanish conquest, in this case, brought about a radical transformation not only in this region but throughout the world and imprinted as a result new ways of ordering the world, both geopolitically and ecologically.

These colonial structures translated into ruptures that are still debated today. On the one hand, given the demographic holocaust resulting from the military conquest and as an epidemiological consequence, a climatic change was initiated that man-

ifested in Europe as the "Little Ice Age" and generated a unique increase in deaths for a short period. All this is caused by vegetation cover regeneration in the absence of human work and, consequently, an increase of CO_2 sequestration from the atmosphere and reduction in average temperatures in Europe. Fewer humans, increased forest cover, and, as a result, another demographic holocaust. A planetary demographic history. Some die in the face of war, epidemics, and the drastic breakdown of forms of human existence, and others die far away due to the emptying of populations in the "New World." This inaugurates the ecological impacts of the human footprint caused by the emergence of the Anthropocene. That is why humans become a physio-biological force that will ultimately determine and transform the planet's metabolism, and the emergence of the ecological and civilizational crisis being experienced today.

But from another spectrum, the "encounter" produced and has produced another world, another planet. A place where emerging social and geopolitical relations became a new ecological world focused on widening inequalities to favor the needs of empire. Resulting in the advent of a new world-ecology focused on the accumulation by plunder of these other truncated realities, namely the Capitalocene. For this transformation to accelerate with the Industrial Revolution, the necessary resources, energy, accumulated wealth, and labor were extracted from the colonized territories. Land use changes in colonial Mesoamerica reflect this. On the one hand, ethno-historical evidence in the region refutes the sudden regeneration of vegetation caused by the Indigenous holocaust due to the sudden colonization of the lands. The colonial need to supply goods to the crown and the establishment of a new geoeconomic order demonstrate that the sudden regeneration of the natural conditions of landscapes and territories was neither homogeneous nor lasting, in the face of African slaves' arrival to make up for the absence of Indigenous labor and the presence of millions of native inhabitants scattered in the various geographies of New Spain. The process of deforestation of thousands of square kilometers to supply energy to the mines, trapiches, and the new towns energy needs signals a diverse process of plant regeneration and deforestation, depending on each location and throughout the 300 years of colonial life.

How much did New Spain contribute in its Mesoamerican area to CO_2 sequestration and average temperatures decrease in Europe? It is still difficult to verify, but the sudden demographic decline of Mesoamericans in the region and its ecological, cultural, economic, and political consequences during the first 100 years of colonialism are already more precisely known. One can synthesize land use changes from diametrically opposed ontological, epistemological, and practical points of view. First, the conquest and colonial time as an imperial project involved the historical breakdown of relational ontologies, which organized the Mesoamerican world under assumptions of interrelationship between humans, non-humans, and more-than-humans. For the polytheistic societies governed by sacred and material criteria there

was no such separation between the profane and the sacred. These symbolic frameworks – as diverse as cultures deployed geographically and historically – organized culture-nature relations as a single ontological dimension, linking the sacred with the profane.

In contrast to those ways of world making by the "savages," a dualistic ontology focused on the superiority of the human (the white and Christian man) was imposed, under an ideology that separated (human) subjects from nature as an inanimate object, in the service of the empire for exploitation. This fragmentation became a way of operating the symbolic and material assumptions to organize colonial life, extractivism, and dispossession. This dualistic ontology allowed the normalization of looting and original accumulation through the legalization of property titles and the Catholic and monotheistic religion imposition that had consequences on the ways land use changes were conceived and deployed. There are two crucial aspects we have noted in this regard. The imposition of an engineering and technocratic gaze (technotasking), in the face of the dense and prolonged shaping of the landscape through human labor (labortasking), which had allowed the maintenance of agrodiversity (biocultural diversity) through sophisticated agricultural and agroforestry systems for the daily livelihood of its sculptors. Regardless of this, the engineering vision, imposed sugar cane plantations, monoculture, extensive livestock, lake drying, mining, and deforestation as ways of obtaining goods for the gain of a few.

The arrival of new crops and animals, together with their associated techniques, seeds, and knowledge, undoubtedly enriched the already vast Mesoamerican agrodiversity. But this also generated impacts on the landscape, as mentioned in several studies about soil erosion caused by goat and cattle farming, mainly. The demographic holocaust during the first 60–100 years of the colonial period, land grabs by landowners and mining companies promoted by various colonial institutions such as encomienda, reductions, and tributes, undoubtedly reduced and eroded Mesoamerican agrodiversity by widening monocultures, deforestation, and livestock activities. Still, the cultivation of milpa and the genetic stock of its main cultivars survived, especially the maize-bean-squash triad in the Indian towns and republics. This is due to a regional economy that required these products to cope with supply needs, impossible to reach through overseas import of goods and products.

As it is referred to here, the intensification of land use changes allowed the rapid colonization of lands surrounding new towns according to the nutritional requirements of Spaniards, Indigenous slaves, and Africans in plantations, mines, cities, and livestock farms. In this way, this intensification took the form of rings starting from the cities or towns and going to the peripheries, thus extending the borders through land grabbing and promoting the reorganization of extensive livestock to these peripheries, and stimulating intensive agricultural enclaves near urban or

mining centers. This process reorganized the Mesoamerican territories in a complex and varied process of deterritorialization, now in the hands of the new occupants with the benefit of the vice royal administrations, the administrative organization of the provinces, the establishment of Indians and Spaniards republics for the purposes of population control and tribute, and with the support of the Spanish crown, in need of resources in the context of a beleaguered and contentious European theater.

Indigenous and African revolts, rebellions, and wars escalated after the Bourbon reforms, beginning in the last third of the eighteenth century, and increased their virulence until independence in the early nineteenth century. These resistances and wars expanded beyond the old Mesoamerican borders, both in the northern provinces of New Spain and in Central America. The resurgence of these political demonstrations was because these reforms entailed the end of the Indian republics, accelerated tax growth, the increase of latifundios via the consolidation of the hacienda, the arrival of foreign companies and the expansion of mining, and new taxes on the church that were accompanied by recurrent droughts in a territory with a growing and mostly dispossessed population.

Thus, the change of land use in New Spain during its 300 years of colonial existence is a reflection, a symptom, of the radical transformations that occurred during the ontological, epistemological, and material breaks. This chapter has synthesized here the symbolic and material bases of accumulation processes through plunder, dispossession, and extractivism, which elucidate the Anthropocene emergence, and the socio-ecological consequences of the Capitalocene's abrupt establishment.

Reading land use changes in New Spain's Mesoamerican area, allows one to debate whether it is humans in general, as a physical-global force, that have led to the breakdown of planetary metabolism, or whether, on the contrary, it is the socio-ecological systems imposed by minority groups of global society, that have imposed the metabolic breakdowns deployed during the last 500 years. Humanity or some humans? This chapter has shown how changes in land use are inherent in this metabolic breakdown, which focuses on making resources and labor cheap and advancing accumulation. This has also had indelible effects on the landscapes of the region to this day. However, from the historic and densely shaped landscapes of age-old Mesoamerica, communities struggle to find new ways to reinterpret Capitalocene's heritage.

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Land Use in the Caribbean in the Colonial Period

Plantations and Livestock on the Islands

Leida Fernández Prieto and Reinaldo Funes Monzote

Defining the Caribbean is a controversial issue that has much to do with different historiographical traditions and disciplinary approaches. The sea that gives it its name is bordered by the arc of the Antilles and the territories of Central America, Yucatan, and northern South America. Thus, to speak of the region without including the continental areas may offer a limited perspective. However, for many scholars, Caribbean belonging has more to do with the shared experience of slavery and plantation in the islands than with any other socioeconomic process that has taken place there (Moya 2007). Its territories can also be encompassed by the geographical concept of the Antilles Archipelago, which includes most of the islands in the Caribbean Sea (Palmié and Scarano 2011).

For the purposes of this chapter, the focus will be on the insular Caribbean with the aim to analyze the main land uses after the Spanish conquest until the beginning of the nineteenth century. Located on the Caribbean plate, the region comprises the Greater and Lesser Antilles – to which are usually added the Bahamas group and the Lucayas archipelago – the north of Cuba, and Hispaniola (therefore outside the Caribbean Sea), as well as Trinidad and Tobago and the islands north of Venezuela. This totals to an emerged surface of more than 7,000 islands, islets, reefs, and cays with an approximate extension of 234,000 km^2, representing less than 8 percent of the total area of the Caribbean basin, not counting the Gulf of Mexico. Therefore, the interaction of land and maritime zones is a central element in researching Caribbean societies.

The region is considered a space with its own geographic, economic, political, and cultural characteristics, which make it exceptional in world history as the starting point for the European colonization of the New World and the consolidation of the capitalist system. Therefore, if 1492 is adopted as the date of the beginning of the Anthropocene, its study becomes even more relevant. Although most of the islands have favorable conditions for agriculture or livestock farming, there are many local specificities between them. Rainfall is one of the most important factors affecting crop growth. In correspondence with its tropical and subtropical climate, two well-defined seasons can be identified: the rainy and the dry. But the duration of both

depends on factors such as their location within the Caribbean and their relief. The northern and eastern sides of higher elevation receive more precipitation than the southern and western slopes. Rainfall in the mountainous areas fluctuates between 1,500 mm and 2,500 mm as an annual average, although in some localities, it may be higher. On the other hand, on the islands with lower altitude and in lower areas, rainfall can be between 750 mm and 1,000 mm. Likewise, the size of the islands and seasonal rainfall caused by other effects such as convection have an influence.

The existence of two well-defined rainy and dry seasons played an important role in land use according to the period's technological conditions. The rainy season was more closely linked to the sowing season and the dry season to the harvesting of crops. Similarly, during the rainy season, livestock yields increased for meat and milk production. Other decisive factors included the proximity to the coasts for international trade, the relief, and the size of the islands. In any case, the location in the tropical zone has meant that most of the nutrients are found in the vegetation and not in the soils, where the decomposition of organic matter is faster than in other latitudes.

Christopher Columbus described the islands' lush, green, and fertile vegetation. It is estimated that approximately half of the region's forest cover corresponds to tropical and subtropical dry forests, which also boast a higher density and diversity of birds. Several types of tropical and subtropical humid and rainy forest are also represented, especially in mountainous areas. In turn, the soils' local characteristics influence the types of vegetation, based on their capacity to retain moisture. For example, the composition of savanna or natural grassland vegetation has more to do with soil types than with climatic conditions (Newson and Wing 2004: 20).

In the insular Caribbean, ferralitic soils and tropical podzols predominate, but over time the disappearance of the original vegetation has caused a marked loss of nutrients. These processes tend to be more pronounced in mountainous areas. It should be taken into account that about 75 percent of the Antillean territory is made up of mountains or elevations of different heights. Flat landscapes predominate only in Cuba, the Bahamas, Barbados, and other small islands in an inverse proportion. On the larger islands, some areas have alluvial soils, while in the smaller Antilles, volcanic soils can be found.

Before 1492, there was already ancient land use in the Antilles from the Amerindian communities' different waves of settlement. The first groups arrived on the islands from Central America to the Greater Antilles and from South America to the Lesser Antilles around 6,000 – 7,000 BP. From this period until about 2,500 BP, small communities were dedicated to gathering, hunting, and exploiting the marine environment without practicing agriculture. Then, the arrival of Arawak-origin ceramic groups from the Orinoco and other South American basins began; they lived in circular villages around a central plaza and practiced agriculture.

These communities and the subsequent migratory flows led to the formation of more complex societies, in which social stratification increased and agriculture intensified, although fishing still prevailed as a source of animal protein. The popular name given to these cultures, which inhabited a large part of the insular Caribbean prior to the 1492 encounter, is the Taíno and their nucleus, also known as Classic Taíno, was located on the islands of Hispaniola (Haiti) and Puerto Rico (Borinquen). Within the migrations of ceramic peoples, various arrivals of groups known as Caribs occurred, who have been characterized as more aggressive or warlike. Part of them began arriving in the Lesser Antilles from 700–800 BP, while another migration stream occurred around 1,300-1,400 BP from areas of present-day Colombia to the Greater Antilles (Morgan 2022).

With the Taíno, a more intensive agriculture emerged, contributing to the displacement of their settlements towards the interior of the islands. Ceramic groups from South America introduced a wide variety of food plants, especially fruits such as guava, papaya, soursop, and pineapple, but also other crops such as peanuts, pepper, sweet potatoes and tobacco. However, the most valuable plant was the cassava or manioc. Although it may have been introduced earlier, it was these groups who turned it into the most important staple food in their diet through the production of *casabe* (cassava bread). Several authors have emphasized the central role of cassava in Taíno horticulture, thanks to its high caloric value – three times greater than corn –, resistance to droughts and hurricanes, high yield, and the possibility of harvesting it year-round (Reynoso 1881; Sauer 1992).

The ceramic groups practiced the planting of their basic crops in polycultural *conucos* (small plot agriculture). One of the most praised techniques was the *camellones,* where soil and organic matter were accumulated for planting and which constituted a kind of permanent food store all year round. The riverbanks were among the most productive areas, and at the same time, water storage and irrigation techniques were used to cope with droughts. Forests were burned to establish cultivation areas but in a controlled manner that allowed the restitution of soil fertility. A fundamental difference with post-1492 land use was the non-existence of large domesticated mammals that would demand the opening of extensive pastures. Ceramic groups of the insular Caribbean domesticated terrestrial animals such as the *perros mudos* ("dumb dogs" so named for their inability to bark) and rodents such as guinea pigs, but their main source of protein came from fishing and marine resources (Morgan 2022).

After the Spanish conquest, newly introduced diseases, forced labor of the Indigenous people for gold mining, and violence led to the demographic collapse of the native populations in most of the insular Caribbean. Only small nuclei of Caribs survived in the Lesser Antilles, other parts integrating with the European colonizers and enslaved Africans in a long process of *mestizaje*. One of the consequences of the population decline in the Antilles was the natural reforestation of areas that had

been dedicated to agriculture, which may have contributed to the recovery of soil nutrients due to the cessation of grazing (Watts 1992). But at the same time larger and larger areas began to be deforested to make way for the new biota introduced by the colonizers.

The following pages focus on the evolution of farming and ranching practices from the beginning of European colonization until the early nineteenth century. Slave plantation agriculture was the most prominent element, whose long-lasting effects and legacies of colonialism led to the successive deterioration of ecosystems. Sugarcane, introduced by Christopher Columbus on his second voyage, was the most important crop, described as green or white gold when converted into a final product. During this period, other cash crops came about at different times, such as tobacco, ginger, cotton, or coffee, but none on the scale of the first. The reason for this was its agro-industrial character given the need to process the raw material in the fields to obtain sugar.

The plantations had a greater impact in terms of land use. However, if the Antillean archipelago is taken as a whole, it can be seen that most of the land was still covered by tropical forest, whether dry or humid, or dedicated to extensive cattle raising, conducted also to a large extent in the interior of the forested areas. This has to do with the fact that the classic plantation system began on some of the smaller islands of the Lesser Antilles in the mid-seventeenth century and, in the eighteenth century, spread to larger areas on the islands of Jamaica and the western half of Hispaniola. But on these two islands, and especially in Cuba, there were still extensive territories dedicated to other uses. Therefore, in an overall view of the region, plantations and sugar were not yet the central components of the landscape. Rather, the landscape was characterized by the forests and extensive cattle ranching of Cuba, Santo Domingo (in the east of Hispaniola), and Puerto Rico, whose combined area represents approximately 72 percent of the area of the insular Caribbean.

The *Hatera* Society in the Hispanic Insular Caribbean

Mainly coming from the Iberian Peninsula, with a long and powerful cattle-raising tradition, the Spanish colonizers were concerned from the beginning with the introduction of large domesticated mammals. In the second expedition organized by Columbus to the new lands, a few horses and pigs were transported. The following fleets were joined by horses and cattle shipped from Andalusia, together with sheep and goats from the Canary Islands. It is estimated that in the early days there was a preponderance of sheep in these shipments, in accordance with the livestock policy of the peninsula that favored the *Mesta*. But the species' difficulty adapting to the Antillean climate, together with the low demand in the local market, deepened the preference for porcine, equine, and bovine species. The rapid proliferation of these

domesticated animals in the Antilles made it possible to cover the domestic demand in Hispaniola and other Caribbean possessions in a short period of time. Additionally, it provided an economic alternative when gold mining began to decline in the second decade of the sixteenth century (Río Moreno 2012).

Since then, livestock began to be one of the most viable activities for the economic life of the Antillean colonies. On the one hand, the decline of gold mining in Hispaniola and its scarcity in other islands, along with the migration of many settlers to the mainland possessions, made it necessary to look for other sources of income. On the other hand, the multiplication of cattle offered the opportunity to take advantage of their excellent adaptation to local conditions with little labor. Thus began a "cattle cycle" that became the hallmark of the Hispanic Caribbean until the beginning of the nineteenth century, even during the commercials booms of crops such as sugar, tobacco, and ginger.

The rise of cattle raising in Hispaniola is linked to the need to supply meat to the local market and the provision of animals for the conquest of the continent. But as both demands were met, a need arose to find more viable alternatives. Among these were the export of hides to the metropolis and European markets, the supply of traction power to the nascent sugar plantations, and food. Over time, the contraband trade with subjects from other powers that began to arrive in the Caribbean acted as another major stimulus maintaining the cattle economy. Towards the end of the 1530s and the beginning of the 1550s, annual production of hides is estimated at over 30,000 units per year (Río Moreno 2012: 203).

In the second half of the seventeenth century, there was a drop in cattle numbers in many territories of Hispaniola, influenced as well by smuggling and the activity of the buccaneers that prowled the Caribbean. As a consequence, there was a shortage of meat for the colony's population and it became necessary to adopt measures for livestock recovery. With this objective in mind, the slaughter of cows and their calves was frequently prohibited, and a registry was created to prevent the inclusion of female cattle in the leather trade. Even in 1580, a more drastic measure was adopted by the Council of the Indies at the request of the town council of Santo Domingo to suspend the slaughter of cattle for a period of six years (Río Moreno 2012).

The sugarcane plantation boom from 1518 to the 1570s represented an important demand for cattle and other livestock. Breeding was a source of accumulation that made it possible to invest in the sugar agroindustry, but the most important thing was its complementary nature. The mills required a constant supply of oxen to move them and the wagons that carried raw material to the factories or the final product to the shipping ports. There was also a high demand for meat to provide for the *dotaciones* (enslaved labor force in the mills).

Cattle ranching in the Hispanic Antilles had its ups and downs during this period, but it remained the predominant land use in most of its territories, especially those farthest from the centers of colonial power. The chronology may vary from case

to case. In Puerto Rico, three phases of colonization can be identified between the sixteenth and eighteenth centuries; the first, from 1508 to 1542, centered on gold mining with *encomienda* and Indian slavery; the second, from 1540 to the mid-seventeenth century, saw the sugar mill prevail with African slave labor; and the third, from 1660 to 1770, experienced the rise of the *hatera* (cattle ranching) economy based on a mixed labor system of slavery and peasant servitude (Moscoso 2020).

Similar processes took place in Cuba. From the beginning of the seventeenth century to the 1680s, there was a boom in the sugar agroindustry in the territories near the town of Havana, followed by a period of increased tobacco cultivation between the end of that century and the first decades of the following one. But this in no way signifies the decline of the cattle herds, which provided animals for both activities and above all to supply the oxen for the mills and wagons, as well as meat for the dotaciones. The sugar mill owners used to be part of the hatera aristocracy, and even the owners of tobacco plantations and mills appear among the major cattle owners. Most of the island was divided up for cattle raising in lands granted by the *cabildos* (Spanish colonial municipal unit) from the middle of the sixteenth century, while cultivated areas were concentrated in small areas around the main towns. From 1729, the Spanish crown sought to put an end to the cabildos' land distribution, but the practice continued for several years amid conflicts with the town councils (Balboa 2013).

Land grants in Cuba were ratified and regulated by means of the *Ordenanzas de Cáceres* in 1574, which established the concession of two leagues of radius for large cattle herds and one league of radius for small cattle corrals. The equivalence to the metric system reveals the great extension of these units: 226 km² for the former and 56 km² for the latter. This is an ideal measure that was rarely complied with, but it reflects the degree of land concentration on the part of the authorities that used to control the cabildos. Over time, there was also a tendency to create mixed units for large and small livestock.

The distinction between herds and corrals had to do with the differences between free-range cattle and swine systems. The herds used to be linked to the existence of open land, known as savannahs, whether of natural or anthropogenic origin. This does not mean that the entire extension of the *haciendas* had these characteristics, in fact wooded areas were predominant. In the rainy season, the open spaces were key for the *rodeos*, the time when the animals were gathered for the little attention they received each year. Some of the activities included counting, branding, or curing, taking advantage of the greater availability of natural pastures. On the other hand, during the dry season, the animals could enter the wooded areas to feed on fallen or foraged fruits.

Although it is not possible to go in depth into the land occupation by the Hispanic Caribbean hatera society, some of its peculiarities can be noted here. First, this occupation was part of a concept that included the community of uses of mountains,

waters, and pastures, according to the Castilian peninsular tradition. For this reason, there were tensions from the beginning between the private use of the land by the beneficiaries of the grants and the royalist precepts that considered these grants as a usufruct of the crown. These interpretations were in conflict until 1819 when full private ownership of the old grants was accepted (Balboa 2013).

Regardless of the common uses, herds and corrals evolved in two main directions. Due to the opportunities for accumulation made possible by the system of the Spanish treasury fleets that landed in Havana from the 1540s on, the cattle ranches (*haciendas*) in the west were controlled by the most powerful individuals, with some even owning several such ranches. On the other hand, in more distant territories, many of these original haciendas tended to be subdivided by inheritance or sale, giving rise to what was known in the nineteenth century as *haciendas comuneras*.

Without fences, these divisions were virtual. Instead, they were constituted by a right of use based on the individual *pesos de posesión* within the community. In this way, common use of pastures, watering places, and forests remained. The *hacienda comunera* system had less weight in Puerto Rico since the beginning of the nineteenth century, but was preserved in several territories of central eastern Cuba until that century's end and in the Dominican Republic until the first decades of the twentieth century. A large part of their territories was covered with forests, such that logging was one of the most widespread activities within the original cattle ranches.

These haciendas were subject to limitations such as the obligation to supply the internal market of the cities through the *rueda* or *pesa* system. At the beginning, this system functioned without major setbacks, but as the population increased and new possibilities for agricultural activities opened up, it was seen as an onerous burden for the farmers. Another restriction for the cattle ranches in Cuba was the preferential right granted to the Spanish Royal Navy for the exploitation of their forests, with the aim of guaranteeing the supply of wood for shipbuilding in Havana (Funes 2008).

The rise of the hatera economy and society based on free breeding connects also to the trade of contraband with other European powers that occupied Caribbean islands since the mid-seventeenth century. Many of the inland cities in the Hispanic Antilles and its regions prospered in the heat of this illicit trade that compensated for the limitations of the Spanish commercial monopoly of Atlantic traffic through a single port. This monopoly prevailed until the first openings in 1765 and the commercial liberalization within the empire that started in 1778. Until then, smuggling was a determining factor in the extensive cattle ranching of the Hispanic Antilles, and this, in turn, was key to the success of the foreign colonies' plantations (Giusti 2014).

The existence of cattle ranching, logging, or smuggling does not imply the absence of cash crops in the insular Hispanic Caribbean. In fact, it can be said that the American slave plantation had its beginnings in Hispaniola. The early decline of

gold mining led the Spanish encomenderos to start growing sugarcane in the area of present-day Santo Domingo, where the plant was introduced to America in 1493. From there, sugarcane expanded to other islands of the Hispanic Caribbean and the mainland. In 1515, the encomendero Gonzalo de Vellosa founded a horse-driven cylinder mill on the banks of the Nigua River, hiring Canary Island technicians and employing slave labor (Rodríguez 2012).

Thus, commercial sugar agriculture burst into the New World following the model of the Atlantic plantations of the Canary Islands, Madeira, and Sao Tomé. In 1517, Seville received the first shipment of sugar from Hispaniola. In this first stage, the *trapiche* referred to mills powered by animal power, while the *ingenio* referred to those operated by hydraulic power. In 1535, Santo Domingo had more than 30 ingenios and just as many trapiches, some employing 100 African slaves or more (Rodríguez 2012). In Puerto Rico, the first sugar boom occurred between 1540 and 1550 with the founding of a dozen ingenios that produced around 170 mt of sugar (Cabrera, 2010). Cuba joined the sugar industry with a loan from the Spanish crown in 1602 to Havana residents interested in the business.

The initial sugar plantations took advantage of the *camellones* system practiced by the aborigines. The choice of land was determined by proximity to water supply sources and ports, rather than soil type. Agribusiness represented an increase in deforestation due to its demand for soils for crops, fuel, and construction timber. This early incursion of the sugar plantation in Hispaniola ended between 1580 and 1585 due to lack of capital, a reduced demand in the metropolis, and an insufficient labor force, together with the competition of exports from Brazil. This was despite the fact that the Crown facilitated loans and the introduction of equipment, technicians, and the trafficking of enslaved Africans to supply the dwindling Indigenous labor force (Rodríguez 2012).

From the beginning, the processing of cane sugar had an agro-industrial character due to the need to process the raw material on site in less than 24 to 36 hours after cutting the stalk of the plant in the fields. After this time, the juice deteriorates and the sugar content is lost. This explains why the mill and other manufacturing facilities were located adjacent to the sugar cane fields. To process the juice or *guarapo*, boilers or boiler houses were required. Here, the juice was cooked to prepare it for its later crystallization process, which lasted about a month in the "purge house."

In addition to this, forest reserves were needed to provide firewood to fuel the boilers and pasture areas to maintain the animals. With various driving forces and some technological changes, this initial type of plantation, which brought together the agricultural and manufacturing sectors, remained largely unchanged until the end of the eighteenth century. One could speak of a pre-industrial plantation within the framework of organic agriculture, dependent on solar energy through photosynthesis and an enslaved labor force, reliant also on the energy of wind, water, and animal traction.

Sugar and Slave Islands

Towards the middle of the seventeenth century, the sugar plantation model resurfaced with renewed force in the Caribbean, this time promoted by other northern European powers, particularly the kingdoms of Great Britain and France, which shortly before had begun the occupation of several of the Lesser Antilles considered useless by the Spanish crown. An impulse in this regard came from the Dutch model during their occupation of Northeastern Brazil, centered in Recife, between 1630 and 1654. After Portugal's recovery of those territories, the Dutch subjects migrated to the Caribbean.

The Pernambuco Dutch brought to the new British and French possessions of the insular Caribbean their knowledge of sugar cultivation and trade and an entrepreneurial mentality associated with the beginnings of capitalism. This connection is further illustrated by the case of Barbados, occupied since 1627 by the British. In 1637, the Dutch introduced sugarcane and contributed capital, machinery, and technicians, as well as commercial networks and slave labor until 1650. Thus began a rapid transformation, taking advantage of a moment of the local settlers' relative autonomy from their British metropolis (Klein and Vinson 2013).

With an area of 430 km², Barbados is considered the archetype of the classic seventeenth century slave plantation model. It was the first stage of the "sugar revolution" that would later be repeated in different periods and scales in most of the larger islands of the Caribbean archipelago. According to Higman (2000), this revolution implied a shift from diversified agriculture to monoculture, from small farms to plantations, from the free labor of European settlers to the African slave trade, and from subsistence crops to crops with high commercial value. This was correlated with the rise of the African slave trade, the triangular trade, and the growing European interest in their tropical colonies. These changes are linked to the emergence of new eating habits in Europe and the transition of sugar from a luxury item to a commodity for mass consumption in the midst of the Industrial Revolution's birth in England (Mintz 1985).

Barbados had soils suitable for sugarcane and water sources. It was also uninhabited at the time of its occupation. The island contained a large number of wild pigs that reproduced from previously abandoned specimens. In 1644, sugar production was estimated at 8 percent of the value of all cash crops (tobacco, cotton, indigo). Five years later, sugar accounted for 100 percent. Richard Ligon estimated in a work from 1674 that 40 percent of the land was devoted to sugarcane in the mills of Barbados. In 1680, 175 large landowners held 54 percent of the land with 100-acre plantations and an average of 60 slaves (Klein and Vinson 2013: 146).

The mills were established on the coast and in the valleys. In about two decades, the island was deforested to make way for large plantations, after the coastal scrub vegetation and seasonal rainforest were cleared. Intense deforestation not only al-

tered soil fertility, but also facilitated erosion and salinization. Likewise, much of the native fauna disappeared and the new introduced plants gradually displaced the native ones. However, in some cases, such as guava and campeche, they became pests (Watts 1992: 223).

The rapid irruption of sugar was repeated in other islands occupied by the British since the seventeenth century, such as St. Christopher or St. Kitts (1624), Nevis (1628), or Antigua and Monserrat (both in 1632). By 1700, these islands were exporting some 22,000 mt to the mainland, of which Barbados accounted for just over half. Nevertheless, this share would fall during the eighteenth century, due both to the rise of other producing islands and to the decline of Barbadian exports, which in 1748 was 6,442 mt (Sheridan 1998).

By the 1680s, planters were already complaining about the loss of soil fertility, so to counteract this they began to build terraces and use fertilizers. Environmental deterioration made Barbados a leader in sugar industry innovations in the eighteenth century. The colony introduced windmills and single-fire boiler trains (*trenes de caldera a un solo fuego*) that consumed less wood or could be fed with the leftover cane residue after grinding. This was accompanied by the planting of new varieties of sugarcane, irrigation, and later inorganic fertilizers (Galloway 1985: 334–351).

The sugar revolution also spread to the small Antilles occupied by France, such as Martinique, Guadeloupe, and part of St. Kitts, shared with Great Britain. In the early days, the contribution of the Dutch was also vital. For example, in Martinique, colonized since 1635, the first mill was installed by a Dutchman in 1640. A few years later, in 1654, 600 Dutchmen settled in Guadeloupe with 300 slaves. In 1680, there were a total of 350 plantations in Martinique producing 8,000 mt (Klein and Vinson 2013). It is said that from the beginning the French islands had a greater diversity of plantation crops, even if sugar was the dominant production (Burnard and Garrigus 2016).

The limited territorial scale of the Lesser Antilles caused the nucleus of the slave plantation model to move to new territories in the insular Caribbean, such as the island of Jamaica and western Hispaniola, both in the Greater Antilles. Jamaica, with 10,911 km², was a Spanish colony until 1655, when it was occupied by the British. Half a century later, with the Treaty of Ryswick in 1697, the Spanish Crown ceded to the Kingdom of France another portion of its territories in the Caribbean, giving rise to Saint-Domingue (later Haiti) in an area de facto colonized by the French, with an extension of 27,750 km².

Jamaica had a slower start with sugar than the other British possessions. At the beginning of the eighteenth century, it exported slightly less than 5,000 mt, equivalent to one-fifth of the sugar coming from the British West Indies. In 1748, its export amounted to 17,399 mt, 40 percent of all the sugar shipped to the metropolis from the West Indies. This leap entailed the multiplication of the number of mills, a greater number of slaves per unit, and the use of new technologies to increase the productive

scale. In 1670, the island had 57 mills, a number that rose to 455 in 1746. In 1774, some 40,000 mt were produced in 775 mills. By the end of the 1780s, production reached about 60,000 mt, and in 1804, it reached a record 100,000 mt coming from about 700 plantations (Higman 2021).

The expansion of the African slave trade was vital to these production increases. The number of enslaved people in Jamaica increased from less than 40,000 to more than 300,000 in the course of the eighteenth century. The average per unit of sugar production was 150 to 300, far higher than any other plantation crop in British America at the time (Burnard and Garrigus 2016: 38). In the second half of the century, the slave plantation in the British West Indies reached its peak thanks to the expansion of sugar plantations on Jamaican soil, heavily dominated by absentee owners. Between 1748 and 1815, its share of imports from the metropolis grew from 21 to 28 percent of the total. Sugar was the main imported product from the 1750s, when it replaced flax, until the 1820s, when it was surpassed by cotton. This had to do with a considerable increase in the per capita consumption of sugar in the metropolis, from 4 pounds in 1700 to 10 pounds in 1748 and 20 pounds in 1800 (Ward 1998).

In Saint-Domingue, the sugar revolution occurred more rapidly than in Jamaica. The French colony recorded an increase in production from just over 10,000 mt in the early 1720s to 60,000 mt in the 1760s. Its size, about 25 times the size of Martinique, allowed for the optimal use of space, available resources, and technology. At the beginning of the eighteenth century, the island had a much smaller number of enslaved people than Jamaica, but by the beginning of the 1750s, the ratio was about 162,000 in the former to 106,592 in the latter. As early as 1740, Saint- Domingue's sugar production (40,000 mt) exceeded that of all the British Isles (35,000 mt) (Burnard and Garrigus 2016: 35).

By 1791, the French colony was exporting some 80,000 mt of sugar, representing half of the world total. The proportion was even higher in the export of coffee, its second largest plantation crop. In this case, as in other cash crops, large investments in land, labor, and technology were not required, such that they could be grown in smaller units. In 1789, there were 793 sugar plantations, 789 cotton plantations, 3,171 indigo plantations, and 3,117 coffee plantations (Garrigus 2006). At the time, Saint-Domingue was considered the richest and most successful colony in the world. But that wealth depended on a constant flow of enslaved Africans and deep social stratification. Against the backdrop of the French Revolution in 1789, a major revolution of enslaved people broke out in the northern sugar plains in August 1791, leading to the proclamation of the new independent state of Haiti in 1804.

At the beginning of the revolt, the population of the colony was 520,000, of which 90 percent were enslaved, compared to 40,000 whites and 28,000 mulattos or free Blacks (Moya 2008). Sugar plantations occupied the best lands in the plains and some interior valleys, while coffee began to enter the mountainous areas. The revolution implied first and foremost the ruin of sugar production, which in 1800 barely

reached about 10,000 mt (Higman 2011: 166). On the other hand, the fall of coffee was less pronounced and, in a few years, it had become the basis of the Republic of Haiti's exports, together with what was left of precious woods.

The collapse of the plantations during the revolution in Saint-Domingue made Jamaica the main exporter of sugar in the world during the transition from the eighteenth to the nineteenth century. For a short time, it was also a leader in coffee production, despite not reaching the figures of the neighboring colony. As noted by Burnard and Garrigus (2016: 3–4), both symbolize the apogee of the slave plantation from 1740 until the Haitian revolution and the end of the slave trade for Jamaica in 1807, which contributed to the development of capitalism in the Atlantic world and represented a proto-industrial model for the Euro-Western metropolises. The integrated sugar plantation dominated the economy and society of both colonies, although with its own peculiarities.

In both Jamaica and Saint-Domingue, sugar factories were located in more accessible areas such as the coastal plains, which facilitated the movement of the final product to shipping ports. In the second half of the eighteenth century, these lands became even scarcer, so sugar plantations were established more frequently in the interior valleys. These formed a kind of niche in the middle of the mountainous topography of both islands. It is estimated that this new location reduced profit margins; in times of crisis, they also were the first to be abandoned (Higman 2011: 166). Mountainous and inland territories were often preferred for other cash crops or livestock. This occurred with the expansion of coffee in Haiti, where a Swiss visitor noted around 1780 that coffee plantation owners had already exhausted half of the mountains they cultivated, modifying the colony's climate (D'Ans 2011: 185). About Jamaica, the planter and historian Bryan Edwards wrote in a work published in 1794 that it was difficult to find 300 acres of uniform soil to establish plantations.

This situation was different in Cuba, which began its sugar boom in the second half of the eighteenth century. Not only is it the largest of the Antilles, with an area about ten times that of Jamaica and four times that of Haiti, but its landscapes are dominated by vast plains, more than 75 percent of the Cuban archipelago. Since the 1740s, the Havana-centered sugar industry had begun to recover from a long crisis, and after the eleven-month occupation of the city by the British in 1762, a sustained sugar boom began. The revolutions in the thirteen North American colonies and Haiti were definitive moments for the Spanish colony to be the scene of a new sugar revolution in the Caribbean.

The great availability of forested land and the extensive plains were a fundamental part of the optimism about Cuba's potential for the plantation leap. In 1768, the military engineer Agustín Crame pointed out that the lands of Jamaica, which are inferior to those of Havana, and are already tired of producing sugar, need almost every year that new cane be sown in them and that they be fertilized with manure. In

those of this island, that work is not necessary for a long time, nor this cultivation, because the cane fields last 12 and 15 years in their vigor. (Fernández 2009: 64)

In 1807, Cuba's sugar production amounted to just over 41,000 mt (Moreno 1978), which represented about half or less of what was obtained in Jamaica in those years. But its prospects were far superior in the long term. Two decades later, it met the amount obtained by Saint- Domingue at the time of the revolutionary outbreak, and in a few more years, it had already surpassed the 1804 record of Jamaica several times. As was to be expected, this growth in sugar took place at the expense of the forest frontier and produced ecological and socioenvironmental consequences similar to those of the other Caribbean slave and sugar islands (Funes 2008).

Although sugar is the dominant crop because of its scale of production, the large interests involved, or its high profits, it cannot be thought of as having an absolute monopoly on land use. Its greater or lesser share compared to other crops or agricultural activities had to do with market conditions, the size of the islands, topography, and the sociopolitical particularities of each colony. Saint-Domingue had a more diversified plantation economy with several cash crops. Jamaica was more focused on sugar, but also had other crops, a significant livestock presence, and a tendency towards crops for self-consumption in plots of land given by the owners as part of their *dotaciones*. In Cuba, sugar had to compete for several years with the Royal Navy's monopoly on forest exploitation (Funes 2008).

Alternative cash crops to sugar plantations expanded unevenly throughout the territories of the insular Caribbean. The oldest was tobacco, which was present in the islands when Europeans arrived. By 1530, it was established in Hispaniola and from there it spread to other Hispanic colonies. In the seventeenth century, the British and other European powers promoted plantations for short periods of time, as was the case in Barbados. Tobacco was important in the French colonies and in Saint-Domingue until 1690.

Its production in Cuba stands out. It replaced sugar as the first crop for several decades between the end of the seventeenth and the beginning of the eighteenth century. Of great importance was the cultivation of the Vuelta Abajo area, at the western end of the island. Between 1632 and 1844, Spain implemented the tobacco *estanco*, a monopoly that lasted until the nineteenth century. In Cuba, as in other Hispanic colonies, tobacco was cultivated mostly by free peasants in small plots, although slave laborers were also employed, and later larger-scale plantations arrived (Ortiz 1940).

Ginger, a plant from tropical Asia, was introduced in Hispaniola around 1525. In the mid-1540s, the first exports to the metropolis took place, and after the decline of the sugar industry, it became the main export crop. In 1582, it was cultivated in Puerto Rico, where it was grown by poor and enslaved people. The plant, highly sought after in the European market, was less demanding in terms of soil conditions, and its production cost was low. Until the middle of the seventeenth century,

the plant was the object of conflicts and disputes with sugarcane cultivation (Gil-Bermejo 1970). It was also present in islands such as Nevis, Barbados, and Jamaica.

From its introduction by the French colony of Martinique in 1723, the coffee bush spread to the other Caribbean possessions of France and, from there, to the English and Spanish colonies. By far the largest producer and exporter in the world at the end of the eighteenth century was Saint- Domingue, where there were more than 3,000 coffee plantations with an average of 33 slaves. Its export volumes increased from about 3,100 mt in 1755 to 32,000 mt in 1790. After the revolution, emigrants from the colony contributed to the coffee boom in Jamaica and Cuba, which both maintained some primacy in the world market for a short period (Marquese 2017). Another crop that boomed in the insular Caribbean was cotton, as the West Indies in the 1780s became the main source of this raw material for the British textile industry's rapid expansion (Ward 1998).

Jamaica and Puerto Rico are illustrative of the cultivation of melegueta pepper. The latter produced for the Spanish market starting in the first half of the eighteenth century. In 1777, a Royal Order requested that some trees be sent to the Botanical Garden of Madrid for acclimatization and subsequent propagation in the southern coastal areas of Spain. The spice is one of the distinctive ingredients of Caribbean stews and dishes born in the sugar plantation era (Gil-Bermejo 1970).

Several crops associated with the transatlantic trade, such as rice, yams, okra, and pepper, had an important presence in the Caribbean fields (Carney and Rosomoff 2011; Fernández 2021). These cultivars were part of the dynamism of land use and the practices and knowledge in accordance with global and local markets. The enslaved Africans and their descendants dedicated themselves to the cultivation of many subsistence crops in the *conucos*, contributing to ensure their diet. But at the same time, this small-plot agriculture was also part of exchanges in the plantation areas and could even produce income later used to buy freedom.

Cattle Ranching in Plantation Colonies and Smuggling

Spanish colonization concentrated on the larger Antilles (as well as Trinidad) and abandoned the smaller islands of the Antillean arch for being "useless." On several of these islands, there were Indigenous populations that had already adopted the European domestic animals. In addition, on their coasts, buccaneers hunted wild cattle to send hides to Europe and to make salted meat. At the beginning of colonization, horses and other animals were imported from the metropolis and Atlantic islands such as Madeira and Cape Verde. But due to the sugar revolution in the Lesser Antilles, the demand for animals and their by-products skyrocketed.

Satisfying this growing demand from these same islands of limited space became increasingly difficult, and it was. Therefore, essential to turn to external

sources to supply needed traction cattle and foodstuffs. However, livestock farming was not entirely absent and, in some cases, was a relevant activity. For example, due to the accelerated deterioration of soil fertility, the "manure farms" (*granjas-estercoleros*) appeared in Barbados between the last third of the seventeenth century and the first decades of the eighteenth century. This name was given to units that raised cows, pigs, and horses to supply fertilizers to the sugar factories.

In 1720, these farms began to disappear due to an epidemic that decimated livestock and the increase in the price of sugar, which led small landowners to dedicate themselves to planting sugarcane. On the other hand, since 1730, official efforts have been made to encourage cattle raising by the planters themselves (Watts 1992: 444–445). One of objective was to guarantee traction cattle for the plantations, including those destined to move the mills. There was a tendency to replace horses and mules with oxen, whose slower movement allowed more juice to be extracted from the canes. By 1710–1712, out of a total of 485 sugar factories, 76 employed animal-powered mills and the other 409 windmills (Shepherd 2009: 30). By the 1760s, however, the mills of the first type had disappeared, attributed not only to the advantageous location for wind power but also to the scarcity of pasture areas for animal maintenance (Higman 2021: 127).

The free-range system was not absent from the Lesser Antilles, but its presence was greater in larger islands such as Jamaica. During the Spanish occupation, the land was designated as cattle ranches, and one of its main purposes was the export of hides with shipments to Havana and Spain. The decline of the colony and its sparse population explain the proliferation of feral cattle. When the English settlers arrived, a large number of wild animals were available to them that could be captured to supply their food needs. Likewise, the leather industry continued for many decades. By 1768, 2,287 skins were exported to markets in North America, increasing in 1774 to 8,636 (Shepherd 2009: 4–6).

The profits generated by the hatera cattle ranching became one source for the subsequent reinvestment in the sugar agroindustry in Jamaica. But unlike other British Isles, livestock farming remained an important economic activity to supply the sugar plantations. There was a close complementarity, although not without conflict, between the advance of the plantations and that of the cattle ranches or paddocks. One of the reasons was that in Jamaica, animal-drawn mills prevailed over other sources of energy. In 1804, out of a total of 1,077 mills in 830 complexes, the majority fell into this category (656), followed by water (333) and then wind (88) (Shepherd 2009: 31).

In 1684, there were 73 haciendas or paddocks. A century later, the number had increased to around 300. Their location and distribution usually followed that of the plantations, with a tendency to be located in areas less conducive to sugar. In many cases, they settled in savannah lands or marginal and mountainous areas. These haciendas characteristically produced for the domestic market (especially of ani-

mals and pasture for plantations), rather than for export. Their owners tended not to be absentees, as were many planters. Their farms were more diversified and contributed to the self-sufficiency of the colony. One of their products was manure to replenish soil fertility. For this purpose, "mobile paddocks" emerged where animals were gathered and fed with guinea grass and fodder in order to later collect their excrement (Higman 1995).

Although the Jamaican cattle ranches satisfied a large part of the demand for animals for traction and food, the island was no stranger to smuggling with the Spanish Antilles. In fact, the owners of the paddocks used to claim the increase of import duties on the animals of that origin. The cattle ranching areas on the southern coast of Cuba supplied cattle and mules, as well as timber for different uses. During the eighteenth century, the Hispanic colonies of the continental Caribbean provided a large part of the animals required by the plantations of the insular Caribbean. Alexander von Humboldt wrote that through the Port of Cabello in Venezuela alone some 10,000 *mules* were smuggled annually to the eastern Caribbean islands and Saint-Domingue (Giusti 2014: 29).

Nowhere was this interdependence between the Hispanic Caribbean cattle ranching and the plantations of other European powers more evident than in Hispaniola. The occupation of the western part of the island by the French had to do with the growing smuggling of furs in the northwest of the island to sell to merchants in northwestern Europe and the activity of the buccaneers who began to settle in this area, engaging in animal husbandry since 1670. After the French occupation, there was a progressive differentiation of the two colonies.

The planters of the western part required a growing supply of draft animals for the mills and wagons, as well as food for the dotaciones, while the herdsmen and peasants of the eastern part found a flourishing market to sell their livestock and hunting. This trade was illegal for several decades, but in 1762, the monthly sale of 800 cattle from the Spanish side to the French side was authorized. By 1780, of the 15,000 head of cattle purchased abroad by the colony of Saint-Domingue, some 12,000 came from the neighboring colony of Santo Domingo, the rest coming from Puerto Rico, Cuba, and other Hispanic colonies on the continent (Giusti 2014: 21–24). The presence of French and Spanish troops during the Seven Years' War (1756–1763) increased the demand for cattle, often affected by epidemics and diseases that decimated the herd. In addition, animals were stolen in the border area to alleviate the cuts in official cattle shipments, with the goal to eliminate shortages on the Spanish side (González 2011: 125–139).

Brief Conclusions

This text has analyzed land use in the insular Caribbean between 1492 and the beginning of the nineteenth century. A general look allows the conclusion that plantation agriculture – that aimed at producing tropical fruits through the use of enslaved Africans for the foreign market – and cattle ranching were the two economic activities that modified the landscapes of the region in the period, although this occurred unevenly across the islands. In some cases, the sugar plantation coexisted with other cash crops (tobacco, indigo, cotton) and subsistence crops. Extensive cattle ranching was also more important in the Hispanic Antilles and Jamaica.

The sugar revolution – which began in Barbados in the 1640s and spread to other islands of the Lesser Antilles in the same century, to Jamaica and Saint-Domingue in the 1700s and, finally, to Cuba in the 1800s – resulted in a great socioecological, economic, and demographic transformation of the Caribbean region. The expansion of the slave sugar plantation caused deforestation based on the slash-and-burn system for cultivation, with the consequent use of forest income to guarantee high sugar yields and the intensive use of firewood. The depletion of soils and the alteration of both the hydrological system and biodiversity were a constant that was repeated in all the producing islands at different times of their sugar development.

With the consolidation of plantations, soil degradation, and loss of fertility, there was a parallel process of technological innovation in manufacturing and the agricultural sector. On the one hand, single-fired boiler trains were introduced and the use of bagasse as fuel was extended, along with the generalization of wind and water mills wherever possible. On the other hand, new varieties of sugarcane were brought in and irrigation was used, as well as fertilizers for the recovery of the depleted land.

Plantation agriculture and livestock farming depended on each other throughout the period. Even so, unlike the British, French, or other northern European colonies, the "cattle cycle" was the most characteristic feature of the Hispanic Caribbean until the beginning of the nineteenth century, even during the cash crops' period of expansion. More intensive cattle raising grew in response to the demand for leather in Europe, the internal consumption of the populations, smuggling, and the needs of the sugar plantation in the region.

It should be noted that while the northern European Caribbean colonies were already experiencing high levels of soil deterioration and falling yields, the Spanish colonies, which were much larger, presented a promising horizon for sugar and plantation expansion. In contrast to the intensive land use by plantations, extensive cattle ranching only compromised to a very limited extent the natural fertility potential derived from the tropical forest.

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From the Mid-Nineteenth Century to 1950

Source: Fernando Efrén Sandoval (2021).

Introduction: Land Use, Second Conquest, and the Anthropocene in Latin America from the Mid-Nineteenth Century to 1950

Olaf Kaltmeier, María Fernanda López Sandoval, José Augusto Pádua and Adrián Gustavo Zarrilli

Until the late eighteenth century, large areas of Latin America and the Caribbean remained largely untapped for the exploitation of capital and barely integrated into the world market. The attainment of political independence from the Spanish crown and the establishment of republics from the 1820s onwards initially had little impact on this situation. It was not until the middle of the nineteenth century that the Latin American republics and the Brazilian empire were rapidly integrated into the capitalist world economy. Liberal elites in Latin America and external, Western European and, increasingly at the end of the nineteenth century, U.S. American investors promoted extractive and export-oriented agrarian economies (Bértola and Ocampo 2010). This led to a comprehensive and profound transformation of land use and of the relationship between humans, the environment, and their territories.

While the nineteenth century is considered the age of the industrial revolution, most human societies worldwide were characterized by regionally differentiated forms of subsistence-oriented agriculture (Osterhammel 2011: 314–316). This also applied to Western Europe, except for England, but especially for Latin America. On the one hand, efficient forms of agriculture adapted to diverse ecosystemic conditions persevered under the colonial regime despite the substantial disruption of complex agricultural systems in regions like the central Andes, with their sophisticated irrigation channels and terraces, or the agroecological systems in Mesoamerica. Indigenous agricultural practices, such as the *milpa* in Mesoamerica or the vertical control of different ecological floors in the Andes, played a crucial role in sustaining Creole and mestizo populations during the colonial period and the early republic.

On the other hand, the demographic catastrophe and genocide during the Conquista, which resulted in the disappearance of 90 percent of the indigenous population of the Americas, significantly influenced land use by the mid-seventeenth century and led to a rewildering of former agricultural landscapes. European

settlement, particularly in Latin America, remained limited until the end of the nineteenth century, focusing on specific core areas such as parts of the Andean highlands. The areas under effective control, whether of Eurodescendant, colonial or postcolonial influence, can be conceptualized as an archipelago of regional islands (in regard to Brazil see Pádua 2024: 29). Forests and other ecosystems, such as those in the Amazon-region, expanded again, leading to more extensive forested areas by the mid-nineteenth century compared to the end of the colonial period in the mid-seventeenth century (Denevan 1992: 379–381). This phenomenon contributed to the "pristine myth," the notion of an untouched nature, as perceived by the nineteenth century European explorers (Hemming 2015). During the eighteenth century, there was finally also a demographic recovery of indigenous populations, including in the Amazon basin.

Latin American ecosystems, once under the control of indigenous population, became target areas for agricultural colonization and expansion of the new nation-states in the mid-nineteenth century. Beyond expanding the agricultural frontier, colonization aimed to contribute to the issues of civilizing and securing the national territories. Post-colonial states, in collaboration with European – and increasingly, at the beginning twentieth century U.S.-American – enterprises and scientists, sought territorial control. They opened up the last "white" unexplored spots, through cartographic and military ventures. This internal colonization was also explicitly directed against indigenous peoples, constituting a genuine second conquest (Gabbert 2019, Kaltmeier 2022, Topik and Wells 1998). The ruling elites elevated these processes to the level of universal history, invoking ideas of civilization and progress.

In Argentina the Conquest of the Desert, a military campaign directed against the Mapuche between 1878 and 1885, advanced across the Pampas practically as far as Cape Horn and placed Patagonia under state control. On the Chilean side, the military conquest of the Mapuche nation, known as the Pacification of the Araucanía, facilitated the agricultural colonization of large areas in southern Chile (Kaltmeier 2022). In the southern Patagonia region began large-scale sheep farming, which led to the genocide of the indigenous peoples of Tierra del Fuego and in the canals around the Strait of Magellan. The colonization of these conquered territories in Patagonia, the Chaco and southern Brazil was mainly carried out by Western and Eastern European settlers who immigrated to the Americas, often with the support from government programs.

The conversion of these apparently "empty" wastelands, often known as *baldíos*, and of indigenous communal land into private property was crucial for the establishment a liberal-capitalist regime of spatial control. In the 1850s, laws facilitating the privatization of communal indigenous lands were forcefully enforced across most countries in the plateaus and valleys of the central Andean highlands (Larson 2004). This led to a massive expansion of the hacienda and resulted in the formation of a neo-colonial hacienda state in Ecuador (Kaltmeier 2021a). The enforcement of

private property rights, the systematic introduction of new technologies and the rise of agrarian science served as central instruments of liberal, export-oriented capitalism. The factors led to a profound intensification and commodification of land use, accelerating the social metabolism of the agrarian capitalist system. This overarching trend was accompanied by a reduction in ecological complexity, notably evidenced by the loss of biodiversity, and the large-scale homogenization of agricultural landscapes, which made space technically controllable (Scott 1998). The beneficiaries of this intensive concentration of private landownership included not only the large Creole landowners but also capital, mining and railroad companies supported by European and, increasingly, U.S.-American capital. The Mexican Revolution stands out as a unique event that managed to mitigate land concentration through an agrarian reform and the (re)introduction of communal land ownership structures, through the *ejido*.

As early as the seventeenth century, plantations emerged as a central dispositive driving the fundamental transformation of land use and metabolic rifts (Machado Aráoz 2022). This development was rooted in a new spatial planning regime characterized by monoculture. The introduction of exotic plant species, initially focusing on sugar cane from Asia, and the enforced introduction of alien workers in the form of enslaved African populations, allowed plantations to combine agro-economic mass production in the Americas with the growing demand and new consumption regimes in Western Europe. In the nineteenth century, the plantation dispositive underwent a crucial change with the abolition of slavery and the advent of mass consumption in Europe. Sugar production played a pivotal role in the emergence of the transatlantic industrial age. Consequently, the circum-Caribbean sugar industry witnessed – especially in Cuba – an early adoption of steam engines in the sugar factories and steam-powered transportation, reducing the need for human muscle power and draft animals while increasing productivity (Funes 2008). The billowing industrial chimneys of southern England found their counterpart in the smoking chimneys of the Cuban sugar factories. However, the shift to fossil fuels had profound ecological impacts on the Caribbean islands, the southern states of the USA, the Guyanas, and the Brazilian Atlantic coast, where forests became the primary "fuel" for the plantation-based agro-industrial export model.

In the mid-nineteenth century, the agro-export model in Latin America triggered further diversification in cultivation products and techniques within plantations. Coffee, originally from the Middle East, was acclimatized in the mid-eighteenth century in southern Brazil. A century later, coffee cultivation experienced a massive expansion, leading to varied regional outcomes (Topik 1998: 37–50). In southern Brazil, this expansion resulted in massive soil erosion, prompting coffee barons to clear new areas for large-scale cultivation. Conversely, in Colombia and in large parts of Central America, coffee cultivation tended to promote a peasant land

use structure. It is noteworthy that coffee was probably the only important cash crop that was not affected by a major epidemic (McCook 2019).

The scenario differs in the banana plantations of Central America, Colombia and Ecuador from the 1880s onward. These plantations were affected by devastating epidemics, resulting in large deforested and contaminated agro-industrial wastelands (Soluri 2005: 104–127). This sector, particularly prominent in Mesoamerica, was heavily dependent on emerging transnational corporations such as the United Fruit Company (Viales-Hurtado 2001). Other agro-industrial export products such as cocoa, grapes, henequen, cotton, indigo, tobacco, nutmeg, vanilla, among others, also significantly influenced land use (Goebel Mc Dermott and Montero-Mora 2021; Topic and Wells 1998).The agro-export model in Latin America was characterized by its dependency on the international market, the concentration of capital and credit in the hands of agrarian oligarchies and transnational corporations along with their partners, and the tendency towards monoculture. This model resulted in a fundamental transformation of the landscapes and biomes in question. Most plantation systems developed enclave-like, expanding along easily accessible tropical and subtropical coastal areas, particularly in the Atlantic, but also along the Pacific realm.

While the plantation economy was dependent on the high availability of labor, extensive livestock farming spread in the savannah-like, sparsely populated areas, with deforestation also occurring due to the high demand for land (Ausdal and Wilcox 2018). Innovations in refrigeration and preservation technologies created new export opportunities, intensifying livestock farming, especially in the Argentinian pampas. This expansion was accompanied by the cultivation of new forage plants and pasture grasses, as well as the introduction of European cattle breeds. Sheep wool production spread in the central Andes and southern Patagonia. Methane emissions from grazing animals contributed already to the overall balance of greenhouse gas emissions in the region.

However, the exploitation of natural resources in the agro-export model was not solely based on the direct, comprehensive changes in land use and socio-ecological metabolism. In the mid-nineteenth century, there was also a massive peak of simple extractivism, where natural resources from peripheral, difficult-to-access regions were exploited and brought to national and international markets. This included the extraction of timber, particularly along the Rio Paraná (Zarrilli 2008), as well as medicinal or pharmaceutical products such as cinchona (*Cinchona officinalis*) and coca (*Erythroxylon coca*). Regional products such as mate (*Ilex paraguariensis*) in northern Argentina, southern Brazil and Paraguay, or rubber extracted from the rubber tree (*Hevea brasiliensis*) in the Amazonian lowlands, which experienced a veritable international boom in the last third of the nineteenth century without the development of a plantation form, should also be mentioned (Coomes and Bradford 1994).

Particularly, rubber played a crucial role in deepening of the industrial revolution, especially in the fabrication of tires and tubes (Pádua 2024: 51).

The transportation revolution, based on fossil fuels, served as a key prerequisite for all of these products. It resulted in an increasing compression of space and time (Harvey 1990), connecting the raw material regions of Latin America with the mass markets, particularly in Western Europe and the USA. Steam navigation expanded on the Amazon and Parana rivers, while simultaneously, railroad companies expanded their rail networks throughout Latin America. Deep-sea ports, especially those designates for export, also underwent expansion. In 1914, the construction of the Panama Canal linked the Pacific coast of the Americas more closely to world trade. Although the entire region was still predominantly agrarian in the nineteenth century, with large portions of the population tied to rural areas, urbanization processes began in the Latin American metropolises towards the end of the nineteenth century. This marked a departure from colonial urban models and a shift towards French modernism (Almondoz 2002). With these dynamics, a tendency towards the expansion of the modern-capitalist technosphere began, which intensified after the Great Depression of 1919 and the models of import-substituting industrialization.

To enhance production, agriculture became increasingly dependent on externally obtained or produced fertilizers. The *guano* boom on the Chilean-Peruvian Pacific coast mirrored the agro-export boom and the expansion of neo-European agro-ecological systems (Cushman 2014). The demand for fossil fuels also increased, resulting in an oil boom in Mexico and Venezuela, in particular (Brown and Linder 1998). The importance of oil was so huge that it gave rise to a distinct imagination of a magical national state based on oil (Coronil 1997).

These accelerated and expansive processes in the dynamics and forms of land use are also evident in massive deforestation processes. Between 1850 and 1920, an equivalent amount of virgin forest was destroyed worldwide as in the period from 1700 to 1850, which was twice as long (Williams 2006). From 1850 onwards, a rapid increase in the destruction of tropical forests can be observed, parallel to the increase of cultivated agricultural land, reaching its plateau value around 1950 (Steffen et al. 2015: 87). Forests are central elements of climate regulation and act as vital CO_2 sinks. In terms of planetary boundaries, they advocate for a cover percentage of 85 percent for tropical and boreal forests and 50 percent for temperate forests. This limit was surpassed in many Latin American forest regions in the mid-twentieth century (CEPAL 2021). Export-oriented agriculture stands out as one of the major drivers of excessive application of phosphorus and nitrogen as fertilizers, exceeding planetary boundaries. The exploitation of guano deposits and the development of the plantation system highlight these processes, and are evident in Latin America. The land-use changes described here, along with the exploitation of fossil fuels, serve as central vectors for the greenhouse gas emissions that are driving anthropogenic climate change in the Anthropocene.

The environmental and climate-damaging impacts of land use change, especially deforestation, were already clearly acknowledged and identified. At the beginning of the twentieth century, new environmental regulations were introduced for forest, soil, water, wildlife, and fishery resources. Argentina, a few years after the establishment of the world's first national park, Yellowstone in the USA, became an international pioneer in nature conservation by creating its own national parks (Kaltmeier 2021b). Prior to 1950, further national parks were established in Chile, Brazil, Bolivia, Venezuela, and Mexico, among others Latin American countries. Nevertheless, these efforts proved insufficient in mitigating the onset of the great acceleration of the Anthropocene.

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Land Use in the Southern Cone from the Mid-Nineteenth Century to 1950

María Verónica Secreto, Juan Manuel Cerdá and Jorge Olea Peñaloza

This chapter analyzes the genesis of legal and agronomic "modernity" in a territory that generally had low density human occupation and exploitation during the colonial period until the middle of the twentieth century. The chapter discusses the role of the state, the private sector, and Indigenous groups, differentiating the forms of land use in relation to productive activities in the subregions. It should be noted that the period under study coincides with the fall of the colonial empires (Spanish and Portuguese) and the birth and consolidation of the nation states. For this reason, the chapter focuses on explaining the modalities in which a system of exploitation was established in four countries: Chile, Argentina, Uruguay and Brazil.

Within this framework, it presents a critical view of the process of insertion of the Southern Cone into the world market and the impacts this has had on the natural and human environment of these territories. Native groups and ecosystems were extinguished or profoundly modified. These transformations occurred with such magnitude, accompanying a set of changes in global and planetary ways of life and consumption, that they are considered as defining a new geological era: the Anthropocene. It can be noted that the Spanish Empire's logic of territorial occupation was challenged by the other European powers from the seventeenth century onwards. This situation intensified in the eighteenth century when large areas of formal domain became contested and, in some cases, occupied by the French and English. The pressures exerted by these powers – mainly England – and by the new economic theories on the role of agriculture and trade led Spain to redefine the colonial spaces and their functions. Metallism no longer reigned unanimously as an economic theory. This is evidenced by the creation of the viceroyalty of the Río de la Plata (1776), the encouragement of slavery, and the "plantation" model for Cuba and Puerto Rico. Although the transformation that began to be envisioned in government treaties, took a long time to occur, it indicated a change of direction that involved a new understanding of the American territory, its spatial occupation, and the role of natural resources.

In the second half of the eighteenth century, Spain and Portugal were involved in boundary treaties that sought, finally, to discern and differentiate their American

domains. Although the territorial delimitation policy covered the entirety of both empires, it had one of its most difficult chapters in the Río de la Plata in the southern part of Portuguese America. The Treaty of Madrid of 1750, its annulment in 1761, the Treaty of San Ildefonso of 1777, and the occupation of Santa Catarina and the Colonia de Sacramento all involved disputes for the control of this portion of the continent and the resources contained therein: men, herds, yerba mate, etc. This, additionally, entailed rights to the accessibility to the interior of the continent through the network of rivers that make up the La Plata basin. The border treaties also included territorial water rights. Spain had lost access to the waters of Newfoundland, a fishing area dominated by England since the Treaty of Utrecht. Thus, the disputes over the American territories also included the possibility of exploiting maritime resources such as whales and gadiformes that could replace cod, imported in large quantities by Spain. The interoceanic passage was also disputed towards the end of the eighteenth century because it allowed access to the Pacific and, therefore, the possibility of connecting the East Coast of the United States with the Pacific Coast of the same continental block. For this reason, the Captaincy General of Chile gained strategic value in this period. In 1795, Spain and the United States signed a treaty on borders and navigation. The United States, in whose seas whales were becoming scarce, was very interested in marine mammals such as seals and sea lions, which were abundant in the Atlantic and South Pacific.

The independent states adopted Enlightenment ideas about the wealth of nations linked to both trade – perhaps the most widespread among the balance of ideas that fueled the revolutions –, agriculture and livestock, and the legal forms that were to accompany the process of putting land into production: private property (Moraes 2015). At the time when the independence movements were gaining strength in the first decades of the nineteenth century, the reconversion of the political-administrative divisions of the colonial era into nation-states began to be at stake. However, at the same time, a period of internal rearrangements began to take place in the viceroyalties and territorial subdivisions, with the oligarchies being decisive in the disputes over the distribution and nomination of these territories.

Thus, notions of land use began to change. New economic ideas, such as those disseminated in the Río de la Plata by Hipólito Vieytes, proposed an agriculture practiced in modern terms from an agronomic and legal point of view. From the time of independence, individual private property was sought to guarantee exclusively economic uses, devoid of the symbolic and economic prestige of the former regime or the "wild" uses of the native peoples. But the very revolution that propelled these ideas hindered their realization. The prolonged war created unavoidable urgencies. The set of liberal "postponements" between 1810 and 1850 was called a "long wait" by Tulio Halperín Donghi (2008). Although this idea is relativized and criticized today, from the perspective of environmental impact, a real transformation in land

use took place in the mid-nineteenth century, for which the instruments of liberal rationality were necessary: agronomic science and private property.

As Jason Moore (2010) puts it, every major wave of capitalist development has been paved with cheap food. As industrialization in core countries deepened in the 1850s, the demand for raw materials and food intensified. Would it be appropriate to place the starting date of this process in 1846, when England abolished the Corn Laws? Up to that date, England had protected its landowners by limiting grain imports and forcing the industrial sector to "subsidize" rural income through factory wages. The grain trade liberalization in England opened a new stage in the world food trade.

In the mid-nineteenth century, the countries of the Southern Cone reconfigured the forms of land appropriation, legislating on the modalities of transferring public equity to the private sector, supported by internal colonization processes. Land legislation was passed, and the lands occupied by native peoples were included in the new stocks transferable to private individuals. In the new institutional arrangement, national territories – and their populations – were defined as homogeneous and available for capitalist production, making invisible the Indigenous presence and their particular land use practices. During the first half of the nineteenth century, while liberal ideas and proprietary concepts strengthened – exclusivism, inviolability, and free use –, ancestral forms of land tenure persisted throughout the territory.

The second half of the century reconciled legal innovations with agronomic developments. New practices for cultivation and soil utilization, species improvement, and the incorporation of productive technologies mark the insertion of the region's countries in the international market. Likewise, each territory began a process of productive specialization, which in many cases was the continuation of what was already being done in colonial times. This process was accompanied by a transformation in social and productive relations. In both cases, these two moments precisely mark the beginning of the global process of capitalist acceleration and the moment of consolidation of the Anthropocene. The transformation of nature was intensified as modern conceptions of private property and agronomic science solidified.

Brazil, the Mercantile Use of Land from the Colonial to the Independent Period

In the second decade of the nineteenth century, when Brazil became independent, the land actually occupied by the empire was a more or less narrow coastal strip, with some deeper penetrations, such as those caused by the mining exploitation in the early eighteenth century, fluvial transportation – such as in the Amazon and Paraná basins, or the Plata basin –, and the extensive cattle raising that widened the terri-

tory towards the *sertões*. When the constituent deputies met in 1823, after independence was declared, to produce the country's most important body of law, they did not risk defining its western boundary. They defined the territory of the empire as that between the mouth of the Oyapock River to the north and 33 degrees south. It is worth clarifying that this constitution was never valid, because the emperor overthrew it and sanctioned another body of fundamental laws.

In 1850, when the parliament discussed the first public land law, the deputy Baptista de Oliveira said that the occupied area in that moment should not exceed 8 percent of the Empire's territory. It is clear that Brazil, like other Latin American countries, entered independent life with sovereignty over a territory much larger than that which was effectively under its dominion, explored, populated, or occupied. By the second decade of the nineteenth century, large areas of the nation's territory, relatively close to the major population centers, were under Indigenous control and occupied by economically invisible populations. These territories were called "empty spaces" by the colonizers, vacant lands that would be incorporated into the capitalist land tenure regime. This made it possible for the legislator to state that only 8 percent of the territory was occupied, counting only the areas occupied by agriculture for the domestic and export markets.

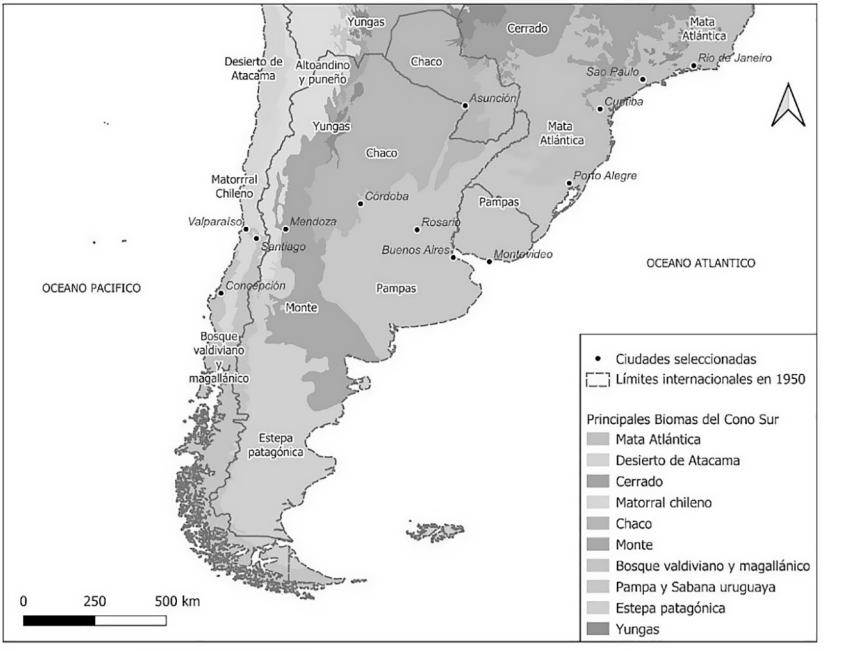
Colonial agrarian systems had allowed the existence of two models living side by side, systems that were in some way mutually supportive and that lasted until the end of the nineteenth century. These were, on the one hand, large slave properties producing exportable goods such as sugar and coffee and, on the other hand, the small and medium-sized plots that supplied the domestic market and also used slave labor, although on a smaller scale.

The agrarian frontiers moved in step with the advance of both systems. The nineteenth century saw export products opening up agricultural spaces in the Atlantic Forest, a forest biome present in the current states of Alagoas, Bahia, Ceará, Goiás, Mato Grosso, Minas Gerais, Paraíba, Paraná, Pernambuco, Piauí, Sergipe, Rio Grande do Norte, Rio Grande de São Pedro, São Paulo, Rio de Janeiro, Espírito Santo, Santa Catarina.

For a very long time, humans lived in tropical and subtropical forests. The relationship between the native peoples and these biomes was durable, although it involved practices of deforestation and controlled fire management. The Portuguese occupation created a pronounced imbalance by increasing the rate of logging. The exploitation of the native brazilwood (the name given to several species of the genus *Paubrasilia*) and its near extinction is one example of the relationship that was established with the flora after the conquest. This southern portion of South America was called the land of Santa Cruz but later received the name Brazil, given its identification with the dye wood. The red pigment derived from the bark of this tree was in great demand in Europe. Great painters such as Raphael, Rembrandt, Pietro da Cortona, and Van Gogh used the red obtained from the bark of brazilwood. These

pigments were used until the nineteenth century, when synthetic pigments replaced them. As in other extractive forestry exploitations, production was taken to the extreme, causing the near extinction of the species.

Fig. 1: Main Biomes of the Southern Cone and Contiguous Regions



Source: Facundo Rojas (2023).

It was not only in extractive activities that this relationship of destruction of the natural environment was seen. The sugar plantation model was highly devastating. The forest was the "fuel" first for the Portuguese colonial agricultural model and later for the Brazilian State. The land was prepared for cultivation on its ashes, and its firewood fueled the mills to produce refined sugar. The boundaries of sugar production did not constitute a continuous or homogeneous frontier, rather its bounds were composed of a group of territories located on the northeast and southeast coast. The cultivation areas were not far from the coastal ports that connected to the slave trade routes and the markets for tropical goods. The scales of these farms could be very different, but they all developed around the use of slave labor. Thus, it created a doubly devastating agriculture for the environment and for humans. Parallel to the plantations, livestock activity developed and became internalized. The mobil-

ity of livestock allowed this activity to develop in regions where export agriculture could not do so due to transportation difficulties. This vocation was first present in the so-called *sertões* in the northeast and the pampas in the south. This livestock activity aimed at supplying, through cabotage, the domestic consumption of salted meat. The mining center of Minas Gerais became very attractive as a consumer pole for food, promoting a supply-oriented hinterland and driving more distant productions. During the Empire, there were no major technical transformations in livestock breeding and processing; extensive grazing and the expansion of the interior frontiers were maintained. It was not until the end of the nineteenth century that some "improvements" were introduced to modernize the sector, which was to undergo major development in the twentieth century, becoming one of the main causes of deforestation since 1970.

By 1760, coffee, originally from the Middle East, was already acclimatized to the environment of Rio de Janeiro. In the nineteenth century, almost coinciding with independence, it expanded, climbing the slopes of the hillsides. In environmental terms, coffee was even more devastating than sugar. Its cultivation at high altitude on the slopes of the sierras caused rapid soil erosion. In the vicinity of Rio de Janeiro, the Tijuca massif was the scene of deforestation on such a scale that it endangered the city's water supply. On the one hand, the aforementioned coffee occupied its slopes. On the other, wealthy courtiers built their residences inside the forest, seeking refuge from the torrid carioca summers. The pressure on the massif responded to the pronounced demographic growth caused by the transfer of the court from Portugal to the American lands. Numerous fugitives arrived from the Napoleonic wars who disputed the scarce urban real estate and the lands surrounding the city. The first measure prohibiting new logging in the water springs of the Tijuca Forest dates back to 1817 (Drummond 1988: 285), and the following year the possibility of expropriation to protect the springs was already being investigated. The effects of coffee cultivation were immediately felt in the city: in 1824, 1829, 1833, and 1844, there were droughts, and the water supply for human beings was limited. After the crisis in 1844, the most fragile areas were expropriated for reforestation. The city's needs brought to light the consequences of coffee monoculture. However, the diagnosis of its effects did not inhibit its spread. By the middle of the century, coffee had already become widespread in the valley of the South Paraíba River, both in the area of Fluminense and São Paulo. Between 1850 and 1900, it further occupied the Zona da Mata Mineira, the region of Campinas, and part of Espírito Santo. Between 1900 and 1950, it occupied central-western São Paulo and northern Paraná (Vale do Ivaí). The expansion of coffee was tremendous and accompanied by great transformations.

In the 1840s, the naturalist Félix Emile Taunay painted a picture entitled *Mata reduzindo a carvão*. In it, one can see the tropical forest being reduced to firewood, to be transformed into charcoal. In one half of the painting, there is the lushness of the forest; in the other, the devastation of logging and fire. In the lush middle,

two people collect water in jars in a stream. On a path that leads through the trees, a man can be seen carrying a mule with barrels of water, while others peek out from behind the large tree trunks. In the other half, on the left side of the painting, the devastated landscape is depicted, where two groups of men, probably enslaved, are at work. Some of the men control the fire on a pyre and others arrange the logs in a pit to later burn them. José Augusto Pádua has reviewed the representative writings of Lusobrazilian political thought between 1786 and 1888 in search of elements that attest to an environmental concern. The author found an expression of concern regarding the possibilities and limitations to guarantee the permanence or durability of economic activities that made use of certain natural resources. The textual concerns raised by Pádua were quite similar to those depicted in Taunay's paintings (Pádua 2002).

Fig. 2: Mata reduzindo a carvão by Félix Emile Taunay (1848).

Source: National Museum of Fine Arts, Rio de Janeiro.

Mule transportation, characteristic of the transport of goods until the middle of the nineteenth century, was replaced by railroads that arose due to the demand from coffee planters who sought land further west and, therefore, farther away from the ports of export. The railroads constituted a new investment opportunity for the capital coming from the São Paulo coffee industry. From 1867 to 1930, a transportation network on steel tracks, consisting of 18 lines, made the export of coffee and the

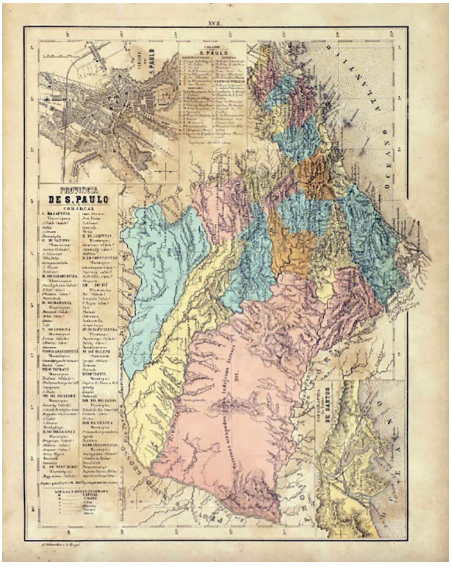
movement of merchandise and passengers possible. This form of transportation allowed the incorporation of lands from the "far" west of São Paulo. The centrality of São Paulo in the production of coffee is evident in the following data: in 1870 its production represented 16 percent of the national total of the rubiaceae, in 1885 the proportion rose to 40 percent. While the railroad lines served the network of the largest population and production centers at the beginning, by the end of the century and into the next, the railroad opened new areas to production and accelerated the advance of the agricultural frontier.

In 1868, Cândido Mendes de Almeida published an Atlas of the Empire of Brazil, dedicated to the emperor and intended for public education (Almeida 1868). In it, the province of São Paulo appeared with its western end inhabited by "fierce Indians" (a huge area colored in pink on Fig. 3). Eighteen years later, the *Sociedad Promotora de la Inmigración* made and published a map of the same province; in that case, however, the western end appeared as "uninhabited land" (portion colored in green on Fig. 4). It may be that, in the span of almost two decades, the Indigenous population had considerable declines, given the pressure of the core of export agriculture; nevertheless, the propaganda effect of a map that intended to attract immigrants to the province should not be underestimated. The 1886 map might not have reflected the truth of that moment, but it made clear where the actions of the São Paulo Immigration Promotion Society were aimed: to draw the attention of immigrants to the possibility of having access to land.

After World War II, the coffee frontier expanded further south through the State of Paraná, which involved the movement of a large population. In 1920, the state had 685,711 inhabitants; in 1960, it had 4,268,239. This growth was due to the large internal migrations that were motivated by the opening of new lands for coffee in the state.

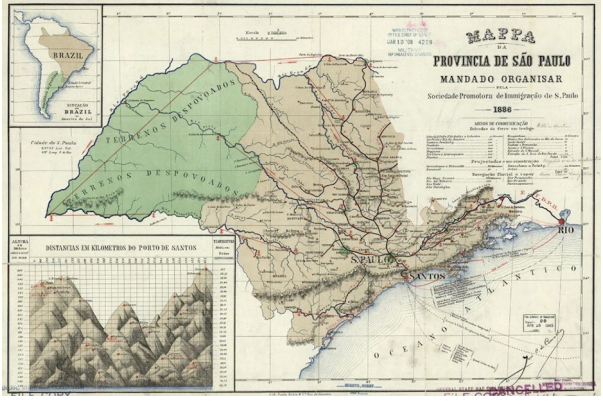
Until 1920, little land had passed from public to private ownership and most of the forests (Atlantic forest and Araucaria forest) were still standing. Between 1922 and 1932, the state of Paraná made numerous concessions of public lands to private colonization companies. Among these companies, the *Compañía de Tierras Norte de Paraná* stands out, receiving more than 12,000 square kilometers. The colonization of the north and west of Paraná was the greatest development of the 1940s and 1950s, and as such, an area of numerous agrarian conflicts.

Fig 3: Province of São Paulo (1868)



Source: Atlas do Império do Brazil. Lithographia do Instituto Philomathico map XVII.

Fig. 4: Map of the Province of São Paulo (1886)



Source: Sociedade Protetora da Immigração de São Paulo.

The Southern Cone of Spanish America

The Spanish empire underwent a major transformation between the end of the eighteenth century – a product of the Bourbon Reforms – and the beginning of the nineteenth century with the outbreak of the wars of independence. The juridical institutional scheme of the Spanish government in South America had placed the production of metals in the territories of the current states of Peru and Bolivia at the center. However, with the creation of the Viceroyalty of the Río de la Plata (1776) and the strengthening of the Captaincy General of Chile (1798) – together with the recovery of silver mining in Potosí – the occupation of the space south of present-day Peru began to develop significantly. These measures, among many others, guaranteed the provision of the necessary inputs for the extraction and processing of silver from Upper Peru and transformed the entire area. This, in turn, was favored by the development of the transatlantic trade and livestock activity destined for the export of dried meats and hides through the port of Buenos Aires and Montevideo. In the corridor of the Pampean coast and the Guaraní aquifer, much of the livestock production – which would set the pace of the local economy in the first decades of the nineteenth century – was based on large properties and, to a lesser extent, the cereal production, horticulture, and livestock raising of medium-sized family farmers. The western slope of the Pacific Ocean began to develop in relation to the supply and demand of the colonial settlements between the ports of Callao and Valparaíso (Cavieres 1999). The internal and external markets articulated the space in an unequal manner. For example, in the Banda Oriental, there were two differentiated social formations, one to the north of the Río Negro and the other to the south. The southern formation was linked to the Atlantic markets and the northern one to the internal colonial market. The former based on individual rights over the main resources and the latter on common rights (Moraes 2015).

The crisis of the colonial order and the wars for independence created an institutional, economic, and social crisis throughout the territory formerly dominated by the Viceroyalty of Peru, the Viceroyalty of the Río de la Plata, and the Captaincy General of Chile. The wars conditioned economic performance, disarticulating the colonial commercial and credit circuits. This reconfigured migratory flows and signified the beginning of a process of privatization of the territory that forcibly displaced the native peoples. These changes suggest the first steps towards the consolidation of the capitalist system in the region and the progressive elimination of other forms of land occupation and production developed by ancestral peoples.

In the case of the Captaincy General of Chile, agricultural activity was concentrated at the beginning of the nineteenth century in the central valley. This was the name given to the territory between Santiago de Chile and Concepción's areas of influence. Its southern border corresponds to the area of La Frontera, where the Bío-Bío River stands as a geographical, cultural, and political landmark (Bengoa 2015).

It is precisely this region that was most affected by the battles for independence. Consolidated during the colonial period, the large property system (*hacienda*) was practically unchangeable and the economic matrix remained focused on supplying regional markets – except for silver mining that was beginning to gain strength in the north. The ports that had already been conducting smuggling with the English and/or North American markets allowed the entry and exit of products related to agriculture: wheat, tallow, and hides traveled through the Pacific to the north, and plows and iron tools for the exploitation of the land began to enter (Sepúlveda 1959).

On the other side of the Cordillera, especially in the humid pampa region, the wars of independence and, later, the civil wars affected cattle stock, the region's main export activity. This caused export prices to rise while manufacturing prices fell as a result of industrial development in Europe. This "comparative advantage" boosted the production of raw materials on the humid pampas. This region is one of the largest plains in the world and stands out for its temperate climate, fertile soil, and proximity to surface watercourses that cross it from west to east, favoring river navigation. Thus, throughout the first half of the nineteenth century, cattle, sheep, and cereal production began to develop in order to supply an international market that increasingly demanded foodstuffs to sustain industrial growth in Europe.

Livestock use modified the landscape, anticipating agricultural use. Cattle domesticated the grasslands, and it was only after this transformation that agricultural work was introduced. Although the transformation was not as dramatic as that of tropical and subtropical deforestation, it involved a major alteration of an already anthropized landscape.

In the mid-nineteenth century, the formation of nation states definitively consolidated the hegemony of capitalist land occupation throughout the region, extending to the ends of the American continent. This can be seen in the case of Patagonia, where the new states of Chile and Argentina imposed private property and appropriated territories previously dominated by native communities. Although the sectors most favored by this process were large ranchers (*grandes estancieros*) and landowners (*terratenientes*), there were also small and medium-sized proprietors – largely European immigrants – who benefited from the state's land privatization policies. These settlers, in general, dedicated themselves to intensive agriculture coexisting with large landowners. Thus, extensive agriculture accompanied by a strong wave of European immigration that quickly outnumbered the inhabitants of the native villages followed the cattle ranching (sheep and cattle) of the first half of the nineteenth century.

The forms of land use between these two social formations were very different. In the areas dominated by the nation states, private property prevailed in its different forms: *estancias*, haciendas, or agricultural colonies. To a large extent, they all aimed to supply the international market that demanded raw materials to sustain capitalist development in the context of the Anthropocene. These individually con-

trolled productive units were organized according to mercantilist logics, with their productions progressively becoming more and more integrated into international markets. On the other hand, depending on the Indigenous frontier, different organization and very different land uses will be found. Raúl Madrini (1987), when studying the Indigenous societies of the Pampean region, emphasizes their pastoral vocation, where sheep, cattle, and horse breeding related to a use and exchange value. According to this author, these were tended and controlled herds of livestock, whose mobility was determined by seasonal rhythms and the need for pasture and water. The circuits of breeding, reproduction, protection, and commercialization involved hundreds and thousands of kilometers, including the penetration of "transnational" borders.

Nation states used different practices to relate to Indigenous populations. During the first half of the nineteenth century, they sought negotiated forms of coexistence as the Spaniards had done in some cases (Contreras Painemal 2022). Negotiations involved exchanges of favors and merchandise. But after the second half of the century, when the lands inhabited by these populations became more coveted, these agreements began to thin. The ideology of civilization and the superiority of maximizing land use became a dominant discourse. Julio Argentino Roca's military campaign between 1878 and 1885 is a crude and clear example of the relationship that the Argentine state would come to have with those considered "others" within the nation. Populations of native peoples such as the Mapuches, Ranqueles, Pampas, and Tehuelches were annihilated or, in the best of cases, expelled from their territories and corralled in marginal spaces of the new nation states. To a large extent, they were expelled from the most productive lands. These lands were passed into the hands of the European immigrant groups that arrived – or were from the colonial period – in these territories. The "war" against the Indians implied, as Alimonda and Ferguson have said, the physical and symbolic production of the desert, "the material elimination of the peoples that inhabit it, but also the denial of their own existence" (Alimonda 2004).

The "Conquest of the Desert" in Argentina's case involved the advance of military forces from Buenos Aires to the south. In various campaigns between 1878 and 1885, the Argentine army occupied the territory, displacing and annihilating native inhabitants from Buenos Aires to Cape Horn. On the Chilean side, Patagonia was subjected to control from the extreme south with the installation of the colony of Punta Arenas and the extermination of the Selk'nam, Kaweshkar, and Yaganes peoples on the large island of Tierra del Fuego and the channels surrounding the Strait of Magellan (Harambour 2019). The geopolitical control of the canal that connected the Atlantic Ocean with the Pacific Ocean was one of the main reasons for this occupation. However, the two newly created states were unable to have effective control over these territories. This allowed some native communities to survive, the formal boundaries of the two states remaining in dispute for more than a century. The first

boundary agreement between the two nations was issued in 1881 and revised in 1904. It was only recently in 1998 that the political boundaries of the two countries were defined by the agreement on "continental ice." At the same time, livestock companies – most of foreign origin – were set up in these territories, taking advantage of the large extensions of pastures to carry out a mainly sheep industry.

In the area of Aysén in Chile, a different scenario took place. Its abrupt geography did not allow the establishment of a definitive connection with the rest of the national territory until late in the twentieth century. Although certain *Sociedades Explotadoras* (Exploitation Societies) established themselves, such as those of Aysén and Baker, the region's occupation was much more sporadic and undertaken by settlers coming from the Chiloé archipelago or through the Argentine pampas, who gradually moved into the Patagonian valleys. Here, there was no hegemony of large estancias as in the southernmost area of Magallanes, but there was a great process of anthropization to convert the closed temperate forest into open fields for cattle ranching. A series of fires were lit here with that aim in mind that mold the landscape to this day.

Production to supply European markets led to an increase in herds. From the last quarter of the nineteenth century onwards, the transformations in the sector through genetic modification, the introduction of technology – first wire fences and then the mechanization of agricultural tasks – and the improvement of crops required increasing investments of capital and labor.

This whole process was framed by a social and demographic rearrangement of the countries, which in the case of Chile and Argentina meant a silent dispute for productive spaces. As the republics consolidated, the market for land and its privatization followed suit. One of its main consequences is found in different moments and intensities of depopulation in central areas and the search for survival in the spaces that became available. In the Chilean case, those expelled from the central valley settled in the recently colonized areas of Llanquihue and – after the military occupation– the Araucanía. However, once this process was established and after economic and production crises, other groups were expelled and the Patagonian territory became their new option. In the Argentine case, the annihilation and the later invisibilization of native peoples meant that only a few small Indigenous groups were pushed to marginal areas on the Andes. There, they managed to survive until the present day, maintaining contact between the communities on both sides of the mountain range.

Although the Andes Mountains had not been a barrier for human beings, the consolidation of nation states transformed it into a "natural" frontier. The Cordillera became a political border dividing Argentina and Bolivia on one side and Chile on the other. Thus, something that had not been experienced as a frontier by humans and non-humans began to change progressively. The more traditional settlements began

to reorient their production for the domestic markets, which grew at the same pace as immigration.

In parallel, this process of occupation by nation states, accompanied by a certain political stability, gave way to the massive arrival of European immigration. These immigrants came to these lands displaced by capitalist development in Europe, yet another consequence of the effects of the Anthropocene in the Southern Cone. Although these immigrants occupied various territories, there was a rapid concentration in port cities (Buenos Aires, Montevideo, Santa Fe, and Asunción, among others). Large cities began to grow significantly based on the development of services (banks, commerce, etc.) that linked primary production with the international market. The port-cities grew with the expansion of world trade and the demand for raw materials from expanding European economies. Initially, in the first decades of the nineteenth century, the cities exported dried beef and hides. Next, they shifted production to sheep and cattle to supply the English textile industry's growing demand for wool and hides. Finally, by the end of the nineteenth century, they started producing beef and cereals, becoming the "breadbasket of the world."

In the case of Argentina and, to a lesser extent, Uruguay, the introduction of the railroad – which took place between the 1860s and 1870s – accelerated the process of land occupation and facilitated the expansion of livestock and agriculture throughout the fertile plains region. This technology also allowed the development of other regions, further away from the ports, which began to transform their environment. For example, since the end of the nineteenth century, sugar production has spread throughout the northwest of Argentina, wine production in the semi-desert regions west of the Andes, and tannin and cotton production in the Gran Chaco region. The introduction of industrial processes for the domestic market – such as sugar and wine – or for the international market – tannin, cattle, and cotton – transformed the original biomes. The exploitation of quebracho for the construction of railroad sleepers and later for the production of tannin and sugarcane led to the devastation of native forests, as had happened in the Portuguese region of South America. To a lesser extent, significant changes were observed in semi-arid regions associated with the expansion of grapevine for wine production (Abraham and Prieto 1999).

In the Chilean case, large property in the central valley was consolidating, a process that closed in on itself and looked for a way out through the ports. The fluid trans-Andean exchange, which allowed traffic according to geographical proximity and had several crossings to Argentina, shifted towards the ports of exit such as Valparaíso and Concepción as national economies consolidated. The Pacific route became more dynamic. This made it possible to move towards a specialization in wheat production for the South American and, gradually, North American markets. The railroad also played a key role in this territorial reorganization, as the north-south direction of the country was transformed into a new organization of production.

All of this meant greater pressure on the land that could be converted into fields for sowing. On the one hand, land that was previously used for cattle raising was practically naturalized grasslands. Progress was made towards clearing that land, taking advantage of its natural fertility, a product of ancient processes of anthropization. However, there was also an advance on certain areas of native forest that surrounded the large haciendas and had served for many years as a reserve for obtaining fuel – wood and charcoal – and other resources such as fiber or foodstuffs.

In contrast to the region of former Portuguese occupation, this region of the Southern Cone had a few large companies that concentrated vast landholdings (for example, the British-owned La Forestal, dedicated to the exploitation of tannins, or sugar mills). The case of La Forestal has been one of the most studied because its exploitation of the subtropical forests for more than fifty years led to the loss of more than 10 million hectares (Zarrilli 2016). The company's manufacturing units, numbering more than 30, significantly changed the Gran Chaco biome.

The rest of the land remained, to a large extent, in the hands of the states and the European population that arrived during the colonial or post-colonial period. In the latter case, nation states guaranteed private property on the basis of their constitutions. It was the state that carried out the privatization process through direct sale, direct assignment, and/or colonization. In all cases, native peoples were excluded – if not annihilated by the state – leaving behind all forms of ancestral land tenure.

At the end of the nineteenth century, nation states – with a liberal and capitalist vision – saw the environment as just another low-cost or directly "available" factor of production and, therefore, one that could be privatized and intensively exploited. This was part of the "growth" of nations and, especially, a requirement to supply the demand created in other latitudes by the second Industrial Revolution. In this sense, Latin America in general and the Southern Cone in particular, were incorporated into this process as producers of raw materials, strengthening an agrarian structure that would remain more or less stable until the middle of the twentieth century.

The beginning of the twentieth century saw increased immigration and with it a consolidation of urban spaces, which began to cause multiple environmental problems. The concentration in confined spaces created large cities with numerous sanitation and land use issues. Urban conglomerates are often located in spaces that are not very conducive to human life and have therefore been significantly modified. Watercourses are diverted; wetlands are dried up; and semi-arid regions begin to be irrigated in order to be put into production.

Conclusion

From the middle of the nineteenth century, there was a notable acceleration in the change in land use in the Southern Cone that oriented towards the production of raw materials to supply the demand of the European market. The combination of this boom and a sparse population led states to promote immigration. Although the "possibility" of access to land was often a factor of attraction for immigrants, the truth is that both subsidized and spontaneous immigration in the three countries encountered several obstacles to land access. To a large extent, land had already been distributed in the colonial or post-colonial period and had remained in the hands of the ruling classes. This immigration played a key role in a specific conjuncture of the expansion of internal borders, of urban centers, of the production of manufactured goods, and of consumption. The internationalization of the labor market was part of the global process of capitalist expansion. Both push and pull factors were an intrinsic part of this expansion that marked the beginning of the Anthropocene.

During this period, new agricultural techniques began to be developed and deployed in different countries. Whether of external origin or pushed by the states themselves, these developments created a tension with the extensive and traditional forms of production. During this period, research on genetics, improvement of irrigation systems, soil fertilization – both organic and inorganic –, and the development of synthetic saltpeter became prominent. All of them gave shape to a commercial agriculture that would redefine the scales and intensities at the pace of capitalist development.

All these transformations are part of the prelude to what has become known as "The Great Acceleration." In the mid-twentieth century, through a strategy of modernizing the territories, the Southern Cone was at a turning point in terms of redefining the social, productive, and power structures that sustained land tenure. Social demand and technical advances gave way to a system that managed to multiply productive yields but also intensify demands on the material and energy required to implement this plan. At this juncture, capitalism managed to re-impose its logic and its rationality in the sense proposed by Moore. Land became a valuable commodity for industrialized agriculture and livestock, establishing a new system where land, water, and capital were concentrated.

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Land Use in the Andes from the Mid-Nineteenth Century to 1950

Plantationocene, Extractivisms, Conservationisms, and Contested Lands

Nicolas Cuvi and Delfín Viera

This is a story about the complex relationship between biomass and human beings, told through their shared becoming into plantations or locations of extractivisms in the tropical Andes. Barks, trunks, resins, flowers, fruits, seabird droppings, feathers, or mammalian meat and skins are some of the actors of this narrative. Submitted through greater or lesser violence, with axes, saws, or other technologies for extraction or domestication, medicines, textile fibers, food, gums, dyes, fertilizers, stimulants, as well as museum and decorative objects were obtained from these and other non-human actors. To do so, human beings had to deal with uncertainty in the form of climate changes, pests, fluctuating markets, among other difficulties. They also built relationships of subjugation towards each other, marked by the construction of otherness and dispossession, on different scales: local, national, regional, global. And there were those who questioned servile relationships and the destruction of nature, determined to transform them through policies.

This chapter concentrates on the land use change processes in the four countries that occupy most of the tropical Andes: Bolivia, Peru, Ecuador, and Colombia. The chosen countries contain the "Tropical Andes" and "Choco/Darién" hotspots, lowlands on the coast and the Amazon, parts of the Pacific Ocean and Caribbean Sea, as well as islands (Zador et al. 2015).

Andean tropicality has received numerous descriptions, usually associated with such words as variety or megadiversity, for its cultural, biological, geological, geographical, and climatic characteristics. Colombia, Ecuador, and Peru are listed among the seventeen countries on the planet considered megadiverse (Mittermeier, Goettsch Mittermeier, and Robles Gil 1997; Josse et al. 2009), due to the combination of tropicality, mountainous topography, marine currents, and the presence of both continentality and insularity. Andean empires and chiefdoms, Amazonian and coastal, coexisted for millennia with this explosive variety. Until the twenty-first century, dense and growing Indigenous populations survive on all altitudinal

levels, preserving languages, practices, technologies, and ancestral products of agrodiversity (Sichra 2009).

This chapter refers to land use change as socioenvironmental processes of different scales, traceable in the materiality and the landscape, associated with changes in mindsets and in the economic, social, and cultural dynamics. They can occur through the transition from a forest to plantations or pastures, the change of the products sown in a territory, planting trees, the appearance of transport infrastructures, as well as urban or industrial spaces, among others. The chapter will focus mainly on changes related to plantation systems and some transformations caused by biomass extractivism. Those that led to the largest conversions have been selected for the magnitude of the productions and the investments resulting from their financial surpluses.

Other patterns of land use change have been less relevant, with the notable exception of Bolivia, where the impact of mining on the landscape was vast, both because of mines and their need for firewood, food, roads, and other infrastructure, and because of the pollution of soils, water, and air. Since the colonial period, the country's economy had been heavily anchored to mining, first for silver and then for tin. Mining was also important in Peru and generated similar environmental liabilities and land use changes.

The plantations were distributed overall under the hacienda system, which can be understood as extractivist. According to the literature consulted, there were no large plantations managed under Indigenous communal systems. As this synthesis is intended to contribute to the reflection on the processes of the Anthropocene, alluding to the deep human footprint on Earth, and as land use change in the tropical Andes had a great deal to do with the plantation system (in addition to some directly extracted products, like rubber, that also required intensive labor exploitation), this chapter ascribes these processes to the idea of "Plantacionocene" or "Plantaciocene": a devastating transformation of natural ecosystems, agricultural lands, pastures, based on work with servile relationships (Haraway 2015). This involved the domestication and geometrization of territories and populations, under rational control, to maximize production, intensively appropriating nutrients, water, and soils.

The analysis will be, above all, qualitative, although for some products, this chapter has included data on cultivated hectares, transformed areas, or volumes of exportation. It will cover the period from 1830 to 1940 (some 110 years). It begins at the breakup of the colonial period and the rise of the new Andean republics, culminating with the beginning of the intensification of the processes linked to the Great Acceleration of the Anthropocene (McNeill and Engelke 2014).

Two axes structure this chapter. The first is cross-sectional in nature, composed of the crisis elements linked to land use change. Such crises are not just "bad or difficult situations," but allude to "profound changes and important consequences in a process or a situation, or in the way they are perceived" (both meanings are recorded

in the Dictionary of the Royal Spanish Academy). This first axis includes policies, conflicts, land ownership, markets, climate, pests, deforestation and overexploitation, conservation, epidemics, and natural threats.

The second axis articulates activities and products that led to the selected land use changes. The authors focus on actors such as guano, cinchona, rubber, coca, cacao, grapevines, sugarcane, cotton, indigo, tobacco, coffee, bananas, and agriculture for local markets and livestock. This chapter does not dwell on mining (including saltpeter) or oil extraction, which are discussed in detail in other volumes. To the extent possible, items are grouped under spatial and temporal considerations.

The authors consulted secondary sources that address from big panoramas of economic or environmental history, to specific studies on commodities. Few sources give a direct and specific account of the land use change in the selected period. Explicit research on the subject alludes, with exceptions, to processes since the mid-twentieth century and contains generalities about earlier periods (for example, Killeen et al. 2008). From specific research around products such as coca, cacao, coffee, and others, it is possible to analyze the large-scale changes that had, concomitantly, greater consequences in the medium and long term.

Crises in the Tropical Andes

Political struggles and instabilities, whether international or internal, generated material impacts. The decrease in population density, herds of livestock, certain productions, and fiscal coffers corroded by the enormous debts incurred to support the military forces, were some of the repercussions. The War of the Pacific (1879–1884), which pitted Chile against Peru and Bolivia, had effects on port access, labor, production, and exports. Similar consequences brought about other international belligerences: between Peru and Ecuador (1858–1860), Colombia and Ecuador (1863), Bolivia and Brazil (1899–1903), Colombia and Peru (1932–1933), or the Chaco War between Bolivia and Paraguay (1932–1935). The very destructive War of the Thousand Days in Colombia (1899–1902) had considerable implications, including the separation of Panama as an independent republic. There were also consequences after civil strife in Bolivia, the Liberal Revolution in Ecuador in 1895, or resistance processes, including radical social movements that ended with massacres, in Guayaquil, Ecuador (1922), Uncía, Bolivia (1923), and Santa Marta, Colombia (1928). As far as the authors know, Indigenous uprisings were not as frequent.

The dynamics of global mercantilism, particularly those related to the British empire, gave rise to crises. Regardless of the dominant ideology in each moment, the republics sought to connect to the world to promote their economic growth and pay their debts. They did so at the cost of converting natural heritage (fertility, water,

land) into financial capital. Exports, investment, and material prosperity increased for certain groups. But these external markets changed because of the emergence of competition (cotton, rubber, cinchona, or coca) or the collapse of prices due to global financial crises, as in 1873 and 1929.

Deforestation, overexploitation, and biological invasions were indicators of crisis, booms, and busts. The introduction of two Australian species – *Eucalyptus globulus* (as wood and firewood) and *E. citriodora* (as an aromatic) – attempted to counteract, from the second half of the nineteenth century, the loss of forest mass in the highlands, a process that began with the Spanish conquest. In a Colombian law of 1884, a bonus was offered for every 10,000 eucalyptus trees planted in the Bogotá savanna (Palacio 2006: 55–56); cultivation in that area declined at the beginning of the 20th century (Molina 2021). In Ecuador, eucalyptus trees were called "the timber salvation of the Sierra", for their contribution as firewood and timber for construction (Acosta Solis 1945). There were also resistances: in Quito, when President Gabriel García Moreno planted them in the dusty Plaza Mayor, "was ridiculed and even threatened" (Orton 1870: 76–77). In the twentieth century, some peasant women argued that these trees should be taken from food crop plots, because "they were not going to feed their children with eucalyptus leaves" (Mayer and Fonseca 1988, quoted in Martínez Alier 1990).

Since colonial times, the woods around Guayaquil were reserved, destined exclusively for the construction of ships. In 1829, other measures were issued to protect the forest wealth of this region. Willow trees were introduced around Lima to alleviate the shortage of materials (Buenaño Olivo 2000). There were policies to stop the destruction of cinchona stands in the Loja province of Ecuador from the eighteenth century, condemned by Eugenio Espejo (1993). In Bolivia, the government banned in 1837 the cutting of cinchona bark for five years and regulated the form of exploitation of these plants. In Colombia, it was said, in relation to cinchona, that when a medicinal plant was completely extracted, its reproduction had to be ensured, under penalty of having the product confiscated (Palacio 2006: 58). In 1903, the prohibition of the felling of trees of rubber, cinchona, cacao, and other products, under threat of a fine, was insisted on, and in 1905, the free exploitation of national forests was prohibited.

Bolivia passed in 1832 a law to protect overexploited chinchillas (*Chinchilla chinchilla*). There were other laws at the beginning of the twentieth century to prohibit the hunting and export of such rodents as well as vicuñas (Ibisch 2005; Marconi 1991). Both species were hunted for the quality of their fur. Those rules, however, could be left on forgotten on the page, due to poor controllability. The twentieth century witnessed the emergence of forestry institutions throughout the area, along with the adoption of new regulations on forests, soils, waters, fauna, and fisheries.

In the highlands, mineral extraction caused deforestation by road openings, establishing populations and infrastructures, obtaining firewood and other materials,

consumption of food, among other things. In the lowlands, the destruction of mangroves on the Ecuadorian coast was reported and condemned in literary records, such as the novels *Don Goyo* (Demetrio Aguilera Malta 1933) or *Los Sangurimas* (José de la Cuadra 1934). In the Galapagos archipelago, there was no state control until the impacts of fledgling tourism began to be visible and the declaration of the first protected area of the entire region was made, in 1936 (Bustamante 2016). The decline of resources such as guano prompted conservationist thinking in Peru (Cushman 2005). Sajama National Park in Bolivia was declared in 1939 to protect firewood, as well as an area in Nor Lípez (Potosí), to protect chinchillas (Marconi 1991; Ibisch 2005). Decades later, the declaration of protected areas became widespread.

Crop pests were decisive in productions such as cacao. They also affected rubber, bananas, and other cultivars; possibly the only major export crop that did not suffer from a devastating epidemic was coffee (McCook 2019). Between 1860 and 1873 alone, Peru reported the orange blight, rambutan mortality, apple disease, maladies and mortality of peaches, bean disease, poor cassava production, epidemics in willows and other trees, potato disease and loss of barley sowing, aphids in many plants (especially cherimoyas and guavas), epidemics of tomato, cucumber and other nightshades, malaise in alfalfa, corn disease, maladies in banana crops, maladies of cottonwoods, vineyard disease, sweet potato disease, cattle, horses, and donkeys decimated by pests, cattle attacked by *Typhus carbuncosa*, rams attacked by liver fluke or moths, pigs attacked by pests (Garcia and Merino 1876, cited in Díaz Palacios et al. 2016).

Climate threats were decisive, particularly when it came to heavy rainfall, sometimes associated with El Niño events (Huertas Vallejos 2001; Grove and Adamson 2018). The overflow of rivers, alluvions, and floodings occurred along with the destruction of populations, crops, and infrastructure, as well as the emergence of epidemics and impacts to fisheries. Between 1800 and 1987, there were 32 moderate or close to moderate El Niño events; the 1925 event was the strongest of the first half of the 20th century (Takahashi and Martínez 2019; Grove and Adamson 2018; Quinn, Neal, and Antunez de Mayolo 1987; Díaz Palacios et al. 2016). Among other effects, increased temperature and precipitation brought forward the maturation of vines, sugarcane, and cotton, also facilitating the arrival of pests.

Excessive water prompted pleas for "the rains to stop," while its absence also generated losses. Variations in harvests were audited in the records of tithes and scores paid by the Indigenous communities, and it has been suggested that the long period between 1720–1860 was characterized in the Andes by a maximum degree of drought (Tandeter 2001: 232). The impact of climate change, particularly temperature rise, caused the elevation of vegetation and altitude of crops (Morueta-Holme et al. 2015; Moret et al. 2019; González-Orozco and Porcel 2021). The agricultural frontier expanded up and down, due to the interplay of the search for new fertile and

pest-free land, route openings, the introduction of new varietals, and climatic issues such as droughts or rains.

A study on the distribution of eight crops concluded that, over 224 years, there occurred a 740.1 meters change in their elevation range (González-Orozco and Porcel 2021). The crop with the most expanded range was sugarcane, adding 1,426 meters. Also important was the extended range of barley, potatoes, cassava, maize, and wheat.

Epidemics, whether or not associated with climatic aspects, were more decisive in human settlements than in productive enclaves. Bubonic plague, cholera, and malaria were all present. Likewise, some earthquakes, tsunamis, and volcanic activity played crucial roles.

Lack of labor caused crises for productions of scale, in the context of little or no mechanization. In the nineteenth century the population increased, despite the impact of the wars. Slavery had been abolished (Colombia and Ecuador in 1851, Bolivia in 1852, Peru in 1854), but systems such as *yanaconaje*, *huasipungo* and *pongueaje*, among others were maintained. The Ecuadorian writer Jorge Icaza narrated in 1934 this precariousness of work in his novel *Huasipungo*; this system, like *pongueaje,* consisted of the patron giving a piece of land to the Indigenous for agriculture or pastoralism, in exchange for working for the benefit of the former. From the rubber regions of the Amazon to the sugarcane plantations of the Galapagos, there were relationships that maintained characteristics of slavery. Alphons Stübel, a German geologist who travelled the Andes in the 1870s, noted that the abolition of slavery dented productions, so other systems of servitude were attempted (Brockman 1996). With an absence of labor, migrations from the highlands to the lowlands were promoted, as well as that of foreigners like the Chinese "coolies," to extract guano (Cushman 2013). European immigration did not reach the scale of the austral countries, although German populations did reach places like the Galapagos Islands and the Oxapampa colony in the Peruvian Amazon, where other Europeans gathered (Marcone 1992).

Crucial in the transformation of space was the structure of land ownership, particularly since circa 1850. The change from communal to private, and the liberation of many estates, including those of the Catholic church, spawned land grabbing and monocultures of scale (Dollfus 1981; Bethell 1992). The establishment of the plantation system had a strong basis in these processes of land changing hands. In Bolivia, the *Ley de Exvinculación* of 1874 exacerbated the gradual narrowing of the territory of Indigenous communities, the increase in the number of haciendas, along with the resurgence of the *pongueaje*. In Colombia, both liberals and conservatives hoarded land that had been owned by Indigenous peoples and the church (Palacio 2006: 41). The idea of the existence of large tracts of "wastelands" (*baldíos*), "uncultivated" and depopulated lands, was instrumental in fostering colonization and human settlements, as well as sustaining national territorial claims. The idea of emptiness was

maintained in the absence of a particular type of agriculture and land usage, considered an indicator of non-settlement.

Urbanization caused no major changes in land use. Although it intensified at the beginning of the twentieth century, cities barely overflowed uncontrolled until the middle of that century. However, urban landscapes did see important changes linked to the prosperity of exports. The Great Fire of Guayaquil of 1896, together with the immense capitals of cacao, allowed profound reforms. Bogotá, La Paz, and Quito extended from their historic centers to gardened neighborhoods with avenues, parks, and residences away from the agglomeration (Palacio 2008; Guerrero Farías 2012; Gallini and Castro Osorio 2015; Sánchez Calderón 2021; Cuvi 2022). These processes hidden or domesticated rivers and streams, sometimes as part of sanitation and hygienic works (Lossio 2003; Sánchez Calderón 2021). Port, rail, and road infrastructures associated with exports, and industries, were created, as in Medellín.

The intricate topography and poor means of communication limited production. To alleviate this, states undertook their construction with foreign and local capitals. Railways were built between productive sites and ports, but also to communicate highlands and lowlands, such as the train that linked the port of Guayaquil with the high Andean cities of Quito and Cuenca in Ecuador. The first Colombian railway line, completed in 1871, linked the Caribbean city of Barranquilla with the mouth of the Magdalena River, to allow sea access for the entry and exit of products. In Bolivia, the construction of railways to move minerals to ports began in the 1870s and was rapid. The *abrazo de hierro* (embrace of iron) as the alternative to impassable roads much of the year, strengthened the locations through which it passed, giving rise to regional competitions (Clark 2004; Bulmer-Thomas et al. 2006; Contreras and Cueto 2007). These works impacted forests, using wood for railroad ties, infrastructure, or firewood to fuel locomotives. Steamboats, such as those along the Magdalena River, also demanded biomass for fuel. These works proved crucial in enhancing the social metabolism associated with the plantation system and other forms of extractivisms, by facilitating exports, as well as investments and expenditures in urban centers where the revenues were concentrated.

The completion of the Panama Canal improved the connection between the Pacific and Atlantic Oceans. The railway that linked the city of Cali with the Pacific Ocean through the port of Buenaventura in 1915, as well as the land roads to that port (Figure 1), significantly expanded the output of products from the Cauca Valley. Buenaventura eventually became the main point of departure for Colombian coffee. The roads caused substantive changes: note in Figure 1 the magnitude of the movements of mass and materials, and the marks of the explosives used to engineer the route. These routes generated extensive transformations due to the demand for materials to sustain their construction, and the possibility they brought to increase the transport of production.

Fig. 1: Overview of the Road Cali-Buenaventura (1930)

Source: Foto Escarria (1930).

Environmental sciences, particularly botany, agriculture, geography, geology, and cartography, were promoted for the exploration and exploitation of raw materials (McCook 2018). Led by the Italian Agustin Codazzi from 1850 to 1859, the Chorographic Commission fulfilled this role in Colombia (Appelbaum 2016). In Ecuador, this role was carried out by Jesuit scientists brought to the National Polytechnic School in the 1870s, such as the German Teodoro Wolf and the Italian Luis Sodiro (Miranda Ribadeneira 1972). In Peru, the Italian Antonio Raimondi made important and decisive explorations (Seiner Lizárraga 2003). Gradually, national scientists, such as the Peruvian Mariano Rivero, the Ecuadorian Augusto Martínez, or the Colombian Joaquín Acosta, joined these activities and work. The expeditions also had impacts on biodiversity, extracting huge quantities of specimens; for example, the Webster-Harris expedition of 1897 to the Galapagos collected in four months, among other things, 3,000 bird skins, 150 iguanas and sixty-five turtles, many of them living (Hennessy 2019).

Land Use Change

Natural ecosystems were pressured and altered. Some processes came from the sixteenth century, such as the deforestation of the highlands. In the inter-Andean valleys of Ecuador, during the nineteenth century, landscapes more desertic than Palestine were mentioned (Orton 1870) and confronted by intellectuals such as Juan Montalvo (1999), who wrote about the need to take care of the few remaining trees. In Peru, *taquia* (manure of llama – *Lama glama*) and tola (the shrubs of *Parastrephia* spp.)

were used as sources of energy; only from the second half of the nineteenth century did the development of stone coal, gas, and oil began (Díaz Palacios et al. 2016). Deforestation occurred in sites of agriculture, forestry, livestock, mining, urban development, and industry. Isolated cases such as the extraction of fruits from tagua nut or vegetable ivory (*Phytelephas* spp.) were associated with the establishment of populations of Afro-descendants in the Colombian and Ecuadorian Pacific (Leal and Van Ausdal 2014). Similar processes occurred around extractivist practices related to the balsa trees, rubber, cinchona, among others. The capture of birds for the feather trade had local effects (Quintero Toro 2012).

Tab. 1: Estimated Annual Rates of Change for Transformed Area of Forest Ecosystem Types

	1800–1850		1850–1920		1920–1970	
Ecosystem	ha	%	ha	%	ha	%
Tropical dry forests	-5,024	-0.35	-4,206	-0.43	-5,670	-0.75
Tropical subhumid forests	-582	-0.06	-265	-0.03	-11,853	-2.16
Andean Forests	-19,910.	-0.1	-25,888.	-0.21	-40,742	-0.41
Tropical Humid Forests	-7,910	-0.01	-6,994	-0.03	-11,450	-0.03
Total	-33,427	-0.04	-39,753	-0.08	-69,716	-0.12
Low Andean forests (<1,000 m)	-5,779		-2,939		-11,174	-66,453
Mid-Andean forests (1,000-2,000 m)	-12,390		-12,014		-18,925	-55,520
High Andean forests (<2,000 m)	-1,741		-6,935		-10,643	-49,216

Source: Etter, McAlpine, and Possingham (2008:13).

Quantitative information on the processes of land use change is lacking except for Colombia, where overall annual rates of natural ecosystem transformation have been reconstructed (Etter, McAlpine, and Possingham 2008: 13, Table 1). The table shows that the Andean forests located between 1,000 and 2,000 meters above sea level were particularly affected. Much destruction was justified under the idea that these sites were "wastelands" or underutilized. This imaginary also fell on the *páramos*, natural formations where shrubs and grasses, many endemics, predominate; they are located at high altitudes and have suffered the introduction of plant and livestock species since the colonial period; these landscapes were converted to agricultural lands mainly through burning (Kessler and Driesch 1993). In Colom-

bia, Indigenous high-altitude populations were moved from 1821 to reservations (*resguardos*) above 3,000 meters altitude, initiating processes of soil overexploitation and intensified biomass extraction. As in other interventions, there was a geometrization of the territory, alteration of the hydrological cycles, erosion and reduction of the productive capacity of the soils, loss of biodiversity, and alteration of regional and local climate. A second wave of occupation came from the haciendas, which expanded their crops to high altitudes, burning the shrubs to obtain coal and provide land for potato cultivation (Hofstede, Segarra, and Mena Vásconez 2003).

"Wastelands" were state property as they were "uncultivated." With this mindset, the uses of these land by Indigenous peoples were made invisible. In Colombia, their transfer or sale came to be considered as an alternative to cover foreign debt; a project caused great controversy in 1855, as it planned to sell approximately 30 million hectares, almost one third of the national territory, to a French company (Zárate Botía 2001: 138). A few years later, territories of tens of thousands of hectares were granted to national companies. Only a few years later, after the decline in the export of cinchona, the term *baldíos* was replaced by *bosques nacionales* (national forests), which also failed to recognize their millenary Indigenous occupation. Imaginaries about these spaces with potential riches, re-enlivened myths such as those of the Country of Cinnamon, El Dorado, Gran Paitite, Gran Mojo, among others (Cuvi, Guiteras-Mombiola, and Lehm 2021). Literary interpretations in this regard appeared in novels such as *La Serpiente de Oro (The Golden Serpent)*, by the Peruvian writer Ciro Alegría in 1935, which gave an account of the civilizing spirit and criticism of it. There were also insights from travelers, some scientists, adventurers, who left perceptions around such environments.

Biomass Plantations and Extractivisms

Among the activities that modified land use, production to supply domestic markets has been less studied compared with those associated with exports. There were hundreds of species and varieties of crops, livestock, and forestry, both for subsistence and to sustain populations in productive sites. Many changes happened due to the slash and burn system.

The Indigenous populations, particularly in the mountains, used to manage the environment through systems such as multicrop *chacras*, in a microvertical scheme, using ancestral domesticated species, along with others that arrived as part of the Columbian exchange. Certain technologies never fell into disuse, such as crop terraces, or water catchments and reservoirs, called *amunas* or *qochas* (Dollfus 1981; Murra 2002; Cuvi 2018). Until the twenty-first century, food supply in these countries has continued to be supported by the production of smallholders and Indigenous peoples.

There were and still are pastoral groups, some nomads, dedicated to the care of Andean camelids such as alpacas and llamas (Del Pozo-Vergnes 2004; Sendón 2009). Cattle ranching, which has received several historical approaches (Flórez-Malagón et al. 2008), caused intensive and extensive land use changes. In the entirety of the Andes, the size of the cattle herd went from about 350,000 in 1850, to 1,700,000 in 1920, and then up to 6,000,000 around 1970 (Etter, McAlpine, and Possingham 2008). The herds supported the extraction processes of cinchona, rubber, coca, minerals, as well as the construction of railways and other activities. The breeding of cattle for meat, milk, or both purposes, led to the introduction of pastures, which became dominant to the detriment of natural formations. In the highlands of Colombia, Ecuador, and Peru, kikuyu grass (*Pennisetum clandestinum*) has displaced native herbs. In subtropical and tropical lands, forest and pasture conversion led to rapid productivity losses and major difficulties in recovering vegetation cover.

Two export products, connected with Peru and somewhat less with Bolivia, were guano and saltpeter. The extraction boom of guano, a substance that is produced by the accumulation of seabird droppings, occurred between circa 1850 and 1875 (Cushman 2013; Bonilla 1984). Although it did not cause substantial changes in land use, because it was removed from small islands, the capital obtained was used for improvements in Lima or as investment in railways associated with sugarcane and cotton plantations (Deustua 2011). Overexploitation, together with the Great Depression of 1873, the War of the Pacific, and the emergence of synthetics and other types of substitutes, brought about guano's fall as the main export product. Part of the decline had to do with the lack of knowledge about the relationship between the quantity extracted and its replenishment by bird populations, since mistaken observations by the Prussian Alexander von Humboldt were used as a baseline. Only in 1890, with the exploitation in crisis and the decline of bird populations, measures were taken (Cushman 2005; Díaz Palacios et al. 2016). The exploitation of guano overlapped, to some extent, with saltpeter, a type of salt that has several uses, particularly as a fertilizer. Thus, the European agricultural revolution was sustained by the fertility of South America. The saltpeter fields were in the Atacama Desert, near the coast, in territories of Peru and Bolivia, until the Pacific War, when they were taken by Chile. Its extraction required more machinery, supplies, and labor, and involved deforestation in areas that had some vegetation.

In the Amazonian-Andean region, three products dominated the participation in exports and land use change: quinine, rubber, and coca. Cinchona trees (*Cinchona* spp.) were exploited since the sixteenth century to obtain their medicinal barks, often by cutting down the tree or, less frequently, debarking it *in situ*. From the eighteenth century, the destruction of cinchona stands was evident in Loja and its surrounding region, south of Ecuador, from where the so-called fine bark had been extracted. It has been estimated that, to gather 20,000 *arrobas* (a bit more than 225 metric tons), it was necessary to cut down 34,000 large trees and that, when using

only the parts where the bark was thin (which was sometimes the only bark received), it was necessary to fell around 100,000 trees (Moya Torres 1994: 54). The extractive frontier increased from 1820, when chemical analyses were developed to determine the quinine content in each species and British demand increased. Cinchona was exploited on both sides of the Andes from about 2,500 meters above sea level, and into the inter-Andean valleys. Plantations were encouraged in Bolivia; 473,180 plants were purchased in Soratas alone, in the foothills north of La Paz, between 1877 and 1882. In Bolivia, just like in previous centuries in the Loja region, there were declinations in overexploited areas (Zárate Botía 2001). In Colombia, cinchona was integrated into the most dynamic export sector, along with gold, coffee, and tobacco; between 1881 and 1883, it became the primary export (Palacio 2006).

As in other exploitations, immigration occurred to extractive sites, with the subsequent displacement of native populations and the emergence of new activities of production, social relations, and spatial organization. The packaging of the bark required leathers, wood, nails, and bitumen. Moreover, the operation required mules for transportation; food, cattle, and crops to feed populations; and fuel for steamboats. Hunting was frequent, partly for the control and extermination of species considered "pests," such as felines. Thus, weapons and tools were introduced into local populations. This dynamic prevailed until various actors succeeded in smuggling cinchona seeds in the 1860s (Brockway 1979), after which Dutch production in Southeast Asia monopolized markets, the British became self-sufficient by their plantations in India and Ceylon, leading to the decline of Andean extractivism, except for a short-lived boom (like rubber) during World War II (Cuvi 2011).

After the decline of cinchona extractivism, capital moved on to rubber, which took advantage of the preexisting structures. The discovery of vulcanization in 1839 led to new industrial applications and increased demand. Overall, species of the genus *Hevea* were exploited, especially *H. brasiliensis*, which provided the highest yield of the top-quality latex. In many places, trees were cut down. For example, in 1903, within a strip approximately 200 km wide, all black and white rubber trees were destroyed from the Ariari River in Colombia to Ecuador (Larrea-Alcázar et al. 2021). Its extraction was associated with exploitative practices such as a bait and switches with the aim to create a debt, or *habilito*, exposed by the Colombian writer José Eustasio Rivera in his novel *La Vorágine* (*The Vortex*) published in 1924, or by the English-speaking authors Roger Casement (1988) or Walter Ernest Hardenburg (1913). Demographic debacles occurred in these and other areas of rubber production, contrasting with the population growth near to coffee and tobacco plantations.

The Peruvian rubber lord Julio Cesar Arana came to control extraction on more than 3 million hectares. Iquitos became a key hub, like Manaus in Brazil. Rubber exports grew until 1911, when international prices declined. In Bolivia, exploitation of rubber began around 1860 with capital from cinchona harvesting, although the

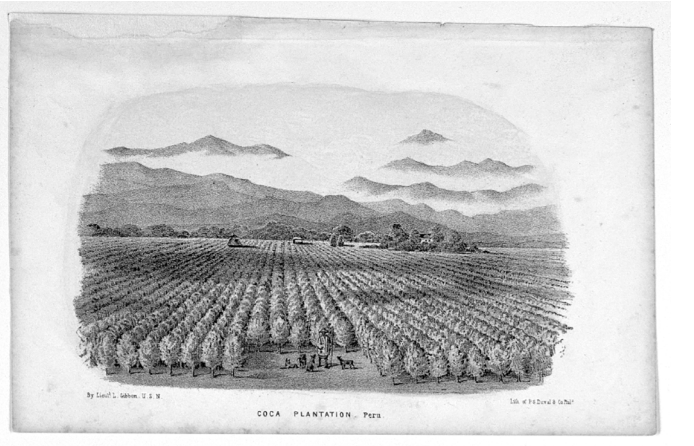
boom only occurred between 1898 and 1919, thanks to high prices attracting foreign capital and benefits for the state in the form of taxes. The Casa Suárez controlled production, transport, food and other aspects associated to the extractive chain (Larrea-Alcázar et al. 2021)

Another product of the Amazon foothills was coca (*Erythroxylum coca*), a ritual and medicinal plant that provides greater resistance to fatigue, hunger, thirst, and improves adaptation to altitude. Ancestral cultivation continued during the colonial period, particularly to supply mine workers. The compact valleys and eastern zones between 600- and 2,000-meters altitude were the active areas of cultivation in Peru and Bolivia (Gootenberg 2008). There was a strong trade of lands, and settlers arrived to take advantage of the "wastelands." The population of Huánuco, transformed into an agro-industrial site, doubled by 1896.

Coca boomed after 1850 as medicine, food, and narcotic. In 1859, cocaine was discovered and promoted primarily as a surgical anesthetic, but also as food, elixir, and tonic (Gootenberg 2008). There was demand from Europe, Bolivia, Peru, Chile, the United States (for Coca-Cola syrup), among other places. Over time, the economic roles of coca and cocaine reversed: between 1904–1908, cocaine revenues were about twice those of coca, but by 1929–1933, profits from the coca leaf were twice that of cocaine. Plantations encouraged the radical removal of wild vegetation, replacing it with a geometric order that gave rise to tight control of the territory. Such an ordered arrangement is seen in Fig. 2: a plantation in a valley appears in the foreground, along with the minor remnants of tree vegetation, while the densest forest masses consist of those in the mountains in the background. In addition, there appears an armed man and some dogs. During peak exportation, between 1900 and 1905, Peruvian businessman and politician Alejandro Garland reported ownership of at least twenty-one cocaine factories. In Bolivia, from independence until 1952, coca farmers around the Yungas were among the elites who ruled in alliance with the military; from 1829 on, they gained the authority to impose taxes on the roads and the sale of coca.

Markets declined in the face of international prohibitions, such as the one imposed by the United States Food and Drug Administration in 1906. In addition, as with cinchona, the Dutch displaced Peru from many markets since the beginning of the twentieth century: in 1904, only twenty-six tons of coca leaf were exported from the island of Java, but this increased to 800 tons in 1912, and 1,700 tons in 1920. These new players built a particularly productive industrial cocaine regime, which was followed by a Japanese network in the 1920s and 1930s (Gootenberg 2008).

Fig. 2: Coca Plantation in Peru



Source: Gibbon (n.d.).

In the lowland and coastal areas, a product that emerged in the late nineteenth century was cacao, a food whose ancestral origins reside in the Amazonian-Andean rainforests (Zarrillo et al. 2018). A base ingredient of chocolate, cacao boomed in Ecuador beginning in the nineteenth century; it was also sown on a smaller scale in other countries. Exported since the colonial period, its exploitation paused during the wars for independence but later recovered (Contreras 1994; Maiguashca 1996). Ecuador accounted for 20–25 percent of world exports between 1895 and 1914, representing 70 percent of domestic exports. With the *pepa de oro* (golden seed), great fortunes were forged, and Guayaquil became the richest and largest city in the country. The cacao district known as *Arriba* (Above) had better quality and priced fruits, navigable rivers, cheap and easy transportation, and "wastelands" available at low prices. Little technology was used, although some ranchers tried to introduce machinery and new farming systems. Since labor was scarce, due to low population density and competition with other crops, peoples from the highlands migrated to the plantations, seeking higher wages and relative freedom from taxes; this was recounted by the Ecuadorian writer Luis A. Martinez in his 1904 novel *A la costa (To the Coast)*. The population of the coastal provinces increased sevenfold between 1873 and 1926 (Pineo 1994).

The increase in cacao production was sustained by the advance of the agricultural frontier through clearing, mainly towards higher regions, humid all year round. Between 1885 and 1910, more than 47 million trees were planted, and by 1923, plantations occupied 85,500 hectares (McCook 2002). Big haciendas appeared that began to displace small and medium landowners; vast properties came to control

most of the land (Deler, Portais, and Gómez 1983). The forest was converted into permanent crops and pastures, causing erosion. The location of farms in higher areas of very heavy rainfall all year round and problematic drainage favored the appearance of pests. First came the *Monilia* fungus, which incited the abandonment of plantations beginning in 1919. Then, in 1923, it was the turn of the "witch's broom" fungus, which affected nearly all plantations. Attempts were made to increase tree density, occasionally on foreign advice, with no results. Production collapsed 60 percent, leading to a national crisis (McCook 2002).

Three other plantation goods stood out in the coastal plains: grapevines, sugarcane, and cotton. The acclimatization of the grapevine occurred mainly in Peru around the sixteenth century. Vineyards were scattered along the coast, although by the eighteenth century, they concentrated in the south, due to the dry and warm climate, taking advantage of Indigenous irrigation systems. Distilleries for grape spirits and pisco appeared. Wines had a boom but declined after 1850 because of the expansion of cotton and sugarcane plantations, and the end of the old prohibition on the production of sugarcane spirits (Huertas Vallejos 2004; Lacoste 2004). Cultivation was also affected by wars, rains, earthquakes, and pests (Díaz Palacios et al. 2016).

Sugarcane, also introduced with early transatlantic travels, caused land use change since colonial times. Its plantations triggered deforestation both in the generation of planting area and the production of firewood to process the cut cane and obtain raw sugarcane (*panela* or *chancaca*), spirits (*aguardiente*), or refined sugar (Díaz Palacios et al. 2016). It played a very important role in the north of Peru, near Trujillo and the surrounding areas, all the way to warm inland valleys, including territories belonging to Cusco, central areas of the country, and the foothills to the Amazonia. The rubber boom promoted markets for sugarcane derivatives such as spirits and *panela*. Plantations were also promoted in dry inter-Andean valleys, such as Chota in Ecuador, where it caused transformations since the nineteenth century. Its cultivation reached the Galapagos archipelago, where a sugar mill was established on San Cristóbal Island in the second half of the 19th century, with very harsh working conditions (Hennessy 2019); sugar was exported to Panama. It was important in the Cauca Valley, Colombia, in the twentieth century, whose sugarcane flowed through the port of Buenaventura (Armas Asín 2020; Tucker 2000).

Finally, in warm coastal plains, there were numerous plantations of cotton, a product obtained from various species of the genus *Gossypium*. These native plants were sown by the Indigenous, and the Spanish tried to replace them, at times successfully, with wool from sheep, as occurred in present-day Ecuador, where large textile manufractures (*obrajes*) were built (Tyrer 1988). Colombia experienced a short-lived boom in cotton fiber exports from the 1850s on (Safford and Palacios 2002); cultivation was mainly carried out in the lowlands of the Caribbean slope, and artisanal mills supplied the country with quality fabrics at affordable costs. Peru, where plan-

tations were larger, took advantage of the gap in the world market when production fell due to the Civil War in the United States (Armas Asín 2020). Later, external demand continued, and cultivated areas expanded and consolidated, sometimes to the detriment of vineyards (Lacoste 2004: 7–8). At the time, entrepreneurs were looking for land, and Peru caught "the white gold rush," becoming one of the main producers: between 1909 and 1914 production reached 260,000 quintals, which ranked the country seventh in the world and second in Latin America. Production continued to rise to 852,000 quintals in 1935–1936 (Armas Asín 2020). Notable in this country was the generation, after enormous efforts, of a local variety, achieved by the Puerto Rican Fermín Tangüis around 1912. Named after him, this variety was advantageous for its softer and shorter fiber. Its cultivation quickly spread throughout the country (Armas Asín 2020).

In Colombia, cotton ceased to be important around the 1870s. In its place, the indigo bush (*Indigofera suffruticosa*), from which a blue ink can be obtained, emerged. This biomass was, for a short time, the main export. Such a turn was the result of unrest in the producing regions of India, the main supplier for the world. Indigo was planted in several locations and, by 1880, accounted for almost 7 percent of exports (Bushnell 1994). Local producers, however, never considered it necessary to invest in systems of irrigation and fertilization, or a more permanent establishment. As with cotton, indigo collapsed in the country after the development of artificial dyes in the chemical industry in Europe in the final third of the nineteenth century.

Tobacco, coffee, and banana were the other three most relevant plantation products, particularly in Colombia. Tobacco (*Nicotiana tabacum*), domesticated in the Americas, was produced since colonial times in the four tropical Andean countries to meet domestic demand. It experienced a major boom in Colombia between 1845 and 1870 (Kalmanovitz 2015), when the government ended its monopoly in 1850 and liberated its production and trade. The Ambalema region, in the Magdalena River valley, was one of the most important areas (Ceballos Gómez 2011). The main destination was Germany, and the earnings from exports allowed the installation of the telegraph throughout the country (Uribe Celis 2011: 230). By the 1850s, it accounted for 28 percent of total exports (Ocampo Gaviria 2017: 244), peaking around 1860, when it reached 40 percent of the value of exports, surpassing Antioquia's gold (Kalmanovitz 2015). By 1875, its key role dropped sharply (Ocampo Gaviria 2017: 228), languishing in a gradual process to never recover. Part of the lack of continuity would have involved problems in presentation and quality (Palacio 2006; Bushnell 1994). In Peru, production was basically for domestic demand, with only a few exports through the Amazon (Armas Asín 2020: 123).

Important attention is paid to coffee (*Coffea* spp.), introduced to the region in the late eighteenth century. Over time it gained global importance, and Latin America became its main producer (Topik and Samper 2006: 126–127). Demand did not fall, and its production has been correlated to that of sugarcane, often used to counter-

act the bitterness of the drink. In Colombia, coffee left its mark on land use from the end of the nineteenth century in a decisive and uninterrupted way. The country became the second-largest world producer, behind Brazil, in 1920s (Uribe Celis 2011); plantations became widespread in the haciendas of central and eastern Colombia and on small properties. In Cundinamarca and Tolima, in the center-west, the haciendas established a subservient and sharecropping system, while in Santander, and mainly in Antioquia, north of the departments named above, there was a free production regime, with a more adequate distribution of land and more equal relations (Kalmanovitz 2015). Coffee brought transcendental changes, such as internal migrations, interventions on "virgin" lands, and population movements to borderlands. Part of this great migration has been described as the Antioquian colonization. The Antioquia and Pacific railroads, as well as the completion of the Panama Canal, consolidated the shift of plantations to the Coffee Axis in western Colombia (Bushnell 1994). It has been the only export product that was almost entirely in Colombian hands, although, since 1920, foreign companies have entered the market (Murillo Posada 2011).

Another product that incited changes in land use through the plantation system was banana (*Musa* x *paradisiaca*); early introduced to be grown in humid, warm lowlying areas. In the late nineteenth century, it was extensively planted in Colombia, for export purposes, particularly in the Atlantic area of Santa Marta, resulting in destruction of primary forest (Soluri 2013: 355). This boom was due to a crisis: epidemics caused by the Panama disease (the fungus *Fusarium oxysporum)* in Central America. A major player was United Fruit Company (UFC), which constructed the plantations in an enclave model, isolated from the local population, with sharp differences in treatment of native and foreign personnel. It controlled irrigation, rail transfer, ships' loading, and sale. The company had 25,000 workers, which weakened the labor supply in other areas. Banana accounted for 8–10 percent of total Colombian exports between 1905 and 1925 (Kalmanovitz 2015). In the face of poor working conditions, there were two major strikes. The second culminated in a massacre in the town of Ciénaga in 1928 (Safford and Palacios 2002: 281), whose infamy was enhanced by an exaggerated story, typical of magical realism, from the Colombian writer Gabriel García Márquez, in his novel *Cien años de soledad* (*One Hundred Years of Solitude)*, published in 1967. The banana boom in Santa Marta lasted until 1943, when the sigatoka appeared. The UFC chose to avoid the cost of fighting the pest and withdrew from the region.

Final Discussion

Land use change analysis usually includes information on the number of hectares transformed. For the territory and time addressed, however, these data, when avail-

able, are approximations on which agreement does not always exist. Instead, there are frequent assertions about the volume or income from exportation, as well as qualitative assessments of systems of plantation and biomass extractivisms.

Over the 110 years considered, nineteenth century liberal ideology gained prominence in both political and economic matters in all four countries. The republics began to participate in the global economy in a way that was in sharp contrast to the colonial situation, when a Spanish monopoly was imposed on production and trade, although contraband existed. In any case, the Republican production of commodities was forged in a framework of inequality that replicated structures of the ancient regime. These were, almost always, stories about elites who concentrated capital, land, and profits, usually with the participation of foreign investment, which ran alongside stories about large masses of people, native or immigrant, who worked under usually exploitative systems, in the context of labor shortages and competition. There were also stories of frontier colonization, of bottom-up ventures, such as in nations that were really beginning to build themselves, with opportunities of different kinds, like in certain coffee or coca growing sites (although there were regional monopolies in those products as well).

Several state policies segregated the Indigenous populations, at times pushing them up into the highlands (like the *páramos*), at others because the aggressive colonization of the frontiers and its "wastelands" pushed them deeper into the jungles. Many Indigenous lands, as well as the properties of the Catholic church, were considered "wastelands" to enable these acts of colonization.

National and international variables and conditions played a role, as commodities formed part of global markets. Wars, price fluctuations, the emergence of competition and substitutes, pests, and social revolts in different production sites, among others, exerted their impact. In the case of competition, much of it originated in the smuggling of Amazonian-Andean species, such as cinchona, rubber, or coca, into Southeast Asia. Something similar happened with cotton. Pests, or the events of El Niño/La Niña, also played a decisive role.

Some crises were not resolved either in the short or medium term, such as the cacao crisis in Ecuador – caused by pests, poor plantation management, and expansion of cultivation into unsuitable areas. In that country, and in other areas, there was a notorious lack of local research and innovation, expressed in the development or improvement of varieties, pest management, and betterment or introduction of machinery. In very few cases did creative and constructive interventions occur, responding to specific needs, such as Tangüis cotton in Peru. The attitude of the elites towards improvements in production conditions was overly comfortable and accommodative, marked by conformism and immobility. Confident ruling classes, waiting for the prodigal nature to provide the answers or solutions, or waiting for technological improvements and renovations to come from outside. Low production costs and relatively low regional competition, as well as resistance to change, could

have had an impact. In extractive systems such as cinchona, rubber, and guano, there were local depredations and extirpations, but little restoration with simple technologies like reforestation.

Ideas and practices appeared, which today one could call conservationist and utilitarian, that challenged hegemonic processes. There were often reforestation regulations, although they were not always fulfilled. In the 1930s, the first protected area initiatives appeared.

Various products were described in this period with metaphors of wealth: golden seed for cacao, green gold for banana, white gold for cotton, bitter gold for cinchona. Several products ended up associated with the psychoactive revolution of commodities, with stimulants such as tobacco, coffee, chocolate, alcohol, coca, and sugar (Gootenberg 2008).

Although there were star products, usually more identified within national dynamics (coffee in Colombia, cacao in Ecuador, guano in Peru, tin in Bolivia), in this chapter, just a glimpse of a connected look, illustrates a more complex and dynamic picture. In several cases the capital of one product was moved to another, either through the emergence of competition, as in the shift from cinchona to rubber, or more favorable prices on international markets, as in the move from grapevines to cotton and sugarcane. Unprocessed biomass was mainly exported; industrialization occurred only in some cases around quinine, cocaine, wines, and refined sugar.

The dynamics analyzed here fit into the broad denomination of the Plantationocene, which includes not only monocultures, but the socioenvironmental processes associated with them (Haraway 2015), where colonial relations and construction of otherness predominate. Part of these processes was an intense geometrization of the territory: just as colonial cities tried to establish the idea of a checkerboard, far from the winding layout of Andean cities and European medieval cities, plantations-imposed symmetry, repetition, rational planning, efficiency, engineering for nature control, and, what Scott (1999) has called, a simplification in agricultural landscapes. They were premature signs of the advent of scientific agriculture, epitomized by the long Green Revolution.

In the period under study there was also a systematic introduction of technologies in the form of domestic animals, plant varieties, tools, means of transport, which intensified social metabolism. There were no major and decisive technological improvements driven by necessity as the mother of invention. There was no intentional search to solve problems *in situ*, but rather improvements came from somewhere outside, if you will, in the face of the passivity of local stakeholders.

The recipients of most of the biomass were in distant spaces. At the same time, the Andean space in transformation was inhabited by groups that accumulated financial capital and masses of workers in desperate situations. Such circumstances triggered conflicts of all kinds over land tenure and the distribution of income from production.

The changes in land use in the tropical Andes were unique because of the geographical space and plants cultivated, but also similar, in several respects, to other Latin American territories. Vast landscapes were transformed to extract minerals or biomass, causing social, economic, political, and cultural changes, including: intensive migrations, alterations of local dynamics (wild, rural, and urban), appearance of elites and subaltern groups, occurrence of wars and conflicts, boom and bust of markets, promotion of knowledge of the territory (particularly scientific), among others. The traces of these processes continued to be imprinted on the landscape during the twentieth century to the present day, some with more intensity than others.

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Land Use in the Amazon from the Mid-Nineteenth Century to 1950

The Transformation of the Amazonian Territory into Capital and its Incorporation into the Global Market

Carolina Hormaza and Miguel Angel Urquijo

After gaining independence from the Spanish crown in 1810 and the Portuguese crown in 1822, Latin America was incorporated into the production cycles set by the world powers and their modernization projects, and an increase in resource extraction was registered in the Amazon. The Amazon Basin encompasses the geographical region drained by the Amazon River and its tributaries. The Amazon biome comprises a set of terrestrial and aquatic ecosystems including tropical forests, flood forests, grasslands, savannas, mangroves, and palm forests. Taking advantage of the Amazon ecosystem in the nineteenth century depended on mechanisms that exploited the Indigenous population, considered not only dispensable, but dangerous for these companies aimed at the accumulation of wealth. Considering that the Amazonian territory develops in a symbiotic relationship with its inhabitants, the disappearance of Indigenous peoples has been one of the main impacts of the jungle's transformation into capital.

From the perspective of environmental history, paradoxically, the Amazon's transformation into capital had a marginal effect in the first stage of the Anthropocene. The basic source of energy was wood, and most of the essential materials in the economy were organic. Thus, from the viewpoint of deforestation, the extraction processes of the Amazon until 1930, including rubber exploitation, produced little environmental damage. This extractive nature, which did not develop into plantations, allowed a transformation of the Amazon into capital without significantly altering Amazonian ecosystems until the mid-twentieth century.

This chapter summarizes the extractive cycles through which the Amazonian territory was transformed into capital and the implications stemming from this process in shaping the current context of resource predation defined as the Anthropocene (Crutzen and Stoermer 2000; Rockström 2009). It intends to reflect on the impact of the Amazon rainforest's transformation after rubber exploitation and the Amazon's integration into the global capitalist project from a position of subalter-

nity and dependence. Given the different cultural matrices that characterize these countries, this analysis considers the different actors and the specific characteristics of the territory divided into three blocs: the Andean countries, the Portuguese Amazon (Brazil), and the Guianas.

Nation-State Projects and Evangelization: from "Empty" and Wild Territory to Inexhaustible Source of Resources

The close relationship that Indigenous peoples establish with their environment has endowed much of the Amazon region with an anthropic characteristic, and landscapes conceived as virgin or natural territories are also part of a cultural landscape shaped by the peoples who inhabit it (Descola 1993: 220). Understanding this relationship entails a conception of space that is alien to Western reasoning, which establishes well-defined boundaries in what it considers spaces endowed with civilization and, therefore, culture. Thus, the Amazon rainforest has gradually become a territory of conquest, depopulated in the Western imagination.

During the mid-nineteenth century, when the extractive cycles that opened the way to the Amazon's colonization began – the first being the rubber boom –, Amazonian indigenous peoples still retained a semi-nomadic rationality that allowed them to move freely through the territory, as well as their own conceptions of space, time, and work. This condition led to three phenomena during the deepening of extractivism: the ethnocide of groups that resisted conquest; the acculturation and incorporation into urban dynamics of peoples forcibly inserted into the productive processes of states through mechanisms such as the *enganche* (a form of indebted servitude); and the internment of Indigenous groups in the jungle, later identified as uncontacted or in voluntary isolation.

The population of the countries sharing the Amazon as a whole in the nineteenth century was small, considering the formal size of their territories. For example, the population of Brazil in 1822, the year of independence from Portugal, was about 4 million – with only around 150,000 living in the Amazonian region of the country. By 1900, it had grown to 17 million inhabitants. However, Brazil's figures, like those of other Amazonian countries, did not include the majority of Indigenous peoples. Many Indigenous Amazonian groups had been subjugated over the centuries and forced into a subordinate role within areas where either *mestizos* or European migrants and their descendants ruled. Other Indigenous Amazonian groups isolated themselves in the deep Amazon and remained virtually out of contact with the outside world (Pádua 2017: 24–25).

The nineteenth century was the setting for the formation of state projects and the Amazon's consolidation as border territory. The construction of nation-states in Latin America was wrongly based on the idea of the free and infinite availability

of lands and natural resources. After the decline resulting from the wars for independence and the instability of the political construction of the nation, this imaginary saw the advance of the internal border over the Amazon as the mechanism that would allow the resurgence of various countries.

As an inland territory, the Amazon challenged the competence of states to achieve governance and national integration. As a borderland, it crystallized the geopolitical concern of states for the defense of their borders. As a resource-rich land, the Amazon met the interests of local elites and the needs of world consumption. As a promised land, it attracted economic migrants and adventurers. The expansion of state power, population growth, and the rising demand for raw materials redefined the notions of economic necessity and national security in the Amazon. Industrialization fueled the expansion of cities and mass markets, while new technologies sparked the urban elites' faith in conquering tropical products. Agricultural mechanization and land commodification displaced millions of small rural landowners to the Amazon border. Thus, with the progress of the formation of nation-states in Latin America, the Amazon was incorporated into the national project, promoting systematic mechanisms of internal colonization aimed at the domestication of this space. State agents, along with local and transnational elites, raided the Amazon since the mid-nineteenth century, transforming the borders of the territory into capital.

Before independence, there was no precise knowledge of the Amazonian territory; even during the first two decades after independence, the territorial borders established by the colonizers were respected, since the Amazon did not seem a suitable space for the establishment of cities and productive centers. Among the territorial impacts of the transition from the colonial era to the Republic in New Granada was the political division of its geographical space and, with it, the Amazon (Duque Muñoz 2013). This political division of the Amazon occupied the elites of Ecuador (Núñez Sánchez 2020) and Peru (Mc Evoy 2004). The Latin American nation-state project followed centralist models that excluded the Amazon. The construction of the nation's imaginary in the Andean States was strongly based on the hacienda and plantation system. One of the objectives of the Jesuit reductions had been to generate labor, which was maintained until the republic through exploitative mechanisms such as encomiendas, obrajes, and mitas.

For these countries, the Amazon did not yet appear on the map as a territory capable of being inserted into the dynamics of the nascent world economy and was, therefore, on the margins of progress and modern nation-building. It was not until the refinement of scientific techniques that the Amazonian territory as a whole (ecosystem and inhabitants) was fully integrated into the commercial dynamics starting with rubber extraction in the second half of the nineteenth century. Both because of its Latin American character and because of the notion of a civilizational frontier that retains vis-à-vis those states that have tried to "integrate" the Amazon

into their national projects only as a source of resources, the Amazon is integrated into the global market from the margins. But the Amazon is also a territory of fundamental interest to humanity, because it is here, as in other natural territories, that the limits of human aspirations must be set (Urquijo 2020: 186).

In the case of Brazil, the nation was built on an expansionist logic: the so-called taming of the jungle, mainly in the Atlantic Forest and in some savannas inside the territory (Yory 2006: 42–43). Brazil's expansion over the Amazon in the nineteenth century was much slower. Agricultural production took place mostly on medium-sized properties, with labor from subaltern Indigenous peoples and also the European colonizers themselves. Until the mid-twentieth century, Amazonian cities were created on the banks of rivers in a slow process of occupation, forest extraction, fishing, and small-scale agriculture. With the rise of rubber, some cities were created as part of the expansion of latex extraction.

For their part, Guiana and Suriname, given their geopolitical position and, above all, their status as overseas domains and points of exchange and commercial connection, were integrated into the slave exploitation process with the plantation model that characterized the Caribbean region. The plantation model also marked Brazil and Colombia – although not in the Amazon – thanks to the massive introduction of Black slaves. This labor enabled these countries to participate in various commercial booms, such as sugarcane, cotton, cocoa, and coffee, among others, enriching the landlords who owned plantations. In the Andean case, the state configuration incorporated the native population of the highlands into the processes of productive exploitation with varying degrees of conflict, while the Indigenous Amazonians were considered an "obstacle" to the full use of the territory.

In the case of Peru, between 1855 and 1879, there was an extensive reform process in the regional administrative demarcations as a result of the guano boom. Thus, the Peruvian elites led a series of policies aimed at the territorial reorganization of the eastern slopes that opened up to the Amazon or the Madre de Dios basins. Lima elites feared foreign incursion into the Amazon and the control of the La Paz elites over tropical products, since the latter had dominated markets due to their successful project of eastern colonization (Mc Evoy 2004: 96). The Peruvian elites sought to overcome the national imaginary by means of European migration, surmounting the model of the colonies as in the case of Pozuzo or the Italian settlers in Chanchamayo. These settlements had persisted as self-sustaining islands, far from the expectations of becoming dynamic trade nuclei (Mc Evoy 2004: 103).

The incorporation of the Amazon rainforest was an effort to control forest resources (mainly rubber) and the Indigenous population. Evangelization was considered one of the civilizing elements to convert the Indigenous people into productive labor, which was necessary to exploit the jungle. In 1885, Monsignor De Macedo of the Diocese of Pará gave a lecture in Manaus entitled "The Amazon: Means of Development of its Civilization." The diocese covered the Brazilian Amazon territory,

which included the province of Pará, whose capital is Belém, and the province of Amazonia, whose capital is Manaus. Together, these two provinces covered an area of 3,044,732 square kilometers in Brazil. The civilizing project of the Diocese of Pará shows the role of evangelization in the productive transformation of the Amazon:

> The Amazon, as we know, only lives and thrives thanks to the extractive industry, especially rubber extraction. Europeans are not fit for this semi-barbaric job and if they were, they would not improve at all the current situation in the country, which receives hardly any foreign immigrants except for a few thousand Portuguese. In addition, they usually settle in cities and towns, dedicated exclusively to trade and small industry. The Amazon could, therefore, count on Indigenous labor, especially when slavery has been abolished in one of its provinces and is about to disappear completely in another. If we want to preserve and develop civilization in this region, we have to take care of the Indians, catechize them, make them better, summon them to a normal life. (Costa 1885: 3)

Travelers, Scientific Expeditions, and Chorographic Commissions

The transformation of the Amazon rainforest into capital was part of the phase of capitalism's expansion into a global economy. The center-periphery relationship structured the exploitation processes. In this process, the scientific conquest of the tropics played a fundamental role in making the mechanisms of exploitation behind the "production booms" effective (Martínez-Pinzón 2016).

The nineteenth century was an era of ambitious geographical expeditions in the Americas. Travelers and expeditions launched the scientific conquest of the Amazon beginning in the early nineteenth century. The transfer of exotic plants and the search for wild plants that could be domesticated were both activities that were rationalized, organized, and put at the service of industrial capitalism. From Europe, collectors were sent to the farthest corners of the Earth, looking for unknown species that could serve as raw materials, remedies, or ornaments. While this endeavor was the expression of scientific and state bureaucracies, it was also a search for the rare, the precious, and the dangerous (Dean 1987: 4).

The Amazon played a crucial role in biology since the mid-nineteenth century for aristocrats, diplomats and scientists. Naturalists Alfred Russel Wallace and Henry Walter Bates lived in the Amazon for several years, working as specimen collectors for British museums. They collected specimens of flora and fauna before Darwinism. The findings of Alfred Russel Wallace in the Amazon in the 1840s prompted Charles Darwin to present his theory of evolution at the Royal Geographical Society. Darwin had long conceived the idea of evolution but was afraid to publish it (Alves 2011; Stepan 2001). On the other hand, the U.S. American scientist L. Gibbon,

in September 1851, had gone as far as the Tono and Piñi-Piñi rivers trying to prove that the Purús and the Madre de Dios were the same river; he also noted the importance of the *cascarilla* (cinchona) extraction, the coca production, and the potential of "elastic gum" in this area, even though it presented challenges due to the persistent threat of "wild Indians" (Mc Evoy 2004: 95). Finally, the diplomat Charles Wiener undertook a scientific expedition in the Upper Amazon on October 9, 1880, after being appointed vice-consul of Guayaquil. The expedition resulted in his best-known text, *Amazone et Cordillere* (Judde 2014: 70).

In addition to individual travelers and expeditioners, states funded expensive and ambitious official expeditions to establish the communication possibilities of the Amazon. In its itinerary and its work to establish a Chorography of the Amazonian Province (*Corografía de la Provincia de Amazonas*), the Madeira and Mamoré Railway Studies Commission (*Comisión de Estudios Ferroviarios de Madeira y Mamoré*) crossed the Amazon from Pará to Manaus (Commissão de Estudos da Estrada de Ferro do Madeira e Mamoré 1885). Bernardo da Costa e Silva published his memoirs about the same route in his travelogue from Belém do Pará to Manaus (Silva 1891).

The mid-nineteenth century saw an extensive process of reform in the regional administrative demarcations. A series of steps were taken at that time that succeeded in laying the foundations of national geography. The data provided by geographers and explorers were decisive. Efforts were made to use scientific data to identify the territory and delimit it externally and internally. Thus, the "classical" Amazon in each South American country became a geographical and political division of departments, provinces, and states. The "legal Amazon," as an administrative unit, remained a space of internal dispute in each country until the end of the twentieth century.

Expeditions in the Orinoco and Amazon river basins revealed the process by which local knowledge was incorporated into elite representations of Amazonian populations and territory of the nineteenth century (Codazzi et al. 2000). The Colombian Chorographic Commission, which began in 1850 and lasted almost ten years, was one of the most influential in Latin America. Its objective was to delimit and map the nation and its natural resources with the aim of contributing to its modernization. Those who participated in the Commission and its sponsors believed that a prosperous republic required a unified and homogeneous population. The Commission's reports, maps, sketches, and drawings demonstrate the tension between what geographers observed in their fieldwork, and the homogenization ideas to which they aspired. Their assumptions and methods helped shape a national imaginary. The famous geographer and cartographer Agustín Codazzi considered the Casanare and Caquetá as regions of decline in which economies had stunted, populations had stagnated, and the state had to urgently make a presence in the foothills. Nevertheless, through powerful rivers that interconnect the Andean Nueva Granada with Venezuela, Brazil, Ecuador, and Peru, the Orinoquia and the

Amazon would become future centers of international trade. First, however, these low-lying tropical lands and their inhabitants would have to be transformed. They had to be governed as special territories by the national government, mediated by a prefect. Thus, while the rest of the country became autonomous federal states, the Amazon became a colony (Appelbaum and Pombo 2017: 212–213).

The same need to demarcate the Amazon that the Colombian Chorographic Commission had was echoed in the other Andean nations. In Ecuador, as in Colombia, the Amazon was considered a fledgling province of the Ecuadorian State in the nineteenth century (Esvertit Cobes 2008). In the case of Peru, engineers, rather than geographers, led the Amazonian commissions.

From Military Engineers to Civilian Engineers

To be productive, the Amazon needed to connect to the coastal Andean country and, thus, to the rest of the country and international markets. This would only be possible if the necessary road infrastructure was planned and the existing natural resources were inventoried. Both tasks required the reconnaissance and mapping of the new regions, as well as the introduction of the scientific and technological premises that had enabled the revolution in transportation and communications. Between the 1920s and the 1980s, military engineers became civil engineers. They imagined the Amazon transformed and articulated by new means of communication – railroads, river navigation, telegraph – and placed emphasis on achieving a thriving economy founded on technical-scientific progress and its transformative potential, linked to foreign capitalist markets (Sala i Vila 2006: 441).

Peru, more than any other Andean country, imagined the connection of the coast or the highlands with the Amazon rainforest. Engineers saw the way out of economic stagnation as hand in hand with promoting tropical colonization and direct communication with emerging Atlantic markets by way of Amazonian rivers. Among the official engineering expeditions to the Amazon, the most famous was the Amazon Hydrographic Commission (Comisión Hidrográfica del Amazonas). Civil engineers played a key role in the transformation and articulation of Amazonian projects in Peru, specifically in the jungles of the departments of Ayacucho, Cuzco, Puno, and Madre de Dios in the nineteenth century. Their economic and social imaginaries about the Amazon had an enormous influence on this region's transformation into capital, thanks to its close connection with the state (Sala i Vila 2006: 441).

In Peru, engineers imagined a railway connecting the coast to the hills and punas, then descending to all the headwaters of the Amazon rivers. In 1862, Manuel Pardo, in his work *Estudios sobre la provincia de Jauja*, prioritized the construction of the Lima-Jauja railway. His perception was that the Central Sierra was a strategic point equidistant to the main cities of the Sierra and the main points of penetration

into the jungle. His goal was to reach substantial progress in trade and "civilization," while defending Amazonian colonization with national troops, which would curb Brazil's interference and competence, hidden behind migrations up Amazonian rivers (Mc Evoy 1994: 174–182)).

From the mid-nineteenth century until the Pacific War, Peruvian authorities organized Amazonian explorations composed of specialists from different fields – military, marine, or medical – in order to collect geographic and climatic data, map the regions explored, describe potential natural resources, evaluate ethnic groups to incorporate them into the national economy, and propose the most feasible and convenient road networks. The most renowned Peruvian engineers of this period for their Amazonian explorations were Arturo Wertheman, Juan Guillermo Nystrom, and Herman Göhring. Arturo Wertheman, of German origin, was the engineer of the Amazon Hydrographic Commission (*Comisión Hidrográfica del Amazonas* 1868–73), whose objective was to explore the Amazon and its main tributaries, recognize its navigable course, and map out its overland route to the capital of the country. For his part, Juan Guillermo Nystrom, an engineer of Swedish origin, explored the Cuzco forest by government commission in 1866, running through the Convención and Paucartambo Valleys to the head of the Madre de Dios River. Nystrom also explored the Peruvian Central Forest with the task of demonstrating the feasibility of the Amazon Hydrographic Commission's conclusions to open communication between Lima and the highlands with Iquitos and the Amazon, through the "central road." This road was meant to run through the Pichis River and, from there, to the Ucayali River. Herman Göhring was the engineer of the Madre de Dios River expedition in 1873. The exploration responded to an attempt to incorporate new regions to recover agriculture in the Paucartambo valleys, opening communication from Cuzco to the Madre de Dios region and the Madera-Mamoré (Sala i Vila 2006: 445–446).

In Brazil, one of the last Amazon explorers was the military officer and explorer Cândido Mariano da Silva Rondón, known for his exploration of Mato Grosso and the western Amazon. After leaving the Brazilian army in 1930, he devoted himself to studying Amazonian flora and fauna and to defending the Indigenous peoples who inhabited the rainforest. Rondón headed the Indian Protection Service (*Servicio de Protección al Indio*), created in 1910, and the National Indian Protection Council (*Consejo Nacional de Protección al Indio*), created in 1939. His reputation as a great explorer and defender of Indigenous peoples arose while he was still in the army, taking part in the construction of telegraph lines and other territorial reconnaissance missions. Rondón also dreamed of a system of national parks. In particular, he contributed to the creation of Xingu National Park. His merits led him to receive the rank of marshal, which is the highest Brazilian military grade. The state of Rondonia was named after him, and he was nominated three times for the Nobel Peace Prize (Rohter 2023).

Cinchona, Rubber and the Incorporation of the Amazon into the Global Market

Technological advances made it possible to exploit resources hidden in the Amazon rainforest, particularly rubber, essential for building European modernity until the arrival of oil. Thus, the Amazon was integrated into the discussion of the nation-state model and conflicts over its effective control. From the perspective of environmental history, following Pádua, the transformation of rubber from an "exotic good" into a commodity was only possible in the context of modern capitalism's expansion. Only from the nineteenth century, with the emergence of steamships and railways, did international trade begin to promote an intense flow of materials. In the pre-fossil-fuel world, where ocean shipping imposed severe limitations on the quantity and weight of materials, the transportation of exotic products from the Americas focused on products that had high exchange values in relatively small quantities (such as sugar, gold, timber, etc.) (Pádua 2017: 26).

Before rubber, cinchona was one of the most important tropical products with which local elites sought to conquer the world market. Until its artificial synthesis in 1944, quinine was the main raw material in the manufacture of different drugs to fight malaria. By then, this was not only a disease of the tropics. It had also become a problem in Europe and the United States. What was known commercially as cinchona was the bark of the *Cinchoneae* tree. In the mid-1870s, European manufacturers valued cinchona for its quinine content (Webb 2009).

In the first half of the nineteenth century, the cinchona regions were explored by scientists from botanical expeditions, such as Poepping, Karsten, Delondre, and Weddel, and, around 1800, by Humboldt and Bonpland. The scientific advances of the second half of the nineteenth century were related to the cultivation of cinchona and the way to obtain the maximum yield of quinine sulfate. The highest quality cinchona came from Bolivia, medium quality from Colombia and Ecuador, and low quality from Peru. The haphazard nature of its exploitation influenced relations between entrepreneurs and *cascarilleros* (those who stripped the bark), creating a climate of mutual mistrust. This mistrust, coupled with disputes over the allocation of wastelands (*baldíos*), created conflicts in cinchona exploitation areas, sometimes leading to violent clashes (Ocampo 2013: 224–226). During the development of cinchona plantations in the East in 1880, its exploitation was a typical extractive industry. Due to its characteristically destructive form of exploitation in all South American countries, it was impossible for the same region to guarantee a stable supply. The economic result of cinchona exploitation was the continuous mobility of the extraction frontier, especially during periods of high growth in world consumption (Ocampo 2013: 227).

In the late nineteenth century, the deterritorialization of cinchona trees was decisive for the geopolitics around the plants and their alkaloids until the 1940s. Inde-

pendently, but in parallel, the governments of England and the Netherlands pushed for the smuggling of cinchona seeds from the Andes into tropical regions in Asia. After multiple attempts, the first successful shipments of cinchona were obtained from Ecuador. Thus, the smuggling of cinchona led by the colonial powers, and later by the United States, helped to strengthen imaginaries that the inhabitants of tropical countries were unable to control their production. "It was no longer just about subduing the Indigenous people, but the Creoles and their republics" (Cuvi 2018: 6).

Cinchona and rubber transformed the Amazon into capital. Thus, cinchona and rubber traders and state agents, in many cases represented by religious orders, managed the Amazonian territory as a zone of capital extraction. On the Amazon border between Colombia and Ecuador, cinchona and rubber merchants, as well as religious groups, led the development, success, and failure of state projects during the second half of the nineteenth century. While defending their interests, these actors took part in border disputes with neighboring countries. Through their presence and actions, the three groups supported, in different ways, Colombia's claims to the Amazonian territory (Mongua Calderón 2022).

The rise of rubber in the Amazon has been extensively studied in the history of commodities (Stokes 2000). In 1839, Goodyear found the definitive solution to fix rubber's properties by mixing it with sulfur and subjecting it to high temperatures, a process he called vulcanization. This gave greater resistance to the product than it had in its natural state. Vulcanization laid the foundations for the industrial exploitation of rubber, the ultimate thrust of which would come from Dunlop's invention of the pneumatic wheel in 1888 (Domínguez Ossa and Gómez 1990: 114).

The wild and most abundant tree that produced the purest and most elastic rubber was native to the Amazon basin. Known in the trade as *Pará rubber*, it soon became the object of an immense and complex commercial system that extended from Belém, at the mouth of the river, 3,000 kilometers into the interior of the largest and densest rainforest in the world. In the case of Brazil, the rubber trade became a pillar of its economy, providing at its peak approximately 40 percent of its export earnings, almost equal in importance to coffee (Dean 1987: 4).

Between the late nineteenth and early twentieth centuries, rubber history became the economic history of the Amazon region. In the economic sphere, the rubber boom represented the rise and enrichment of rubber elites, who projected their wealth in the beautification of Amazonian city centers. Manaus, for example, came to be considered one of the most modern cities in the world between 1890 and 1920 for its advanced drainage system, its European-style architecture, and the almost complete distribution of electric power. Abundance became synonymous with the region and was generally accompanied by the obscene enrichment of rubber companies, established mainly in Brazil, Peru, Bolivia, and Colombia. However, the apparent European and American modernity of Amazonian cities did not go beyond a few main streets. The peripheries of Amazonian cities were still made of mud, wood,

and straw without modern sanitation (Dias 1999). The rubber years represent one of the darkest periods in the Amazon since the time of the conquest due to the slavery and genocide of several thousand Indigenous Amazonians forced to collect rubber.

The commercial boom of rubber triggered a fever in explorers, one that promoted a profound phenomenon of internal colonialism, resulting in the region's insertion into a global economic structure framed within a worldwide dynamic determined by resource extraction. Under this dynamic, entire regions became monoproducers. Such was the case with sugarcane in the Caribbean or coffee and cocoa in certain jungle areas. Under this logic, an unprecedented process of occupation and commercial exploitation was undertaken in Amazon territory. Moreover, given the characteristics of the extractive activity involved in an inhospitable area laden with dangers, diseases, and extreme conditions, the rubber companies sought to employ labor from populations considered expendable and exploitable to death.

Countless rubber entrepreneurs were entrenched in the Amazon without necessarily having concessions from the states for rubber extraction. The most prominent export houses of the time were those of Peruvians Julio César Arana, Luis Felipe Morey, and Cecilio Hernández, who operated between Iquitos (Peru) and Manaus (Brazil) – the centers of the rubber economy – the Casa Elías Reyes & Hermanos, installed between the Caquetá and Putumayo rivers of Colombia, and the Casa Suárez in the Bolivian East.

The most powerful was undoubtedly the Arana House, which had rubber plantations stretching from Brazil to Colombia along the Putumayo River. Its lands also touched border areas of Peru and Ecuador. The expansion of this company began in 1903, when Julio César Arana acquired La Chorrera station (Putumayo area) from Colombian businessmen and founded Casa Arana y Hermanos. It should be noted that, at the time, the territory was still disputed between Peru and Colombia, so that Arana had to resort to the Peruvian army to displace other Colombian-origin rubber tappers from the area.

In 1907, Casa Arana became the Peruvian Amazon Company after partnering with an English company. This gave it unprecedented power in the region, which was to be seen not only in the monopolization of the rubber trade – eliminating its competitors even by force – but in the ability to concentrate slave labor through the most heinous and ruthless means. The natives were kidnapped and forced to work, facing punishments such as torture, amputations, or death. To exact these penalties, foremen were brought from the Antilles. During the forty years that this company operated, about 100,000 Indigenous Uitotos, Ocainas, Boras, Bora-mirañes, Muinanes, Nonuyas, and Andokes, among other ethnic groups, were killed. Although this was a reality well known both to the Latin American states involved and to the foreign powers benefiting from rubber, no effort was made to stop it.

Thus, the emergence of rubber on the global stage transformed Peru, Ecuador, Bolivia, and Colombia, particularly in the way these countries constituted their pro-

ductive and territorial management models. For example, in the case of Colombia, rubber production triggered the occupation of Amazonian territories by national and foreign settlers. However, despite the economic distances that the Amazon regions established with the states that administered them, this territory became the scene of a brutal form of capitalism due to the extraction and exploitation of rubber.

In this context, the Andean states assumed the role of facilitators of the region's occupation and exploitation, which was invigorated by the free international navigation of the Amazon River approved by Brazil in 1865. This event facilitated the rubber boom's development and expansion. Due to political weakness and the dismal administration of the governments of the Andean Amazon, the great beneficiary of these territories' abandonment was Brazil, which in 1899 stripped Bolivia of an important region, the Acre (1899 – 1903).

In the case of Colombia, the emergence of rubber houses opened a period of voracious and violent exploitation. This had its apogee with Casa Arana, which operated in both Peru and Colombia in a space that was characterized by porous borders. However, the civil war that Colombia experienced in the early twentieth century favored rubber extraction in Peru, moving part of the bureaucratic administrative apparatus of rubber exploitation to Iquitos.

Countless documents attest to the atrocities committed during the rubber period. The most famous report was by Irishman Roger Casement. In September 1910, he arrived at the Putumayo appointed by the British Foreign Ministry to investigate allegations against the Peruvian Amazon Company, better known as the Arana House, for the mistreatment of Indigenous populations and the terror that it sowed among them (Pineda Camacho 2000; Casement 2011; Steiner et al. 2014). In addition to Roger Casement's report in Putumayo, recent literature has reissued reports of advocates who denounced the crimes in rubber plantations, such as Benjamin Saldaña Rocca (Lagos 2005) (Bernucci and Varela Tafur 2020) or in the case of Ecuador, the Amazonian writer Percy Vílchez (Vílchez Vela 2012).

In Colombia, rubber emerged as a result of the consolidation of large landowner groups, which were favored by state policies such as *Decreto No. 645* (1900), which allowed them to privately exploit land considered to be wastelands. This decree, in turn, favored the advancement of colonization to the Greater Putumayo area, where small towns and colonies began to be established that were part of the entire commercialization network around rubber, promoting the development of a road and river infrastructure that connected the jungle with the rest of the country.

One of the most important rubber houses on the Colombian side was the Casa Elías Reyes y Hermanos, which operated with exclusive privileges. This meant the direct possibility of exploiting indigenous labor, mainly of Witotos, Andoques, and Boras. This exploitation mechanism spread to other companies and individual colonizers that also entered the rubber extraction business under the same dynamics of subjugating the Indigenous.

At the end of the nineteenth century, rubber gained increasing importance, becoming the excuse and reason for the expansion of state borders into Amazonian territories. It grew so important that, in most producing countries, it became one of the three largest export products. The exploitation of the rubber tree provided Brazil with one-tenth of its export earnings in 1890 and even 40 percent in 1910. In Peru, between 1891 and 1910, exports of raw material soared from one to thirty in total value of its exports. And in Bolivia, rubber exports accounted for 19.1 percent of its total domestic exports in 1906 and rose to 22 percent in 1911 (Gamarra Tellez 2018: 146).

In the case of Brazil, cotton, tobacco, indigo, and guarana had been produced in the Amazon region since the late eighteenth century. However, the rubber exploitation that began in the 1850s became a monopolizing force for all productive activity. It hoarded resources for itself and for the economic dynamics derived from it, such as the expansion of urban centers and the vast majority of the labor previously employed in the other productive enterprises (for example, the manufacture of ropes and pottery).

The rubber cycle began in the Brazilian Amazon after a very difficult period, during which the region faced a civil war. On January 7, 1835, the participants of the Cabanagem rebellion took Belém, the capital of the great Pará. At the time, the Cabanagem war cry was one of death to whites and Masons. It was a class and ethnic cry against the colonial and imperial oppression of the Luso-Carioca authorities and the Portuguese and English traders established in the Amazon region. In only five years, the war between the Cabanagem movement and the anti-Cabanagem command claimed the lives of about 30,000 people, equivalent to about one-third of the population by the 1830s, excluding the free indigenous societies that were far from the territory built by colonialism (De Oliveira Ricci 2012: 34).

In Brazil, rubber expansion was of such magnitude that, by the end of the nineteenth century, cities such as Manaus and Belém were a beacon of the Victorian West in the tropics. These cities possessed modern luxuries such as electric lights and a significant presence of motor vehicles and displayed unconscionable luxury and waste. Thus, official historiography has long recognized the "civilizing" role of rubber barons. In Brazil's expansion into other territories, mainly Acre, the *siringalista* (rubber producer) played a fundamental role in its appropriation by pushing for an armed movement against Bolivia's weak and virtually useless regency over this space. Therefore, the territorial occupation of the Acre responded more to an economic than a nationalist discourse, aimed at consolidating the commercial interests of a developing region.

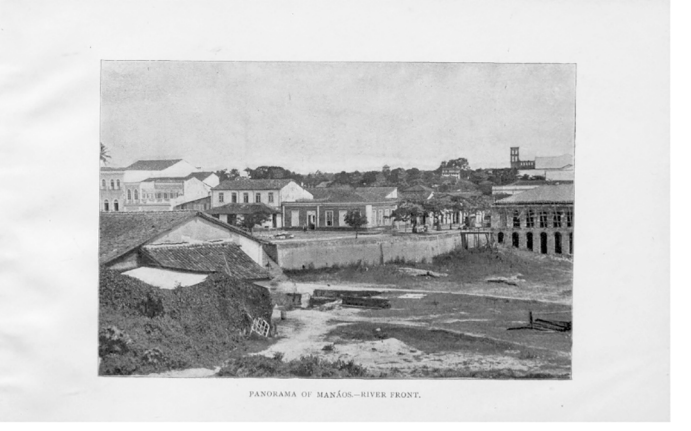
The sectors that were in part modernized with the rubber boom were the media and urban centers, which were needed infrastructurally for the connection between the distant *siringalistas* camps and the nodes exporting raw materials, such as Belém, Iquitos, or Manaus. These urban centers condensed the benefits of rubber exploita-

tion, living between luxury and excess. Cities like Belém, Santarém, and Manaus are still the image of those good years, where one can still see buildings inspired by the French or British style of the early twentieth century covered by the vegetation of the tropics.

Santarém was the third largest city in the Amazon. By the mid-1870s, it was visited every ten days by English company river steamers and almost daily by an assortment of steamships owned by local importers and shippers. In the city, there was even a steamboat built by a Swiss resident, who rented it out. All these boats were able to make the journey to Belém in a few days. In 1869, three-quarters of the city's 6,000 tons of products were shipped by steamships. English steamers departed from Belém almost every week. The arrival to the Amazon, then, was by no means a providential event (Dean 1987: 20).

Manaus was the most important Amazonian city at the World's Columbian Exposition in Chicago in 1893, 400 years after Christopher Columbus arrived in America. It was presented as "The City of Manaus and Rubber Country" (*The City of Manáos and the country of rubber tree* 1893).

Fig. 1: Panorama of Manaus-River Front



Source: The City of Manáos and the Country of Rubber Tree (1893).

In 1890, Manaus was the first city to have electric lights, and at that time, the rubber elites came to imagine the connection of Manaus with Bolivia through the extension of the Madeira-Mamoré railway line. In the future, the railway could facilitate the economic connection between Bolivia and Manaus via the Madeira River. The construction of this railway was one of the agreements in the Treaty of Petrópolis of 1903, which settled the dispute over the Acre between Brazil and Bolivia. However,

the section of the railway that was actually built between 1907 and 1912 was a long way from Manaus (Foot 1988).

Although politicians, aristocrats, and scientists involved in Amazonian rubber extraction attempted to cultivate the plant, such attempts failed for ecological reasons. Rubber cultivation involved many complex problems: the botanical identification of the wild plants from which the rubber was obtained, the collection of information on their growing conditions and how these conditions were used in nature, the organization of expeditions to collect plant material and acclimate it in advantageous locations, and, finally, the implementation of pilot programs to identify optimal cultivation and exploitation techniques (Dean 1987: 4).

Thus, from 1915 the rubber economy in the Amazon declined due to the decreasing price of rubber, which began to be cultivated in Africa and Malaysia under English rule. Environmental historian Warren Dean criticizes the fact that the explanation for the decline of rubber in the Amazon has focused on industrial or geopolitical issues, not environmental ones. Thus, Dean studied ecological relationships that explain why, despite attempts to grow rubber in the Amazon, Brazil was unsuccessful. The *Hevea brasiliensis* is a rainforest tree, thirty to fifty meters high. At first, this tree was exploited along rivers, where it was easy to find as its seeds float. However, taller trees grow on higher ground, and only two or three usable trees are usually found per hectare. As demand for rubber grew and the search for *Hevea brasiliensis* expanded, the tree was found to grow on the right bank of the Amazon within a broad semicircle centered west of Manaus, to the south of Mato Grosso, Acre, in northern Bolivia and eastern Peru. Furthermore, they were located at an altitude of about 800 meters within the portion of the basin experiencing at least 1,800 millimeters of well-distributed rainfall annually (Dean 1987: 12).

Because it was harvested and not cultivated, the exploitation of rubber in the Amazon suffered in different places and times from shortages of manpower, capital, and technology. In Brazil, for example, researchers blamed both domestic and foreign actors for the failure of industry to generate sustained economic development. They claimed that in that country the *seringueiros* resisted the discipline demanded by their work and the increase in plantations, while the local elites wasted the profits. But even when these difficulties were overcome, rubber trees grown in Amazonian alluvial soils were too unproductive to justify their costs. In the Amazon, where rubber is endemic, trees were frequently attacked by a fungus, and attempts to control that fungus were unsuccessful. In parallel, English scientists and smugglers established Amazonian rubber plantations in Malaysia. The harvest of Brazilian rubber collected in the wild could not exceed 40,000 tons per year. This amount became negligible in light of growing industrial applications (Dean 1987: 24).

England had been seeking to control the rubber market for decades. In the 1850s, scientists from the Royal Botanic Gardens in Kew began studying seeds from wild rubber trees. However, it was only until the late 1890s that the first pounds of planta-

tion-grown rubber were put on sale. In this interval, it was necessary to carry out research and experimental programs, many of them inevitably in the wrong direction (Dean 1987: 9). In 1876, Henry Wickham discovered a type of rubber tree that produced the tough and durable rubber that English scientists and businessmen craved. During his journey, he collected 70,000 seeds of this rubber tree. The seeds passed Brazilian customs in Belém do Pará without major inconvenience and were successfully transported to the famous Kew Gardens in London where biologists quickly sent them to the colonial posts of the distant British Empire. The case of Henry Wickham, known in Britain as "the father of the rubber trade" and in Brazil as the "Tormentor of the Amazon," shows the ambition of Victorian England in the Amazon (Jackson, 2008). Finally, other foreign businessmen established plantations in their colonies (e.g. Indonesia), "which undermined the price of rubber for the benefit of industrialists and consumers in rich countries" (Mausacchio 2017: 385).

Thus, from the 1910s, the history of rubber cultivation assumed a global dimension: a large number of Asian peasants were transported to rubber plantations, while many *seringueiros* were released from indebted servitude and returned to subsistence activities or migrated out of the Amazon (Dean 1987: 25). In this account, the Amazonian territory played a fundamental role that undoubtedly makes it one of the leading spaces in shaping the Anthropocene, a period marked by the deepening of extractivism and its consequences for the transformation of the reproductive cycles of the planet's resources.

The natural rubber industry's rise and fall cycle has been considered an example of Latin America's insertion into the global market through the export of raw materials. Political uprisings like the attempted Iquitos revolution in 1921 show the power that rubber cities had at the time of the decline. In Peru, between August 1921 and January 1922, the Department of Loreto was held by a rebel government board chaired by Army Captain Guillermo Cervantes Vásquez, a veteran of the Caquetá campaign in the 1911 Amazon border conflicts with Colombia. The board chaired by Cervantes demanded Loreto's autonomy (Reátegui Bartra 2021).

In the same decade, South American rubber houses decreased their production due to the accelerated disappearance of labor. With the Depression of 1929 and the Colombian-Peruvian War (1932–1933), the first phase of the rubber rush was closed. The massive drop in rubber exports produced a scenario similar to a social cataclysm for the Amazon region. As San Román points out regarding the Andean Amazon, the Amazon rainforest showed the symptoms of a region that had suffered a cataclysm, desolation, and ruin. Many rivers and ravines were left unpopulated or almost unpopulated, as was the case with the Yavarí River. The rubber workers retreated, some to other more habitable rivers or to populated centers like Iquitos, and others, to their places of origin or to other countries. Some Indigenous groups were left in relative peace (San Román 2015: 156–157).

Therefore, the rubber boom represented for the territory and for its actors a period that can be distinguished into two levels. On the one hand, for rubber entrepreneurs, the almost fifty years of bonanza were marked by "adventure" and ambition, the construction of huge fortunes, and the development of urban centers that later became important cities (mainly in Brazil). On the other hand, these were also years of complicity, crime, torture, and terror that led to the destruction of the small towns located on the margins of the Amazon for the sake of the construction of "progress."

It is important to note that rubber extraction in the Amazon region was not so much determined by state borders as by its exploitation mechanisms, which depended on how this resource was distributed in the Amazon basin. Therefore, the rubber barons moved into the territory looking for areas with higher concentrations of the trees from which the gum was extracted, once the resource had been exhausted in already predated spaces.

This process, in turn, prompted the establishment of transport routes necessary for its distribution. Thus, commercial monopolies such as Casa Arana assumed full administration of the territory, abrogating for themselves virtually all productive activities in the region, except the last phase of the commercialization process: the export of rubber to the international market and the import of manufactured goods from abroad. "This activity was always in the hands of large foreign companies, mainly English and American companies such as Norton & Co., based in Belém do Pará, some specialized in exporting rubber and others in importing manufactured goods" (Ulan 2004: 10).

By the twentieth century, much of the Amazonian territory had already been fully integrated into a global logic of production in a condition of subordination. So, with the rubber industry's decline due to the product's expansion to other regions of the world under imperial control, the Amazon continued to insert itself in this logic of production but in a position of lesser importance. Despite this, the establishment of roads and infrastructure made possible the development of towns and small urban centers, as well as the flourishing of other large cities, mainly in Brazilian territory.

The legacy that the rubber boom left in the Amazon territory could be measured at least on three levels. The first would be the opening of roads inside the territory, which strengthened the connection between this region and the state, later leading to the emergence of hotbeds of international conflicts –whether Brazil and Bolivia between 1899 and 1903 or Colombia and Peru in 1932 (Alírio Cardoso 2015; Camacho Arango 2016; Cayo Córdoba 2014; Martinez Riaza 1998). Second, these roads promoted the development of infrastructure that, in turn, gave rise to peripheral towns or urban centers that began to be inhabited by settlers in search of their fortunes.

Third, the rubber activity directly favored the depopulation of the native communities in favor of the entry of the state into the Amazon, which not only authorized

but also promoted the penetration of the rubber companies in the region through the use of their armed forces. The elements of the territory's exploitation and occupation mentioned above are added to this, all of which sowed resentment among the Indigenous peoples towards the states that enabled and promoted slavery and genocide of its inhabitants.

Environmentally, however, the exploitation of rubber generated little damage. Rubber extraction did not require clearing the forest. On the contrary, in order to last for a reasonable time, daily latex extraction required the maintenance not only of rubber trees but also of their environment, which provided them with ecological support. Despite the rapid growth of some cities, such as Manaus and Belém, followed by an equally rapid decline in exports from 1920, the environmental consequences were still diluted (Pádua 2017: 26).

Brazil, as well as the United States, dreamed of developing large rubber plantations in the Amazon. American entrepreneurs and official technicians invested capital and technology in rubber plantations in Brazil for more than twenty years. For Warren Dean, the United States was no better prepared than Brazil to develop the cultivation of Amazonian rubber (1987: 7). Thus, U.S. American entrepreneurs faced the same environmental constraints as local entrepreneurs, but on a broader scale.

An emblematic example of this was the idea of American businessman Henry Ford to colonize the Brazilian jungle, inspired by the conquest of the American West. In the 1930s, Ford decided to emancipate himself from the dependence on rubber production controlled by the British, who extracted the seed of the rubber tree from Brazil to plant in their South Asian colonies. With the idea of setting up his own rubber plantation, the entrepreneur had a city built on the banks of the Tapajós River in the Brazilian Amazon. The village, called Fordlandia, was much more than a plantation, as it attempted to reproduce the urban layout and American way of life, which involved transplanting the U.S. American civilizational ethos into the heart of the Brazilian Amazon. However, this pharaonic project faced a number of technical and practical difficulties, ranging from the presence of Amazonian pests on the plantation to the illness and death of American settlers and the unsuitability of local workers to the dynamics imposed by the foreign businessman, such as the prohibition of alcohol consumption. The project was abandoned, but the ruins of that city were preserved, serving as witness to the failed attempt to tame the territory and its inhabitants. Anecdotal accounts of this insane enterprise have been recorded, embodied in novels such as that of Eduardo Sguiglia, which bears the same name (Grandin 2009).

In the case of Brazil, after the rubber period, the country experienced other forms of extractivism linked, on the one hand, to a second boom in this product and, on the other, to the expansion of agribusiness. Both processes had a direct impact on the Amazonian territory's transformation and the ways of life of its inhabitants. Thus, by the advent of the twentieth century, many Indigenous groups

and communities in Brazil had already been affected by the presence of external actors (church, rubber houses, cattle ranchers, plantations, etc.), while others moved deeper and deeper into the jungle, trying to survive genocide and the destruction of their ways of life and culture.

With the failure of the latter rubber-linked projects, Amazonian cities were abandoned at the same rate as they populated. In the 1940s, after Getulio Vargas took power in Brazil in 1930, a new period of the Amazon's integration was opened in his nationalist project, which had two crucial moments. The first is the period known as the Battle of Rubber (1942), and the other is the creation of the State of Rondonia (1943). In this regard, De Figereido Ribero points out: "The settlement of the area and the signing of agreements with other Amazonian countries for peaceful cooperation were germs of a new perspective for the defense of the region, in the face of rich countries's; ambitions: the Pan-Amazon" (2006: 161). In 1943, the federal territory of Guaporé was created, which in 1956 obtained the name of Rondonia in tribute to the military officer and explorer Cândido Rondón, mentioned in the first part of this text.

The "*Batalha da Borracha*" (rubber battle) prompted a new advance in the Brazilian forest, due to the revival of the rubber industry in the framework of World War II, which affected Asian producers. After fulfilling its objective of supplying rubber to the Allied countries, the region was once again plunged into the slumber that historically determined it as a monoproducer and disjointed space of large capitalist production centers, which in turn allowed the Amazon territory and its Indigenous peoples to reconstitute their own production cycles according to local and national consumption needs. This continued until the arrival of new extractive cycles (timber, livestock, oil, mining) that once again placed the Amazon as a territory of excessive exploitation from which there has been no return.

Geographer Camilo Dominguez (1995) and, more recently, historian Seth Garfield (2013) have recounted the dramatic history of the Brazilian Amazon during World War II. Needy of rubber, the United States spent millions of dollars to revive its trade in the Amazon. In the name of development and national security, the Brazilian authorities launched public programs to transform the interior of the country. Migrants from the drought-stricken Northeast flocked to the Amazon in search of work. In defense of traditional ways of life, the inhabitants of the Amazon attempted to temper outside intervention.

In countries like Colombia or Ecuador, where rubber houses were not as rich as in Brazil and Peru, the rubber companies were followed by a trend of spontaneous colonization in search of land. Over time, the cattle elites of the foothills gradually annexed the jungles opened by the settlers, thus starting livestock exploitation of the Amazon. Melo Rodríguez (2016) has reconstructed Andean migration in the Caqueteño countryside in Colombia. This phenomenon produced the appearance of hamlets and villages as a result of the massive arrival of peasants from Huila, Tolima,

Old Caldas, Antioquia, and Valle del Cauca, some attracted by the colonization led by Maguaré and others by the need for a place to settle with their family. Against this backdrop, El Doncello emerged, a peasant community that since 1929 began to settle on the side of the road that connects Florencia with San Vicente del Caguán (Melo Rodríguez 2016).

Finally, the rubber bonanza fortunately failed to exterminate Indigenous peoples. Recent literature reviews innovation and persistence in several ethnic groups in the Upper Amazon, such as the Western Tucan ethnic group in the Napo River region and tributaries (former Maynas), in the current territories of Ecuador and Peru. Many of these changes and influences occurred shortly after the Conquest (Cipolletti 2017; Henrique 2018).

This situation shows that there are alternative modes of production and reproduction to those that, within the framework of capitalism, establish an accelerated rate of consumption that can be irreversible for the planet (Anthropocene). The survival of peoples such as the Amazonians, as well as human groups that in other latitudes retain a harmonious relationship with the natural environment, is in itself a mechanism of resistance. Added to this, there are affirmative actions such as the coordination of regional Indigenous organizations (for example, those throughout Latin America that are part of the Coordinator of Indigenous Organizations of the Amazon River Basin), which have taken the lead in defending the rights of Indigenous peoples and their territory. It should be mentioned that the Amazonian ethos is a rebellious one, because it resists disappearing. Thus, the peoples who inhabit this region, even if they are not directly related to the capitalist appropriation process, do have to face up to and deal with the consequences of what researchers like Rockström call the Anthropocene, in which all human beings are directly and indirectly involved. In this sense, if this chapter considers that the Amazonian territory, however marginal it may be conceived, has constantly and directly participated in the transformation processes of the last 150 years, then the peoples who inhabit it must be considered as a key player in the search for a solution to the imminent ecological catastrophe that is coming. (Urquijo 2020: 186)

Conclusions

Since the mid-nineteenth century, Latin America has experienced a sustained process of economic growth characterized by a mode of primary export accumulation, whose main resource for several countries (Ecuador, Peru, Brazil, Bolivia, Argentina, Mexico, Venezuela) was rubber, as well as the export of grains and agricultural products (Brazil). In tandem with this process, roads and small urban centers were developed in the Amazonian territory that subtracted several thousand hectares from the Amazon region, which meant the slow but constant assimilation of Indigenous

peoples or the violent disappearance of traditional practices and forms that these communities possessed in the region.

Thus, different local and transnational actors made possible the process of "civilization" from which the Amazon was transformed into capital. For religious missions, the Amazon was a question of converting Indigenous people into productive and faithful individuals; for rubber tappers, loggers, or ranchers, it was a battleground of struggles for sustenance and power; and for scientists and diplomats, it was a space of planning the future and connections to international markets. These visions of the Amazon as part of the tropics used hierarchies of race and nation (Serje 2005).

Paradoxically, the process of transforming the Amazon into capital until 1930 did not generate environmental damage related to modern patterns of population density, landscape changes, and socioeconomic occupation. Thus, in the mid-twentieth century, the map of the Amazon continued to to represent certain areas that were occupied by Indigenous populations and traditional communities, who managed ecosystems in a much lighter way, with a much lower population density, as "voids" of economic life (Pádua 2017: 34).

The primary export model that has characterized the Andean countries caused the colonization of the Amazon to deepen an extractive dynamic, which, along with playing an important role in the inauguration of the "modern world," drove the devastation and genocide within. This process, which took place mainly between the end of the nineteenth and the beginning of the twentieth century, was characterized by little or no effective presence of the state as a guarantor of the right to life of Indigenous peoples.

Along with the problems posed by private initiative and transnational corporations in the Amazon region, as well as by the inconsiderate entry and development of infrastructure in the region, new problems arose in this territory as a result of the disintegration in which these spaces were located, unlike the rest of the nation-state. The colonization processes of the Amazonian territory represented moments of expansion, as well as the reorganization of capitalist projects and the mechanisms by which the state sought to expand into territories that were not formally incorporated within its orbit. Each of these periods has received a response from Indigenous peoples, whose survival constitutes one of the last frontiers facing capitalism in its most voracious phase of extractivism.

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Land Use in Mesoamerica from the Mid-Nineteenth Century to 1950

Historical-Environmental Processes

Ronny J. Viales-Hurtado and Pedro S. Urquijo-Torres

In this chapter, the historical and environmental changes in the geographical superarea of Mesoamerica are analyzed during the period between the first decade of the nineteenth century, when a reconfiguration of territory took place as a result of the independence movements in the countries of the area – with a markedly liberal orientation –, and the middle of the twentieth century, a transitional moment in the management of land and resources towards agro-industrial models. We propose an analysis based on land use and land-use change as well as vegetation substitution at local and regional scales (Turner et al. 1995; Lambin et al. 2000) through a general transnationalist proposal (Thelen 1999) to understand historical and geographical processes beyond the contexts of the different nation-states.

The historical analysis of changes in land use allows us to understand the impact resulting from the conversion of soils and land cover for different types of human productive activities. This implies recognition of the environmental impact derived from changes in the landscape as a driving force for reductions in biodiversity, water cycles, and biogeochemical cycles of geography (Guhl 2008; Montero-Mora and Viales-Hurtado 2015). When analyzing the processes of change, the conditions of land tenure must be considered, that is, the implicit or explicit forms that certify or justify a territorial appropriation for the social construction of the landscape (Urquijo 2014). In the Mesoamerican regional scheme – without considering the normative particularities of each nation – land tenure responds to three regimes: private property, collective property (communal, ejido, or cooperative), and national property.

Land use change is a central issue in the history of Latin America due to the complex processes that have occurred over the last 500 years due to agricultural development, extractive activities, forestry activities, and more recently, accelerated urban development and the exploitation of fossil fuels. The distribution of land tenure seems to indicate an apparent balance, as 33 percent of the land in Latin America is collectively owned by Indigenous and peasant groups, 33 percent by nation-states,

and 34 percent by private individuals (Larrazábal et al. 2010). However, the exercise of power and asymmetrical relations, outside the control of legislation that concerns land use, generate territorial and environmental conflicts. Globalization and the economic policies of capitalism produce demand for agricultural and natural resources that accelerate the depletion of landscapes. Contemporary agriculture, characterized by expansive monocultures, leads to the abandonment of plots of land and intensive soil erosion (Larrazábal et al. 2010). It also brings with it biodiversity losses at a variety of scales, the loss of natural resilience, and an increase of the vulnerability of communities.

"Liberal modernization" focused on the promotion of extractive and productive activities that generated transformations in ecosystems and threatened the biological and cultural diversity of the region (Goebel McDermott 2021). For these reasons, in terms of temporality, the present chapter employs a periodization based on phases of globalization from the perspective of economic history to analyze the transition to independence and the formation of nation-states (Sábato 2018) with a liberal orientation (Mahoney 2001) and, concerning the transition to agrarian-dependent capitalism (Bértola and Ocampo 2010), as contextual determinants of the Anthropocene. We propose, in this sense, four moments: 1) The colonial legacy, as a necessary contextual background; 2) 1810–1870, within the framework of nineteenth-century liberalism; 3) 1870–1930, with the construction of agrarian nationalism and the interventionism of transnational agricultural companies; and 4) 1930–1950, with the transition to the agroindustrial models of economic development and technological and scientific intervention in the countryside. Although there is focus on a regional view of these moments, any understanding would be partial without broadening the panorama to the planetary context and the contradictions of capitalism, which is why the analysis scales from the regional to the global.

Antecedents: the Colonial Legacy

The European irruption and the establishment of the colonial regime brought about abrupt environmental changes, triggering new ecological and territorial realities (Crosby 1988; Denevan 1992; Gligo 2011). In the sixteenth century, the wars of subjugation between the various Indigenous lordships and the European armies, closely related to the epidemics that arrived with the Spaniards and for which there were no biological defenses, significantly depleted native societies. The introduction of cattle ranching, an unprecedented system in the continent, and the establishment of mining as the main economic activity caused substantive changes in vegetation cover, land use, and forms of land ownership in a short period of time (Urquijo 2017).

The expansion of cattle ranching activity was fed by productive lands abandoned due to the demographic catastrophe, which were converted into pastures – although

deforestation also occurred due to the extensive nature of the activity (Melville 1994; Buzter and Buzter 1993; 1995; Sluyter 2001). Cattle ranching led to productive specialization in hot, dry regions: the plains of the Gulf of Mexico, San Luis Potosí, the province of Panama and Veragua, the Pacific lowlands of Nicaragua, San Salvador and Guatemala, and the interior valleys of Honduras. In addition to being used for food consumption, livestock farming allowed for the production of tallow (for sails and protecting the hulls of boats) or leather (for footwear, clothing, and furniture). Oxen were used as draft animals for loading. The waste of livestock was also utilized, for example, for the manure trade, especially in Costa Rica and Guatemala (Fonseca-Corrales 1983; Hall and Pérez-Brignoli 2003).

On the other hand, a slash-and-burn agricultural system, used by different Indigenous societies as an organic socioecological regime dependent on solar energy and the rainy season, was practiced throughout Mesoamerica (Sieferle 2010). The preparation of the soil involved its total or partial cleaning by slashing and burning. Then came the temporary cultivation of the food base, especially corn, and finally the cultivated area was abandoned after the harvest (fallow), where the productive period was differentiated from the non-productive period (land preparation and planting) (Ibarra 1990). The *milpa* agroecological system combined the planting of maize, beans, and cucurbits in addition to more than ninety other plants including tubers (Rojas Rabiela 1989). The practice of burning allowed soil fertilization in the tropical forest, concentrating nutrients in the biomass through phosphorus and potassium, and was carried out during the dry season, to prevent them from being dissolved by the rains (Clare-Rhoades 2017).

With respect to mining in New Spain, the structuring of the territory and the management of the landscape was articulated around the Mexico-Zacatecas axis, which crossed a series of basins of relatively flat relief, separated by small mountain ranges in the center-north of its territory. The road known as Tierra Adentro allowed connectivity between mining and ranching towns. It also allowed the ore extracted from Zacatecas to reach the capital of New Spain, and from there it was transported to the port of Veracruz, where it would be shipped to Europe. Secondary territorial networks made it possible to supply various products to the main population nodes. The corn came from various places in the province of Michoacán and the salted fish came from the western lakes of Pátzcuaro, Cuitzeo. Snook were obtained from Chamela, on the west coast. Cocoa from Maracaibo, Caracas, and Guatemala arrived by way of the Pacific coast. Wheat came from the Bajío region, as did the forest resources used in mining. Livestock supplies, both large and small, came from San Luis Potosí (Bakewell 1997).

The cattle and agricultural production of the haciendas was destined for the maintenance and consolidation of the cities and towns and the supply of mining centers. The reductions or Indigenous republics provided the labor for the large estates and mines and provided an agriculture based on pre-Hispanic management

and techniques, combined with those adapted from the Europeans. However, by the middle of the eighteenth century, haciendas faced a shortage of loans and better roads, high freight and excise costs, as well as the Crown's prohibition to export agricultural surpluses. To this last problem was added that, within the colonial territories, there were strong competitors from Indian villages, whose production was mainly destined for self-consumption, at low prices and with good harvests. To counteract this situation, many landowners built large warehouses for grain storage, which allowed them to wait for the low harvest seasons and then set their own prices (Florescano 1980).

In the eighteenth century, with the arrival of the Bourbon family to the reigning house of Spain, a new policy – the Bourbon Reforms – was established to strengthen the administration. This brought about a jurisdictional reorganization in the Spanish-American colonies in order to channel the economic benefits of the different regions more directly to the Crown. The reforms thus encouraged direct exchanges with the Iberian Peninsula, transforming the tax system to increase fiscal revenue and, in addition, intensifying military defense to contain the commercial and military activities of the English (Díaz-Arias and Viales-Hurtado 2016).

In New Spain under the Bourbons, territory was structured on the basis of the *intendencias*, which functioned as economic regions, whose main authority, the *intendente* (a mayoral figure), was appointed directly by the monarch. The New Spain territory was then reconfigured into twelve intendencias (Mexico, Puebla, Veracruz, Antequera, Merida, Guanajuato, Michoacán, Guadalajara, Zacatecas, San Luis Potosi, Durango, and Arizpe) and four governorships (New California, Old California, New Mexico, and Tlaxcala). In Central America, the Guatemalan colonial elite strengthened its power by controlling the isthmus' three most important goods towards the end of the eighteenth century: silver, indigo, and livestock. Moreover, any problems with production were laid on the producers, while economic profit was controlled by the mercantile elites (Wortman 1975). At the end of the colonial period, indigo was the most dynamic product in terms of exports, which allowed the accumulation of capital for starting up cattle raising, due to the demand for the natural dyes in Europe. These were produced in the Kingdom of Guatemala, which included the territories of the current republics of Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, as well as the current Mexican state of Chiapas (Molina-Fernández 2003).

Economic Liberalism in the Period 1810–1870

The period between 1810–1870 saw a process oriented towards the "radical simplification" of landscapes (Worster 1990) and the social construction of the predominant agroecosystems (coffee and banana), the livestock agroecosystem, and extractivism,

in transition to a dependent agrarian capitalism. Changes in land use were not only contextually linked to the formation of nation-states in the Mesoamerican region but also entailed substantial changes in the economic aspects of the colonial legacy. Institutional and jurisdictional restructuring implemented by the Bourbon reforms was matched by a profound economic reorganization during independent liberalism (Díaz-Arias and Viales-Hurtado 2016).

In Central America, the Guatemalan colonial elite were the main beneficiary of these economic transformations, increasing their power and influence thanks to the control they exercised over the financing of silver, indigo, and livestock in the isthmus towards the end of the eighteenth century. The product that had the greatest impact on the revitalization of the Central American economy was indigo, whose profits were reinvested in highly profitable activities, such as cattle raising. The dye trade soared in the following decades, and it was not until 1799 that began to decline (Fernández 2003; Díaz-Arias and Viales-Hurtado 2016; McCreery 2017). Broadly speaking, guided by the dominant Salvadoran indigo production, the provinces of Honduras, Nicaragua, and Guatemala supplied cattle for meat to feed the workers, as well as the leather to make the *zurrones* (a small leather bag) for packaging the dye powder. Some regions of Guatemala specialized in clothing for the land, maize, and wheat, while the province of Costa Rica saw a short but relatively energetic cycle of tobacco production, which would be marketed to Nicaragua and Panama, while Honduras saw intense silver mining. This economic dynamic generated a concentration of profits in the Guatemalan commercial elite, which soon led to tensions with producers in the provinces, encouraging separatism that would be present during the process of independence (Díaz-Arias and Viales-Hurtado 2016).

After the decline of the indigo trade and the consequent disarticulation of the productive chains associated with the production and commercialization of its dye, the nascent Central American republics sought incessantly to insert themselves in a stable and constant manner in the world market (Wortman 1975). Guatemala concentrated on the exploitation of grana, surpassing Mexico as the largest exporter to the British market at mid-century – although this cycle declined by 1890. Honduras and Nicaragua, although they continued to focus on the activities that had fostered their boom in the colonial epilogue, such as cattle raising and mining, expanded their export offerings with sarsaparilla and precious woods, as well as different forest goods (Díaz-Arias and Viales-Hurtado 2016). This meant taking advantage of the marketing networks for timber and other products, but also of the new trade relations that implied the formal and definitive Central American countries' insertion in the world market as exporters of raw materials and final goods of some added value, in exchange for high-value industrial goods (Hall and Pérez-Brignoli 2003). New findings on the export cycles of natural dyes, in the case of Costa Rica, provide evidence for the continuity of the trend, albeit in smaller quantities after the expan-

sion of artificial chemical dyes, given their use for dyeing certain types of textiles (Goebel McDermott and Viales-Hurtado 2022).

In Mexico, liberal policies had important consequences in terms of land tenure. In the mid-nineteenth century, a political ideology consolidated that proposed societies of free and equal individuals. This nineteenth-century liberalism favored the figure of small landowners, among whom there could be no distinctions of class or ethnicity. This position called for the end of old privileged colonial institutions, such as the Church. But it also questioned other forms of exception, such as the legitimacy of indigenous communal property. In the case of the *pueblos de indios*, it was argued that, although these territorial figures had shown a potential for self-governance, the colonial regime had subdued them through a paternalistic control that had inhibited this capacity (Hale 1985). In terms of production, the liberal governments promoted crops that were highly valued on the foreign market, such as coffee, cocoa, vines, olives, wool, cotton, sugar cane, and valuable woods. Also in these first decades of independent life, laws were issued for the colonization of uncultivated land by interested citizens or foreigners. The overt policy of establishing colonies had displayed its inconvenience in the context of U.S. American expansionism (Urquijo 2017).

Towards the last decades of the nineteenth century, Mexican mining showed an unusual boom resulting from the increase in international demand for metals for industry – such as copper, lead, zinc, and antimony –, the need for fossil fuels – coal and oil –, as well as gold as an object of exchange. Liberal policies removed many of the fiscal obstacles from the first half of the century, and promoted foreign investment, exploration, and exploitation (U.S. American, British, German, and French). This meant, at the same time, the establishment of an extensive and complex railroad network, which linked the important mining enclaves with agricultural productive areas, big cities, and the ports (Herrera and González 2004).

In the nineteenth century, the appearance of coffee was the most groundbreaking in terms of Mesoamerican agricultural production. First, Costa Rica experienced the economic benefits of the product by successfully placing it on the international market and strengthening commercial ties with Great Britain. By the 1850s, coffee had already created an elite group of producers in the Central Valley. which consolidated the focus of the country's economy on its production (Hall 1976; Samper 1990; Acuña and Molina 1991; Gudmundson 2001). In the 1870s, Chiapas, Guatemala, El Salvador, Nicaragua, and, to a lesser extent, Honduras joined in on the production coffee (McCreery 1994; Lindo-Fuentes 2002; Charlip 2002; Santiago 2003). Towards the end of the century, bananas were linked to this economy; however, the benefits of the economic surge generated by these agricultural products were soon limited (Pérez-Brignoli 2000).

In Mesoamerica, the context of economic liberalism led to the emergence of conflicts over distribution, especially regarding land tenure and agricultural wages. Al-

though Spanish colonial institutions hindered internal trade and the Crown's resources were not earmarked for the education of local populations, as was the case in the Anglo-Saxon colonies (Engerman and Sokoloff 1997), social inequality was accentuated after the processes of independence compacted collectively owned Indigenous lands and titled public lands chaotically (Coastworth 1998). The case of Mexico is relevant here. In the mid-nineteenth century, one third of arable land was owned by the Catholic Church, which controlled a significant number of peasants through sharecropping: a contract by which a church lent its land to some peasants to work in exchange for a share of the crops. In addition, through mortgage loans, the clergy exerted a strong influence over small landowners. Then, the liberal government applied the Reform Laws that stripped the Church of the legal capacity to acquire property. The liberals sought to promote a strong and independent bourgeoisie; however, the results differed, as an exclusive landowning elite was created (Hale 1985).

At this stage, a growing international trade also began, sustained by the expansion of agricultural and livestock lands and the development of infrastructure, particularly railroads and ports. Agricultural expansion was not due to an increase of small properties as the liberal project intended but rather due to a procedure plagued with irregularities, if not fraud, with respect to large portions of land that passed into the hands of a few large landowners through alienation, demarcation, or colonization.

Agrarian Nationalism and Transnational Interventionism (1870–1930)

The agro-export model in Latin America (Bethell 1997; Bulmer-Thomas 1998; Thorp 1998; Bértola and Gerchunoff 2011), particularly in Mesoamerica, was characterized by its dependency on the international market, the concentration of capital and credit in the hands of agrarian oligarchies and transnational companies and their partners – such as the United Fruit Company (UFCo.) –, and mono-export with a tendency for monocultures (Barrantes et al. 2011), as well as increased importation and a fiscal dependence on indirect taxes of a regressive nature collected from imports and exports, to a lesser extent (Viales-Hurtado and Léon-Sáenz 2021). The demand for tropical products related to the industrial revolution and the increase in real incomes in Europe and the United States resulted in an international division of labor that forced Mesoamerica to link itself to the world market through an export-led growth style based on two star products in the case of Central America – coffee (between 1850 and 1930) and bananas (between 1880 and 1950) – with greater productive diversification in the case of Mexico.

In the last decades of the nineteenth century, societal differences and disagreements, the unsustainability of the elitist regime, and the economic crises from the hoarding of natural resources became noticeable. In this context of uncertainty, the

rural and land tenure projects that would emerge in the first decade of the twentieth century took shape. In Mexico, fifty *compañías deslindadoras* (organizations tasked with the responsibility to measure and clear land for colonists) had in their domain more than 45 million hectares, corresponding to a quarter of the nation's land mass. The vast majority of the land offered for sale was acquired by ranchers and mining and railroad companies. By the first decade of the twentieth century, 1 percent of the population owned 97 percent of Mexico's territory (Eckstein 1984).

In northern Mexico, the Yaqui peoples resisted the dispossession of communal lands by the government and compañías deslindadoras, which led to military intervention and their mass deportation to the Yucatán peninsula, where the Yaquis worked in semi-slavery on henequen haciendas. Likewise, the increase in henequen production reduced the number of lands destined for workers that were *acasillados* (servants who also lived in the haciendas), so that most of them became dependent on large landowners for their daily subsistence. This situation was complicated when the price of henequen fell in the first decade of the twentieth century. Likewise, in the face of land dispossession, many peasants in Mexico migrated to the United States or joined the mining industry. However, in the context of a recession suffered by various U.S. industries, the U.S. government announced the return of Mexican workers in 1908. The following year, in 1909, the mining industry went into crisis and many workers were laid off. At the same time, the northern corn crops were lost (Katz 1980).

By 1911, Mexico was exporting a different form of primary energy, oil, and importing the capital required to create hydroelectric projects to provide a secondary form of energy, electricity. Seen from an energy perspective, the Mexican Revolution (1910–1920) represented a period of change, as the primary base of energy shifted from biological to fossil fuels. But the transition was variable, contested, and prolonged, giving rise to contradictory phenomena. The effects of the transition are today visible and take many forms: pollution, climate change, plastic waste, among others (Soluri 2009).

The contemporary Mexican territorial organization, the restructuring of collective property and the regulation of changes in land use were a consequence of the ideological tenets of the Mexican Revolution and unprecedented agrarian reform. The post-revolutionary governments granted land to peasants in the form of an *ejido* (land parcels shared communally), as a measure for social vindication to avoid the extension of the armed struggle, despite the promotion of collective property not being part of the plan. The figures are illustrative: at the beginning of the twentieth century, less than 2,000 families owned 87 percent of the nation's land area; by the end of the 1980s, there were more than five million ejido rightsholders. There are currently now more than 29,400 agrarian nuclei, exceeding one hundred million hectares, equivalent to 50 percent of Mexican territory (Hernández 2012). The 1917 Constitution proposed a radical agrarian reform. It declared, on the one hand,

the right to restitution of communally-owned lands or the distribution among the towns; on the other hand, it declared null and void the alienation and demarcation carried out since the middle of the nineteenth century. The constitutional decree resulted in the two Mexican collective tenure figures: first, the restitution of land gave rise to the agrarian community which, in general terms, coincided with the figure of the colonial indigenous peoples; second, the endowment of land to former hacienda laborers and tenant farmers gave rise to the ejido (Garibay 2008).

In addition to harming large landowners, the distribution of land among the former peons represented a latent threat to other rural characters. These included small, but economically impoverished, private landowners with strong ties to institutional Catholicism, settled in the states of Jalisco, Guanajuato, Michoacán, and Querétaro. This type of landowner, known as a ranchero, had strong reasons to distrust agrarian reform: their land, although of poor quality, could be subject to expropriation by the government, which might prefer to take their plots over those of the landowning elites. The tension grew even greater: between 1924 and 1928, the Mexican government launched strong attacks against the Catholic Church – which had a deep-rooted moral leadership among ranching societies –, closing churches and suspending services. This provoked, in 1926, a new agrarian uprising known as the Cristero Revolution (Tutino 1990).

In 1934, Lázaro Cárdenas del Río became President of Mexico and implemented the agrarian reform from the 1917 Constitution. For Cárdenas, the ejido was the most appropriate territorial structure for satisfying the needs of rural settlements, through the establishment of strong communities that would ensure an equitable distribution of the riches of the land and natural resources. The politically neutral term *núcleo de población* (population nucleus) was created to refer to social groups receiving land, replacing the historical notions of congregation, community, civil corporation, or tribe. In addition, a distinction was made for the first time between ejido lands for common use, such as forests and pastures, and plots of land for individual agricultural work by ejido members. In summary, more than 20 million hectares were expropriated from large landowning elites, benefiting around 800,000 families (Garibay 2008).

Towards the middle of the twentieth century, the post-Cardenas Mexican government opted for two actions that had repercussions for rural areas. In the context of World War II, he proclaimed a policy of national unity, which entailing the reduction in internal conflicts generated by agrarian distribution (Salinas 1988). Thus, the bases of urban-industrial development were defined, marking the rural regions as the primary suppliers of raw materials and labor for the secondary and tertiary sectors. Agriculture was no longer a peasant industry, but a commercial agribusiness. In legislative terms, a new Agrarian Code was finally established in 1942, which granted greater guarantees to small property and created land titles for ejido rightsholders (Urquijo 2017). In this context, the process of deforestation increased. Its

environmental impact was made evident by soil erosion, changes in the composition of vegetation, and, as a consequence, changes in climatic conditions, as well as the loss of plant and animal species and the proliferation of some pests. In terms of water resources, both surface and groundwater were affected (CEPAL 1993).

Although the 1917 Constitution stipulated that the exploitation of subsoil resources corresponded to the State, in practice, the participation of foreign companies had been the norm since the nineteenth century. Oil companies, mainly U.S. and British-owned, extracted the resource from different locations in Mexican territory, mainly along the coasts of the Gulf of Mexico. In 1938, in the face of growing complaints and workers' movements, President Lázaro Cárdenas decreed the expropriation of the industry and the establishment of the parastatal company PEMEX (Boyer and Cariño 2019).

In Central America, the period of energy transition occurred before World War I – except in Nicaragua – during which coal was the main imported fossil fuel source. When the war broke out, there were different national responses. Costa Rica, El Salvador, and Guatemala reduced coal imports, but this did not happen in Honduras and Nicaragua. The latter, together with Costa Rica, Guatemala, and El Salvador increased oil imports, and by the end of the 1920s, the entire subregion was a major oil importer. The energy transition, as measured by oil imports as a percentage of total energy, was most radical in Costa Rica, from 10 percent to 90 percent; only Nicaragua remained 30 percent dependent on coal (Notten 2012: 372–376).

Regarding agricultural uses, coffee plantations in Central America took the form of polycultures following from their origins, and the cultivation systems incorporated regulated shade (Naranjo 1997; Samper 2003). This influenced a less fragmented land use, with mosaic logic and greater associated biodiversity (Viales-Hurtado and Montero-Mora 2010; Montero-Mora 2018). The expansion of the coffee plantation consolidated haciendas, as well as the agricultural colonization by small producers, in places where there was an open agricultural frontier or where Indigenous populations were confined, who produced for subsistence by growing corn, rice, beans, tubers, bananas, plantain (*Musa Balbisiana*), chayote, squash, sugar cane, tropical fruits, as well as practicing hunting and fishing (Durán Barrantes 2013). Coffee production generated a process of transformation in order to be marketed, either dry or wet (Montero-Mora and Sandí 2009), where the dry processing, as opposed to wet processing, limited water contamination and the coffee grounds could be used as natural fertilizer.

The technique of planting shade-grown coffee was somewhat positive, as it protected many lands that were previously covered with grasses or herbaceous plants from erosion and sedimentation (Ramírez Boza 2004). Wet milling produced large amounts of waste, mainly brush and *aguas mieles* (wastewater containing the unwanted residue from processing), which were thrown into rivers, leading to the development of problems with contamination. High temperatures and abundant rain-

fall led to intense bacterial activity in the soils and tropical forests, and coffee had to coexist with a variety of species. The construction of the coffee agro-ecosystem created important transformations, such as an increase in luminosity, soil temperature, and wind intensity, as well as a decrease in soil moisture and its potential for infiltration, an increase in runoff, a decrease in soil pH, and erosive processes, already detected as a concern in the 1930s. As soils became poorer, cow dung and other organic fertilizers were used, such as guano, bones, fish powders, oil cakes, lime, ground meat, and wood ashes. *Abonos verdes* (lit. green manures) were also deployed, especially through the use of leguminous plants, but then chemical inputs were used (Rojas 2000).

The process of modernizing coffee plantations took place between 1880 and 1920. In the case of Costa Rica, it entailed the generalization of regulated shade, the incorporation of coffee husks and other organic residues into the soil, as well as the importation of guano, nitrates, and other fertilizers to compensate for the loss of nutrients from the depleted soils of coffee plantations (Samper and Naranjo 2006). The government sought to systematize climatic data, especially rainfall data, given the relative dependence of Costa Rican export agriculture on soil and climatic conditions and its low levels of external energy imports, in order to increase production yields (Goebel McDermott and Viales-Hurtado 2010).

Coffee harvesting was generally practiced during the dry season, when the rivers carried little water, which resulted in the formation of pools that, combined with untreated honey, produced bad odors and the presence of bacteria, fungi, nematodes and insects, affecting aquatic life. Coffee wastes were thrown into the rivers, where they rotted, despite some attempts to minimize the impact of this by using the pulp as fertilizer and as fuel in the coffee mills. Water was used to wash the coffee and as a driving force for the coffee mill machinery; therefore, it was considered a precious and relatively scarce commodity, and permits had to be obtained from the local authorities. Water scarcity was associated with deforestation, especially along the riverbanks, so legislation was introduced to curb it and begin to reforest; fines were established and forest rangers employed, but the scope of the problem increased (Rojas 2000). The societal conflict that is recorded has been linked to the cumulative effect of river contamination from coffee waste (Román 2004).

In the case of banana plantations, in terms of the Anthropocene, the transformation of nature by human activity implied the transition from a low-input system to a capital- and labor-intensive one, where people, plants, and pathogens interacted (Soluri 2000). Under the precepts of late nineteenth century economic liberalism and its vision to modernize and transform nature, banana plantations diverted rivers, destroyed wetlands, flooded land (to combat banana diseases), and degraded soils (Soluri 2005). The forests gave way to extensive plantations of the tropical fruit, which generated genetic erosion through the cultivation of a single variety of banana, a situation that in turn enhanced the spread of diseases (Goebel McDermott

2013). The success of bananas was not only due to the availability of fertile land but also to the interconnections that could be established within and between farms. For the United Fruit Company, the choice of land depended not only on fertility but also on other elements, including roads openings and the possible risk of damage from floods or hurricanes. In the construction of roads, mainly railroad branches, UFCo. took advantage of a natural resource as an environmental service: wood.

The landscape of the initial banana plantations was rather chaotic. The forests lay on the ground and only the constant cleaning by the banana workers and the weather, which rotted the trunks, made it possible to create a new landscape: the plantation landscape. Land use was predominantly agricultural, but there were also other uses, such as forestry land, since neither the company nor the private producers razed all the forest in the region; land for construction purposes, whether for roads, bridges, docks, ports, administrative buildings, or workers' houses; or the land used for paddocks, as animal power was constantly being used as a means of loading during the first banana boom.

At first, the banana plant hardly had to compete with other species for soil nutrients, but later, a number of chemical elements became indispensable for fruit growth. Nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S) are the chemical elements that a plant requires in greater proportions; these are called the major elements or macronutrients. Zinc (Zn), copper (Cu), boron (Br), iron (Fe), manganese (Mn), and molybdenum (Mo) are used in smaller proportions and are known as minor elements or micronutrients. During the early years, the strength of Caribbean soils was unquestionable. After 1910, a drop in the export of bunches began to be recognized, which was linked to a decrease in production due to depleted land. Since then, the need to use fertilizers has been insisted upon. During the first banana boom, the fungus *Fusarium oxysporium var. Cubense* caused the most damage to the industry, as it was responsible for the "Panama disease" (Viales-Hurtado 2006; Viales-Hurtado and Montero-Mora 2011).

Developmentalism and Scientific and Technological Intervention in the Countryside (1930–1950)

Despite the expansion and consolidation of cash crops, the development of livestock activities, urban expansion, and incipient industrial development during this period, there was still considerable forest area, although the rate of deforestation had accelerated: its estimated that two thirds of the area lost since the colonial period was destroyed after 1950 (PNUD 1988). Logging of primary and secondary forests continued to increase, and agroindustrialization required a wide repertoire of chemicals: herbicides, fungicides, fertilizers, pesticides, nematicides, and insecticides, swelling the presence of agrochemical-resistant pests. In addition, the latter created

residues in fruit that were consumed by humans as well as contaminating rivers and aquifers.

Most studies on pesticide crises in Mesoamerica trace their origins to World War II and the introduction of DDT; to the demands of the cotton boom of the 1950s, especially in northern Mexico; and to the spread of the agricultural technologies of the so-called Green Revolution, initiated in the Mexican countryside at the behest of the Rockefeller Foundation in the 1940s. The scientific and technological program of genetic modification of seeds – initially corn – was mainly projected from Mexico to Central America and Colombia (Picado 2008). In the early 1940s, *Fusarium* researchers continued to experiment with chemical fungicides, including formaldehyde as a bactericide (Marquardt 2001). Beginning in 1950, scientific agricultural research impacted coffee farming with the introduction of new varieties, the use of chemical fertilizers, and other industrial inputs that led to an increase in energy imports to coffee agroecosystems (López and Picado 2012). The process was gradual and the chemical change preceded the change of varieties in which coffee farming responded to international market incentives (Montero-Mora 2018; Montero-Mora et al, 2021).

In the case of Central America, the disease that had infected banana plantations since the 1930s was Sigatoka, caused by the fungus *Mycosphaerella musicola*, appearing on bananas as a parasite. This pest was controlled with techniques of fumigation. Beginning in 1935, "bordeaux mixture" (a combination of copper sulfate and lime in water) was sprayed on the leaves and in the air, beginning in the 1950s with a petroleum-based formula (Viales-Hurtado and Montero-Mora 2011).

After 1938, UFCo. used biocidal chemicals as pesticides and fungicides, today designated unfit for agricultural use because of their adverse effects on the health of people, animals, and nature. Manual spraying of these plantations was practiced between 1938 and 1962. After chemical powders spread by airplanes proved unsuccessful, they finally decided to spray it, dissolving the powder with lime in water in a blue-green soup ("bordeaux mixture" as a fungicide). To deliver the enormous quantities needed – 250 gallons per acre, twenty to thirty times a year – the UFCo. created a large-scale fungicide distribution and application infrastructure. The fumigators were nicknamed *pericos* (parakeet) because their work clothes ended up dyed greenish blue after the workday (Marquardt 2002), an activity from which they suffered *pneumoconiosis* (lung damage due to inhalation) and hepatic degeneration, in addition to gastrointestinal and eye disorders. A new stage of agroexport began in the mid-twentieth century, when the UFCo. planted palm oil to reuse land contaminated with copper sulfate during banana cultivation (Clare-Rhoades 2011). After 1950, the widespread use of Nemagon (DBCP), a nematicide with the potential to cause cancer and sterility in humans that had been developed in the 1940s, caused a strong negative health impact on people working in banana plantations in Central America and,

later, led to social movements and lawsuits against banana companies in countries such as Costa Rica and Nicaragua (Boix 2007).

In terms of vegetation cover, deforested areas in Mesoamerica increased exponentially around the middle of the twentieth century (CEPAL 1993; Heckandon-Moreno 1997). To a large extent, this process was due to changes in land use towards pastureland brought on by a new cycle of livestock exploitation to satisfy the demand for fast food, mainly in the United States market, known as the "hamburger connection" (Myers 1981). Mesoamerican deforestation was also stimulated by agricultural colonization policies in different countries, infrastructure construction, food production, and the consolidation of large agroindustrial territories (Kaimowitz 1994). This led to an increase in methane emissions, which also contributed, to some extent, to global warming.

Discussion from the Anthropocene: Strategies and Resistance to Environmental Crises

In Mesoamerica, since the beginning of the period of independence, efforts were made by the new national governments to contain the process of natural resource depletion. In Costa Rica, legal efforts were made by the state to contain accelerated land clearing and mitigate public health problems while obtaining economic benefits, aspects that, with contextual variations, were present in the nineteenth century and the first half of the twentieth century (Goebel McDermott 2005). These policies were a form of utilitarian conservationism, marked both by the scientific knowledge of the time and a set of protectionist legal measures, as well as by a rapacious economy with respect to nature's resources (Goebel Mc Dermott 2008). Costa Rica in 1849, for example, declared that authorities should ensure haciendas created no deposits of coffee husks nor of waters used in the washing process (Montero-Mora and Sandí 2009).

In Guatemala in 1885, the political leadership of Quetzaltenango intervened in the planting of trees to prevent deforestation in Coatepeque (Gallini 2009). In Mexico, the national conservation policy was consolidated in the twentieth century through the establishment of national parks in 1917 as protected areas, mainly of forests. The national parks were the antecedents of the later *Áreas Naturales Protegidas* (ANP: Natural Protected Areas). In the period between 1935 and 1940 alone, forty conservation areas were decreed, more than half of those that still exist today (Vargas 2022).

During the period under study, at the local level, several environmental conflicts occurred, especially over access to water and forests, although the focus was territorial and not necessarily conservationist. For example, in Siquirres in 1915 (part of the Caribbean region of Costa Rica), some neighbors complained because the

UFCo. kept the best timber in the region, an activity which earned it *pingües utilidades* (handsome profits) while the locals had problems even accessing firewood. The forest as a natural resource provided several services, although in the first banana boom, two were considered important: timber and firewood. Some years later, residents of Turrialba (Costa Rica) complained about the company's cutting of laurel trees, which could, in the future, affect the community's water supply (Viales-Hurtado and Montero-Mora 2011). In the case of Mexico, the relative scarcity of water and access to forests generated larger social mobilizations, conditioning local and national authorities (Tortolero 2009).

In the first half of the twentieth century, the greatest environmental impact generated by export agriculture was related to its extensive nature and the consequent simplification of rural landscapes, as well as the systematic contamination of rivers and streams to the detriment of the water supply for various populations (Goebel McDermott and Viales-Hurtado 2010; Goebel McDermott and Viales-Hurtado 2015). In Costa Rica, the utilitarian conception of resources is present in legislation after 1948, and more specifically, in the 1949 decree establishing the *Consejo Forestal* (Forestry Council), and even in the *Ley orgánica del Instituto Costarricense de Turismo de 1955* (Organic Law of the Costa Rican Tourism Institute of 1955), despite the fact that the latter contains some of the concepts that define national parks as a necessary means for environmental protection (Goebel McDermott 2005). In this country, this logic would change in the mid-1960s, with the institutionalization of laws promoted by the state and by other organizations that conflicted with the previous dynamics for production (Goebel McDermott et al. 2019), with a transition towards building a *nacionalismo conservacionista* (conservationist nationalism) and a regime for environmental protection (Goebel McDermott et al. 2020).

In summary, the history of the Anthropocene from Mesoamerica between 1810 and 1950, in terms of land use and change in land cover, directly relate to the construction and transformation of agricultural landscapes linked to activities such as extractive mining and agroexport, with a consequent loss of biodiversity. Contemporary open-pit mining has generated unprecedented environmental degradation; however, in the Mesoamerican region this has been a contextual condition of the last fifty years of the twentieth century and the new millennium, exhibited by emblematic cases in northern and central Mexico (Garibay 2011; Manríquez et al. 2018). On the other hand, the loss is related to climate change, due to the fact that a large part of the mechanisms that regulate the carbon cycle are compromised (Equihua et al. 2015). In the period studied, there was a process oriented towards the radical simplification of nature (Worster 1990) as well as the social construction of the two predominant agroecosystems (coffee and banana), accelerated cattle ranching, and extractivism (Montero-Mora and Viales-Hurtado 2014). Although some impacts come from the legacy of colonialism, the period from 1810–1950 shows dependent capitalism intensified the processes of environmental degradation, whose consequences

are palpable in the first decades of the twenty-first century, in which agricultural commodities, produced extensively or intensively, continue to put pressure on nature through the transformation of ecosystems and the fragmentation of territories (Goebel McDermott and Montero 2022), with strong socio-environmental implications that have been evidenced in this chapter throughout their historical trajectories in the Mesoamerican region.

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Land Use in the Caribbean from the Mid-Nineteenth Century to 1950

Reinaldo Funes Monzote

Plantation agriculture, particularly those dedicated to cane sugar, emerged as the primary land use in the insular Caribbean during this period. However, it was not a homogenous process across the region. The British, French, and Danish colonies entered a phase of stagnation or decline with sporadic rebounds as a result of the abolition of slavery, the appearance of new cane sugar producers in the Caribbean and other tropical areas, the expansion of beet sugar in Europe, and the liberalization of trade in the metropolises. These were small islands where the agricultural frontier could not be extended, except for larger ones such as Jamaica.

The most significant expansion, therefore, was in the sugar plantations of the Hispanic Antilles, Cuba, Puerto Rico, and the Dominican Republic, with the aim of increasing the export of sugar to the United States and international markets. But it was not a simultaneous process either. Cuba, since 1830, has been the world's largest producer of sugar for almost the entire period. Puerto Rico experienced its first boom between the 1820s and 1860s and then another in the first half of the twentieth century. The Dominican Republic took the same path beginning in the last third of the nineteenth century in a more diversified economic context. The three countries formed the so-called "(North) American sugar kingdom" after the consolidation of the northern neighbor's hegemony over the seas and lands of the Caribbean (Williams 1984; Ayala 1999).

The fact that sugar plantations continued as the principal land use in the insular Caribbean had to do with the territorial scale. The Greater Antilles: Cuba (110,992 km^2), Hispaniola (76,484 km^2), Jamaica (11,424 km^2), and Puerto Rico (8,897 km^2) cover 88 percent of the region's land area. The presence of extensive plains in Cuba and other Hispanic Antilles provided favorable conditions for the constant increase of sugar plantations, together with the occupation of some interior valleys. On most of the islands, the mountainous relief covers about 75 percent of the territory, except in Cuba, the Bahamas, Cayman, and some of the Lesser Antilles, where the proportion is inverse. The highest altitude is located in Hispaniola (3,175 m), followed by Jamaica (2,257 m). This has influenced the vulnerability of soils to erosion, after the protective cover of natural vegetation was eliminated. Another aspect to consider is

that many of these soils tend to be deficient in nutrients, due to the rapid decomposition and recycling of organic matter derived from plant cover. Ignorance of real agricultural potential led to a long learning process plagued by practices harmful to soil conservation and fertility, unlike the expertise demonstrated by native communities. The region is characterized by a wide range of soil types, occupied regardless of their agricultural potential, based on the level of organic matter, drainage conditions, natural fertility, etc. They tend to appear intermixed, although some general lines can be noted, such as the fact that alluvial soils are more present in the Greater Antilles or that a range of volcanic soils can be found in the arc of the Lesser Antilles (European Union 2015).

In a general sense, the main land uses in the insular Caribbean can be subdivided into agricultural and livestock, to which this chapter is dedicated. In addition to sugarcane, there are other export crops such as tobacco, coffee, cacao, bananas, cotton, peppers, citrus fruits, arrowroot, nutmeg, and those dedicated to domestic consumption, such as rice or corn. Livestock farming has received less attention in historical studies, but it includes a large part of the domestic animals that have been part of the Columbian exchange in its various stages. As part of the debate on the Anthropocene in the Caribbean archipelago, one can also talk about land uses for urban purposes, for road and hydraulic infrastructure, or more recently for tourist occupation. This built environment, however, had a relatively lower impact until the 1950s.

Due to space limitations, this chapter focuses on the material occupation of land through agriculture and livestock without going into greater detail on aspects of interest such as the process of land appropriation and the institutional legal framework that this implies, scientific studies, or the political, social, or cultural dimensions of land use. Two sections are dedicated to the sugar agro-industry: the first to the expansion of slave sugar plantations and the second to the central mills since the end of the nineteenth century. The third section deals with other commercial crops with an important presence on the islands, and the fourth one deals with livestock activity. Finally, a brief overview of the state of the debate on agrarian reform in the Caribbean at the end of the period is provided.

Towards the beginning of the nineteenth century, a division could be established between the Spanish islands and those belonging to other metropolises in terms of land tenure. In the latter, private appropriation for plantations prevailed, although this does not exclude the existence of other forms of crown ownership or of livestock farms and small peasant units. In the Hispanic Antilles, cattle ranches (*haciendas*) dominated with common customary uses of pastures, forests, and waters. Therefore, one of the characteristics of this period was the elimination of these forms of original tenure towards a commodification of land owned in usufruct by the most influential groups of local power (Balboa 2013).

The appropriation of land brought about the proliferation of land surveying to delimit agricultural units. Higman's book, *Jamaica Surveyed* (2001), studies hundreds of maps and plans of plantations during the eighteenth and nineteenth centuries. The dominance of large plantations, the absentee character of many planters eager to visualize their distant possessions, and the financial capacity to pay for the work of delimiting and measuring land explains this rise in Jamaican land surveying. The political and economic power of the plantocracy allowed them to control the superstructural aspects of land tenure and settlement patterns, hoarding the soils with the highest fertility that were best placed for export.

In Cuba during the nineteenth century, as part of the process of dissolving old cattle haciendas to give way to more intensive land uses, land surveyors also produced thousands of plans and maps as a means of securing agrarian ownership. These forms of representation fulfilled other functions, such as showing the internal subdivisions of the estates and facilitating the organization of labor. Sometimes because of their aesthetic value, they were displayed on the walls of rural mansions as a symbol of the territorial power of the owners (Funes and Piqueras 2023).

The Slave Sugar Plantations

In the eighteenth century, the sugar revolution, which began in several of the Lesser Antilles in the middle of the previous century, shifted to French Saint Domingue (or Haiti) and British Jamaica in the Greater Antilles. The first, formed in the east of Hispaniola after the treaty of Ryswick in 1697, registered an increase of just over 10,000 tons in the early 1720s, to 60,000 tons in the 1760s, and close to 80,000 tons around 1790. The second was lower in the same period, with an average of 40,000 tons at the beginning of the 1770s and 60,000 at the end of the 1780s (Higman 2021). This productive leap occurred as a result of the massive importation of slaves and the occupation of territories suitable for agriculture, along with the same processes of massive deforestation and environmental degradation that occurred before on smaller islands.

Saint Domingue was the symbol of the most extreme and opulent plantation society at the end of the eighteenth century. In the midst of the process of the French Revolution of 1789, a great rebellion of enslaved people broke out in this colony in 1791, which years later led to the formation of the Republic of Haiti in 1804. According to the European worldview, it was then the richest colony in the world. In truth, however, it only benefited a small elite of whites and mulattos, together with the metropolis. In 1789, its population was 40,000 white people, 28,000 Mulatto or free Black people, and 452,000 enslaved Black people, who represented more than 85 percent of the total.

After the declaration of independence, sugar production did not recover in Haiti, despite attempts to resume it. In Jamaica, planters took advantage of the situation to increase harvests to a maximum of 100,000 tons in 1804, obtained from about 700 plantations (Higman 2021: 166). By 1820, the island accounted for 25 percent of total Caribbean exports. The British colonies in the region together contributed 55 percent, more than half of it in sugar (Bulmer-Thomas 2018: 104–108).

From that decade onward, Jamaican sugar production began a prolonged decline. One of the factors was the end of the slave trade in 1807 and then the abolition of slavery in 1834 by the British, whose effects were not homogeneous. Whereas planters managed to retain possession of most of the land, former enslaved people had fewer options to find other sources of work and livelihood, as was the case in Barbados, Saint Kitts and Nevis, Trinidad, Antigua, and Saint Lucia, which achieved productive increases. For example, Barbados went from 8,837 tons in 1815 to 50,958 tons in 1894. On other islands, production declined steadily without ever recovering for the rest of the century. In the 1820s, Jamaica produced about 70,000 tons, but this decreased by the 1890s to less than 20,000 tons (Williams 1984: 366).

The process of abolishing slavery continued in 1847 with the Swedish island of Saint Bartholomew and the following year it reached the French islands of Guadalupe and Martinique, together with the Danish islands of Saint Thomas and Saint Croix. In 1863, the Dutch insular possessions (such as Aruba and Curaçao) and the mainland (Suriname) joined this process. Since then, only Puerto Rico (until 1873) and Cuba (until 1886), both under Spanish rule, maintained the slavery system. The end of forced labor could have affected the decline of plantations in some of these colonies, but it did not always happen that way due to other technological or organizational factors were involved.

Cuba, with a territory four times larger than Haiti (27,755 km^2) and about ten times that of Jamaica, became the great global sugar producer in the nineteenth century. In 1828, its output was similar to that of Jamaica, around 73,000 tons, but by the end of the 1860s, it exceeded that amount ten times. In 1894, Cuba alone supplied two-thirds of Caribbean sugar. But although the volume of regional production increased about five times between the beginning and the end of the century, its place in the global sugar trade fell from 80 percent to less than 10 percent in this same period (Bulmer-Thomas 2018: 117).

The Cuban sugar revolution based on the slave plantation system coincided with a new historical framework represented by the beginning of the first industrial revolution (Funes 2020a). Thus, the island was one of the first colonial territories linked to the birth of modern agribusiness and the expansion of frontiers producing food or raw materials linked to the industrial era, hence a key setting of what is now called "second slavery" (Tomich 2004). The application of steam engines in *trapiches* (mills) went from 26 in 1827 to 1,070 in 1862, along with their constant increase in power. Since the 1840s, mechanization began in the boiler house with vacuum evaporation

trains, and in the 1850s, the use of centrifuges in the final phase began. In 1837, the first railroad was inaugurated on the island, and since that date, an extensive network has been created in sugar-producing areas to transport products to ports, where steamboats were common for trade with the United States early on.

The use of steam as a driving force, together with the importation of duty-free coal since 1848, meant a major change in production conditions. In addition to reducing, in relative terms, the need for labor from human muscle and draft animals, it led to an internal reorganization of the plantations to expand the sugarcane fields, corresponding to the greater processing capacity. In addition, a large part of the demands for food, clothing, or technology could be met through importation. The new era helped to keep slave plantations standing despite the abolitionist movement, competition from other producing areas, and the downward trend in commodity prices, more pronounced in the case of sugar (-1.2 percent per year between 1820 and 1900) (Bulmer Thomas 2018: 129–131).

Steam engines were the best alternative in areas where water currents were very scarce or non-existent and where attempts to use wind power failed, in contrast to the extensive use of both energy sources in other Caribbean islands. The rapid adoption of steam power in Cuba contrasts with English colonies in the Caribbean, such as Jamaica and Barbados, where producers recognized that the machines could not operate efficiently because of the difficulty of achieving the balance between the size of the sugarcane fields and the grinding capacity (Zogbaum 2002: 51).

The creation of semi-mechanized mills in Cuba enabled savings in the consumption of firewood through the use of sugarcane bagasse as fuel and access to charcoal. However, these changes could imply less concern for maintaining forest reserves within plantations. In fact, the system of clearing and burning the forest to establish new sugarcane fields remained the fundamental way to obtain high agricultural yields well into the twentieth century.

Many contemporaries warned about the negative consequences of the rapid advance of the sugar frontier, both for maintaining production conditions and for economic, climate, and environmental considerations. Influential scientists such as Francisco de Frías y Jacott , Ramón de la Sagra, and Álvaro Reynoso called for the introduction of a more rational and scientific agriculture, based on pillars such as fertilizers, irrigation, drainage works, and the introduction of new agricultural implements. Their memoirs and books proposed solutions for the demand for fuel and remedies to reverse the loss of fertility. In the words of the Count of Pozos Dulces, the soils of Cuba were being exploited like an open-pit mine.

In the also Spanish Puerto Rico, there was a shorter boom in slave sugar plantations between the 1820s and 1860s. Several authors highlight the institutional changes since the enactment of the Royal Decree of Grace in 1815, which opened the door to the immigration of foreigners (from friendly Catholic powers) to favor the inflow of capital, granted tax advantages, and liberalized trade in order to promote

commercial agriculture. Sugar-producing areas in Puerto Rico were mostly concentrated in the coastal plains of the south and west of the island, around the towns of Ponce, Guayamas, and Mayaguez. In the mid-nineteenth century, its production represented 20 percent of world exports, only behind Cuba and Brazil (Scarano 1992: 39–41).

However, from then on, investment in sugar began to decline in favor of coffee. Factors such as the flow of exports from Cuba to the United States, the lack of capital, and the slower introduction of industrial technologies such as railways played a role in this regard (Bergad 1978: 65–67). In 1867, 420 mills existed in Puerto Rico, of which 161 (38 percent) had steam engines, 239 oxen (57 percent), and 20 were hydraulic (5 percent) (Cabrera 2010: 312–313). Proportions similar to those of the eastern half of Cuba around 1860, with 120 of steam (40 percent) and 178 of oxen. But far from the large sugar plantations of western Cuba, where there were 829 mills with steam engines (87 percent).

The contrast was greater considering the large investments needed for mechanized mills with vacuum evaporation trains in the boiler house and centrifuges. In 1860, 64 of these existed in Cuba, equivalent to 5 percent of the total, but already contributing 15 percent of the harvest. Despite the differences, the use of steam power also increased pressure on forests in Puerto Rico for firewood. For this reason, the Spanish crown complied with producers' demand by authorizing the tax-free introduction of coal in December 1848, a measure applied shortly before in Cuba (Cabrera 2010: 305–308).

The Era of Power Plants

In the second half of the nineteenth century, organizational changes began in the Caribbean sugar agro-industry, linked both to technological modernization and to the process of the abolition of slavery. Following the model of the beet sugar industry, the trend was towards the creation of central factories (*el /la Central*) and the separation of agricultural and industrial tasks. Development was concentrated on larger modern units, while sugarcane areas were expanded based on various ownership regimes and diverse scales. This is how the so-called colonists appeared, either former mill owners or peasants who could now access the sugar business.

The formation of central mills covered all the producing islands of the Caribbean. The French Guadeloupe and Martinique were pioneering examples after the abolition of slavery in 1848, thanks to the financial support of banking institutions created with funds intended to compensate planters. Over the next three decades, production doubled to about 50,000 tons in Martinique in 1875 and 57,000 tons in Guadeloupe in 1882. The British Isles, on the other hand, took longer to embrace these changes. To give a case, at the beginning of the twentieth century, Barbados main-

tained about 450 plantations that still mostly used windmills and produced about 50,000 tons (Zanetti 2018: 23).

Due to the territorial scale demanded by large sugar mills, centralization had a greater impact on the Hispanic Antilles. In Cuba, this process began after the Ten Years' War and in the context of the end of slavery between 1880 and 1886. The first central mills were installed both in areas of former slave plantations in the west and in areas of the wooded border in the center-east, where agricultural estates were abandoned during the war. With the contribution of the first central mills and the McKinley tariff, which favored the entry into the United States of sugar from the Antilles, the number of tons produced exceded a million for the first time in 1894.

The U.S. occupation of Cuba between 1898 and 1902 created the basis for a new sugar expansion. The Platt Amendment, an appendix imposed on the signatories of the 1901 Cuban constitution that would govern the Republic inaugurated on May 20, 1902, granted the neighboring power the right of intervention and other prerogatives. A year later, the signing of a trade reciprocity agreement granted tariff advantages to Cuban sugar in exchange for a reduction in tariffs on various products. Under these auspices, large U.S. corporations made investments to install central mills in the provinces of Camagüey and Oriente, where extensive livestock farming and vast wooded areas predominated. From 1900 to 1914, twenty-five new central mills were inaugurated, and from 1915 to 1926, another fifty were established. Among these were the so-called *colosos* (giants), due to their large installed capacity: fifteen in Camagüey and twelve in the Oriente provinces. The 1914 harvest was 2,244,500 tons, and in 1925, it rose to 5,200,800 tons. To provide sugarcane to these huge latifundios were crossed by extensive private railway networks (Funes 2008: 218).

The sugar expansion at the beginning of the twentieth century in Puerto Rico and Santo Domingo had similar characteristics. Puerto Rico was declared a U.S. tariff territory in 1901, providing an immediate stimulus to the industry. From just over 50,000 tons, production rose to 200,000 tons in 1905. At the beginning of the First World War, it was 400,000 tons, an amount that increased to more than one million tons from 1934. For this reason, marginal lands where the ecological impact was greater were occupied, such that the need to seek other economic alternatives was already clear in the 1920s (Picó 1986: 238).

In the Dominican Republic, with no tariff advantages in the U.S. market, the jump was less spectacular, from 51,000 tons in 1899 to 100,000 tons in 1920 and to about 400,000 tons between 1929 and 1935. As in Cuba, huge wooded areas were cut down. The treeless landscape in the plains of San Pedro de Macorís, La Romana, El Seibo, and later Barahona, Azua, and Puerto Plata dates back to this period (Moya Pons 1994). From the Dominican sugar plantations, raw material was also sent to Puerto Rico, where the availability of territories to expand plantations was lower and the supply of sugarcane was more dependent on the use of fertilizers and irrigation on a large scale (García Muñiz 2005: 185).

The stock market crash of 1929 and the subsequent economic crisis had a severe impact on the Caribbean. Only Puerto Rico achieved an increase in its exports as a territory of the United States. Some of the British colonies also benefited from protectionist measures in the metropolitan market and the help of modern technologies such as the railway, which reduced production costs. In Trinidad, there was an increase from 40,000 tons in 1870 to 154,000 tons in 1936, favored by the expansion of peasant agriculture and contract workers from India. Jamaica had just 5,000 tons exported in 1913, but the investment of British refiners such as Tate & Lyle in the island brought a rapid increase in production to 178,000 tons in 1945 (Higman 2021: 225).

In Cuba, sugar production fell by half in the 1930s. Under these circumstances, the rejection of monoculture and its economic, social, political, and ecological consequences was increasingly widespread. One of the most pressing problems was the scarce local production of basic foods in both Puerto Rico and Cuba. A study at the time found a greater degree of self-sufficiency in Haiti, where the peasant population produced their own food, and in the Dominican Republic, with a more diversified agriculture that achieved surpluses of rice and livestock products. Jamaica had a more diversified agricultural landscape, although it still imported large quantities of flour, rice, fish, or dairy products (Shaw 1943).

The concentration of agrarian ownership by large sugar corporations or through the leasing and control of independent suppliers was the hallmark of the new era of plantations dominated by the central mills. Therefore, it is not surprising that it was associated with the dispossession of peasants, the restriction of access to land for former slaves or their descendants, and a great deal of rural conflict, as well as demands for agrarian reform in several of the countries where sugar governed.

Other Agricultural Land Uses

At different stages or territories, the sugar agro-industry was accompanied or replaced by other crops for commercial or subsistence purposes. Several already had a significant presence in exports since the eighteenth century or even before, such as tobacco, coffee, cotton, or cocoa. Others began to take off thanks to the new era of steam and the rise of mass consumption in industrial nations, such as bananas.

Haiti was the world's leading coffee producer towards the end of the eighteenth century. This crop was concentrated in mountainous areas, in part because the plains were dedicated to sugar. A Swiss visitor around 1780 pointed out that the owners of the coffee plantations had already exhausted half of the mountains they cultivated, completely changing the climate of the colony (D'Ans 2011: 185). The environmental impact of this crop continued after the revolution, when the export

of coffee was reactivated through small producers, both due to the cultivation of new slopes and the enormous use of firewood.

Jamaica and Cuba set out to fill the gap in the coffee market after the Haitian revolution. The former briefly became the main exporter thanks to the occupation of new areas in the Blue Mountains (Higman 2021: 166). But it was replaced by the rise of Cuba and the coffee recovery of Haiti beginning in the 1820s. Cuba experienced production peaks between that decade and the beginning of the next. However, both Caribbean islands were soon relegated by Brazil, the world's new coffee powerhouse since 1830. The rest of the century saw the addition of production in Java and Ceylon (Sri Lanka), as well as Central America, Venezuela, and Colombia. This explains why Caribbean participation in the coffee trade was also in decline, going from 30 percent in 1830 to 5 percent in 1900 (Bulmer-Thomas 2018: 117).

The Cuban coffee boom had a lot to do with the occupation of the flat lands in the south-west of Havana, based on medium and large slave plantations. Further west, coffee plantations were installed in the foothills of the Sierra del Rosario, several of which were founded by by French-Haitian planters. In the midst of the already evident decline, two strong hurricanes in 1844 and 1846 crossed those territories and destroyed numerous plantations. Another production area was located in the Sierra Maestra, in the east of the country, with a strong influence of Haitian emigrants. Since 1840, this area represented the majority of the Cuban production. Erosion in mountain areas was considerable, and it is no accident that low yields were discussed early on among the causes of coffee's decline.

In the insular Caribbean, only Haiti and Puerto Rico managed to maintain high volumes of coffee exports in the second half of the nineteenth century. The first country retained its leadership until the first half of the twentieth century. In Puerto Rico, production increased from the 1870s, and until the end of the century, exports used to be above 20,000 tons, with a maximum of 26,290 tons in 1896. Its main markets were Cuba and Spain, which absorbed about 75 percent of the total in 1876, although the proportion decreased due to shipments to France, Germany, Great Britain, and Italy. By 1898, 40 percent of cultivated land was dedicated to coffee and only 15 percent to sugar. Coffee farms were mostly managed by the owners, while a high percentage of the sugarcane fields were on leased lands (Bergad 1978: 66–70).

Fernando Picó (1979) highlights the environmental impacts in Puerto Rico of the process of occupying the Utuado mountains by moneylenders and hacienda owners who sought to take advantage of the upward trend. One explanation is that precious woods made it possible to finance plantings in the early years. Problems of loss of fertility and erosion did not take long to appear. On the other hand, the intensive planting of coffee trees led to the neglect of subsistence crops and animal husbandry, increasing dependence on imports and the impoverishment of the workers' diet (Picó 1979: 59).

When Puerto Rico passed to U.S. sovereignty in 1898, coffee entered a phase of stagnation, and in the following three decades, it was reduced to 24 percent of cultivated land. In contrast, the area of sugarcane increased more than three-fold. One of the effects was that workers began a migration to the new sugar areas of the coastal plains controlled by U.S. corporations. By 1929, four of these corporations owned 68 percent of the land dedicated to sugar on the island (Bergad 1978: 78).

Other significant commercial crops were tobacco and cacao. Cuba was the largest tobacco producer since the first colonial centuries and maintained that status after becoming a republic. The main tobacco region is located in the province of Pinar del Rio in the west. In part, this location had to do with the displacement of small producers due to the expansion of sugar in the Havana region. Coincidentally, however, their soils were very suitable for the plant. Although there is a consensus that production depended on small family units and free workers, it also involved forced labor and there was no shortage of larger-scale slave plantations (López 2015).

In the Dominican Republic, a tobacco boom began in the 1840s. The Cibao Valley region in the north of the country was the scene of a close relationship between small and medium-sized rural producers and merchants from Santiago de los Caballeros and Puerto Plata, the main regional port, who provided credit to access agricultural productions for foreign trade. The late arrival of sugar plantations in the country and their preference for plains limited competition for resources with the peasant economy of this region, although this was not exempt from threats such as logging.

The land commercialization process that shaped the peasant society of Cibao in relation to the market involved the disappearance of traditional communal land for the benefit of the more affluent peasants (San Miguel 2012). On the contrary, poor farmers were deprived of access to resources and were displaced to marginal areas or were forced to rely on illegal hunting and logging as a means of livelihood. At the end of the nineteenth century, the fall in the price of tobacco led many producers and merchants to turn their attention to cocoa and coffee, which were more lucrative Peasant families reinvested the benefits of the tobacco economy in cacao, but large-scale plantations controlled by foreign firms were also created. In 1907–1908, this crop ranked as the country's first export item (Moya Pons 2008: 405).

Cocoa and coffee maintained their weight in Dominican exports until the crisis of the 1930s, when farmers focused on producing food. The weakness of the state and the coincidence of interests between the peasantry and the commercial elite contributed to the persistence of an economy based on small production and not on latifundios (San Miguel 2012). Peasants occupied ecological niches where it was possible to combine subsistence agriculture with commercial agriculture without interference from plantations.

The expansion of the peasantry in other islands, such as Jamaica and Trinidad, had similarities and differences with the Dominican case. There it was not a ques-

tion of the dissolution of communal haciendas but of the decline of the plantation economy and its conversion into other economic activities or the occupation of new spaces. In the second half of the nineteenth century, many former enslaved people became peasants. In Trinidad, migrants from India joined, who had access to land after fulfilling their contracts and went on to supply sugarcane to central sugar mills. Indian villages also participated in the cocoa boom between 1880 and 1920 and began cultivating rice on a commercial scale (Watts 1987: 506–511).

In Jamaica, small properties with less than 15 acres (about 6 hectares) increased from 50,000 in 1870 to 185,000 in 1930. In this sense, the colonial government's policy of legalizing occupied land played an influence, as well as the opportunities, since 1895, to buy crown land on credit (Higman 2021: 225–226). The peasantry was key to the boom in the export of bananas as a new cash crop starting in 1876. The main centers were located near the north coast from the Montego Bay area in the west to Puerto Antonio in the east, where the infrastructure for shipping was created. Railroad branches to both cities were installed to serve the banana areas that exported to the United States and that began shipping to England in 1897 (Zanetti 2018: 106)

The banana business towards the end of the nineteenth century included areas of eastern Cuba, the Dominican Republic, and Trinidad. After the U.S. occupation of Cuba, this crop was relegated to the enormous potential of sugar. But in other cases, that country's military presence was essential to promote bananas. This was the case in Haiti in 1935 when Standard Fruit was awarded a contract for twenty-five years to promote large plantations, although the Second World War frustrated expectations (Higman 2021: 227). Small farms were key to banana exports from islands such as Dominica, Guadeloupe, and Saint Lucia.

The list of crops could be more extensive, including several marketed abroad at different stages and which, for some islands, represented the main source of income. To those already mentioned, cotton, rice, citrus fruits, pineapple, coconut, potatoes, along with other native and African tubers, vegetables, or fruit trees are added. In Saint Vincent, cotton and arrowroot stood out; in Granada, nutmeg and cocoa; in Barbados and Nevis, ginger; in Dominica, lemon juice; in Jamaica, pepper, ginger, and logwood (Watts 1987). In the Isle of Pines, to the south of Cuba, U.S. American colonies were established at the beginning of the twentieth century and fostered citrus and pineapple plantations.

Transitions in Livestock Farming

Plantations might be the most visible form of land use, but on several islands, livestock tended to occupy more space. This had to do with their ability to adapt to areas with lower agricultural potential, as well as their contribution to the plantation system itself. At the same time, in these years, there were major transformations in

the management and use of animals. On the one hand, traditional free-rearing haciendas gave way to more intensive practices, through fenced pastures (paddocks) or stables to produce milk. On the other hand, steam technology, and later the internal combustion engine, entailed the gradual replacement of traction and transport by animals.

In the Lesser Antilles, opportunities for raising animals were more limited. It is not surprising that there was a flow of animals to the so-called sugar islands of the British or other European powers, either legal from North American colonies and metropolises or illegal from Hispanic territories in the Caribbean basin. Although on several of these islands it was possible to use wind or water to move the mills, the demand for animals for transport or food was still considerable.

In the same Lesser Antilles, the link between the islands of Antigua and Barbuda can be mentioned. In the first, during the period from 1900 to 1960, sugar and cotton represented 84 percent and 8 percent of exports respectively. However, Barbuda is more affected by drought and this made it less attractive for commercial agriculture, such that livestock farming on common land had greater economic value (Berleant-Schiller 1977).

Extensive livestock farming without fences and with free access to forests, waters, and pastures in so-called communal haciendas dominated the Spanish colonies until the end of the eighteenth century. From then on, the process of dissolution of these original haciendas accelerated. This disappearance occurred in a staggered manner, beginning in Puerto Rico and Cuba with the plantation boom of the nineteenth century. In the Dominican Republic, the process was delayed by the events in Hispaniola following the Haitian revolution and its incorporation into the Republic of Haiti (1821–1844). It is said that in the context of the war crisis at the end of the eighteenth century, the ideal of a supposedly more egalitarian social life dominated by the *señores de hatos* (cattle ranchers) in a *hatera-conuquera* society (a mixture of cattle ranching and small farms for subsistence and commercial farming) opposed to the plantation model was renewed in the Hispanic part (González 2011: 132–133).

The most significant thing in this period was the formation of paddocks as specialized units to supply the domestic market. One of the most extensive studies on this process is written by Shepherd (2009) on the economic and social relevance in the eighteenth and nineteenth centuries of the pens in Jamaica. This type of farm was dedicated to raising livestock, especially cattle and horses, for plantations and population centers on much more limited areas of land through planting pastures of African origin, such as guinea-grass, and food crops.

After the abolition of slavery and the decline of Jamaican plantations, cattle farming experienced a renaissance linked to the meat and milk market. Many of the original sugar farms were converted to raise animals and the number of paddocks increased from 378 in 1844 to 604 in 1881 (Shepherd 2009: 220). This trend was more marked towards the end of the nineteenth century both by the possibilities of the

domestic market and by the demand of Cuba after the wars of independence, as well as to provide equines to other British islands.

In Cuba, paddocks also multiplied during the nineteenth century as sugar plantations advanced eastward. The increase in these units covered both the areas of slave plantations and the areas where extensive livestock herds and corrals still prevailed. In the former, they were created in areas adjacent to mills and plantations as subsidiary units to maintain the teams of oxen and other working animals. In the latter, they were the product of the subdivision of the original haciendas to initiate a more intensive upbringing.

The introduction of steam engines and railroads meant a reduction in the demand for animal traction, affecting the main livestock areas. As an alternative, producers introduced reforms in breeding systems with the planting of artificial pastures and the introduction of new breeds from the United States, such as Durham or Shorthorn, for the meat market. However, these efforts were limited by the large importation of animal products such as *tasajo* (jerky) from South America and U.S. American lard. Even from 1859, livestock began to enter from Honduras and the Tampa area of Florida to supply slaughterhouses in Havana (Funes 2020b).

It is not surprising that livestock areas were the scene of the first war of Cuban independence, the Ten Years' War (1868–1878). After the war, there was a rapid recovery of the herd based on paddocks and the importation of specimens from the Caribbean and the United States. With the new war of independence between 1895 and 1898, livestock in the country fell to its minimum levels. But once again, the facilities for importing cattle, especially from the Caribbean basin itself, were the basis for the cattle herd to go from less than one million heads in 1899 to about five million in three decades. A large part of these animals went to sugarcane carts in large sugar latifundios and sugarcane colonies until they began to be replaced by trucks.

Protectionist policies since 1927 and the economic crisis of the 1930s contributed to a boom in livestock farming to supply the domestic market with meat and milk. The modernization of slaughterhouses since the end of the nineteenth century, the use of railways and then trucks for transporting animals, together with refrigerators, expanded the livestock business. In terms of management, the most important innovation had to do with the popularization of zebu cattle (*Bos Indicus*) from the beginning of the century and their crossing with Creole cattle. The adaptability of this species to tropical conditions favored the expansion of livestock latifundios. During this period, the acquisition of valuable specimens of Brahman cattle from Texas and Florida, considered the first breed of cattle created in the United States, for the improvement of meat farming in Cuba began (Funes 2023).

The dairy industry also had a boost from the late nineteenth century with the importation of Holstein-Friesan and other cattle with greater dairy potential, such as Jersey and Brown Swiss. The expansion of specialized stables in cities then began. Another big change was the arrival of pasteurization and the appearance of the

first dairy factories. The crisis of the 1930s also contributed to the increase in dairy farming, in parallel with the idea of milk as the perfect food with a more democratic consumption.

An assessment by Jaime Bagué on the livestock sector in the Caribbean around 1929 indicated that the British and French colonies had undertaken a task of selecting, caring for, and feeding cattle. New breeds were introduced in Jamaica and laws were enacted to protect their health and facilitate their propagation. From 1910, crossbreeding began at the Hope government farm, where it was determined that the Jersey breed had the greatest potential. Five decades later, Jamaica Hope was declared a new dairy breed (80 percent Jersey, 15 percent Sahiwal – Zebu –, and 5 percent Holstein). In Guadalupe, through interbreeding, immunization, and adequate nutrition, the average production per cow went from 4 to 10 liters in the 1920s (Bagué 1929).

In the Hispanic Caribbean, the picture was less flattering with rudimentary practices such as the use of fire in the grasslands of Cuba and the Dominican Republic. Bagué differentiated between private producers, with a greater interest in beef cattle, and governments, who sought to promote the dairy industry. In the Dominican Republic, the Moca Experimental Station, with an agriculture college and demonstration fields, had undertaken the acclimation of imported stallions, selling them later at cost to local ranchers.

In Puerto Rico, the sugar boom had affected livestock, as many meadows were replaced by extensive sugarcane fields, leading to an increase in the price of meat and milk. Since the creation of the Department of Agriculture and Labor in 1917, measures began to be taken, such as the elimination of ticks and the importation of purebred specimens. The most widespread was Holstein, followed by Jersey and Guernsey, which began the modernization of the dairy farms that supplied the main cities (Bagué 1929).

A 1946 report by the Anglo-American Caribbean Commission presented the situation of livestock in European and U.S. American colonies in the region. The situation was very varied, and progress had been made since the 1920s. Topics such as traction animals, the number of horses, mules, and donkeys, and the importation of water buffalo for that purpose into Trinidad were included. The improvement of cattle farming for meat and milk focused much of the attention, but species such as pigs, sheep, and poultry also appeared. The report reflected the changing landscape in animal husbandry, where traction animals were losing importance and interest in animal protein was growing. Processes that can be studied based on the implications for land use of livestock intensification that encompassed all the islands.

Final Note

In August 1944, the symposium "*Tenencia de la tierra en el Caribe*" (Land Tenure in the Caribbean) was held in Mayagüez, Puerto Rico, sponsored by the Caribbean Research Council, a technical body of the Caribbean Commission. Representatives of the British colonies (Jamaica, Antigua, and British Guiana), the United States (Virgin Islands and Puerto Rico), as well as delegations from Suriname (Holland), Haiti, the Dominican Republic, and Cuba participated. Most of the works were dedicated to the Puerto Rican case, where an agrarian reform was being implemented as a result of the Land Law of Puerto Rico of April 26, 1941 (Caribbean Commission 1946a).

With the approval of the Foraker Act of April 2, 1900, which declared Puerto Rico an unincorporated territory, the U.S. Congress established a limit of 500 acres (202 ha) to prevent land grabbing by large capitals and to favor its division. However, that provision was breached, and in the following years, sugar corporations came to control much of the best agricultural land in the country. This created a great pressure on resources because three-quarters of the population was linked to agriculture and had to occupy mountainous areas to survive, which increased deforestation and erosion.

Land concentration reached its climax in the 1930s, when 50 percent of sugarcane areas were controlled by four large U.S. American companies. 0.4 percent of the farms produced 56 percent of the harvest, an indicator of the predominance of latifundios. In addition, there were low salaries, seasonal employment – less than half the year –, precarious housing, and other ills. In the preamble to the 1941 Land Law, it was written that sugar latifundio had spread their tentacles over their vast domains, limiting the circulation of money and annihilating communal life. The prevailing economic structure created material misery and moral degradation, requiring an agrarian policy that would result in "a greater and more equitable distribution of the country's natural wealth and greater freedom and economic dignity for the inhabitants of the rural area."

This diagnosis can be applied to a large part of the Caribbean region, whose best lands were dominated by large sugar or banana corporations, mostly U.S. American. But there were variations between the Antilles. The presentation on Haiti at the symposium gave a historical account of land tenure, which after the revolution passed almost entirely to the new state due to the confiscation of property from French colonists. The free delivery of plots and the facilities for their lease or purchase them helped promote peasant farms, while the sale of land to foreigners was prohibited. The latter would change with the Constitution of 1918, signed under the U.S. American occupation.

The Dominican Republic submitted a report that highlighted efforts to establish the "sanitation" of property since the creation of the *Tribunal de Tierras* (Land Court).

Through this body, the tenure of more than a third of the Dominican territory had been clarified. One of the policies was the creation of agricultural colonies, with government support through the delivery of seeds, animals, and farming tools. Although cash crops dominated exports, led by sugar, ownership was more distributed. Of the cultivated land, 16.9 percent was occupied by bananas and *guineos* (unripe banana), 9 percent by sugar, and with about 6 percent each, cocoa, corn, and cassava. Pastures covered 36.1 percent of the area.

The most extreme case was that of Cuba, a symbol of sugar monoculture to the point that the slogan "without sugar there is no country" became famous. The 1946 agricultural census recorded an area on farms covering nearly 80 percent of the national territory, but of these only 21 percent were cultivated. 57 percent of cultivated land was dedicated to sugarcane, followed by bananas (10 percent), corn (7 percent), coffee (3.8 percent), as well as tobacco, beans, peanuts, and sweet potatoes. A large part of the areas on farms was occupied by pastures (42 percent), where cattle ranching on latifundios reigned.

The representative for Cuba stated that about 50 percent of the national territory and 25 percent of the arable land remained uncultivated. In 1937, the distribution of state land began, but without the expected fruits because they were poorly located, of low quality, and lacked means of communication. Three years later, the 1940 constitution, drafted by the various political forces, agreed to the elimination of latifundios and recognized the social function of private property, with the purpose of placing agrarian production in Cuban hands and protecting farmers. But the law that would indicate the maximum extension for a person or legal entity remained pending. At that time, the speaker wrote, the limit would be greater than the 500 acres of the Puerto Rican agrarian reform.

Some years later, in 1959, the Cuban revolution led by Fidel Castro against the dictatorship of Fulgencio Batista triumphed, with broad support from the peasants. After the seizure of power, one of the objectives was to put an end to the *latifundista* (large estate) system and enact an agrarian reform that would establish a limit to rural property and distribute land between peasants and agricultural workers. The limit was set at thirty *caballerías* (402 ha, 990 acres) and up to 100 (1,340 ha and 3,300 acres) for the most productive units. Nevertheless, the great sugar and livestock interests, foreign or domestic, with the support of the United States, raised the specter of communism to join forces against a reform whose origin and purposes had much in common with the one that had previously been applied in Puerto Rico.

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From 1950 to the Present

Source: Fernando Efrén Sandoval (2021).

Introduction: Land Use in the Latin American Anthropocene from 1950 to the Present

Adrián Gustavo Zarrilli, Olaf Kaltmeier, María Fernanda López Sandoval and José Augusto Pádua

From the middle of the twentieth century to the present, Latin America has faced highly complex structural problems and challenges, which are, in turn, deeply rooted historically in the ongoing destructuring produced by the conquest. Despite the enormous potential of its natural and human systems, most countries in the region still live in a context of extractive natural resource overexploitation, as marked by the long history of colonial dispossession. This model, which, with nuances, has been repeated for centuries, emphasizes the special importance of the use, appropriation, and transformation of land. The socio-cultural and territorial inequalities, the unfair distribution of income, the concentration of wealth, and the corruption present in the majority of the states in the region are unavoidable frames of reference when it comes to understanding the structural problems associated with the use of the land in Latin America.

Between the 1930s and 1960s, Latin American societies followed the development path of the capitalist centers, promoting the industrialization of the economy. In the 1960s, the Green Revolution positioned agriculture transversally in the Great Acceleration. Neoliberal adjustment programs inserted the economies of the region even more into world markets, causing a true "reprimarization" of the economy in many countries (Pádua 2024: 55). The enormous growth in global demand for raw materials, especially in China and other emerging economies, has led to a massive expansion of extractivism, or a commodity boom, since the late 1990s (Cálix and Blanco 2020; Svampa 2019). In general terms, the region has played a secondary role in relation to the global economy, which has made it resort to its natural advantages to secure a minimum portion of global wealth through a) the massive extraction of raw materials for export purposes; b) the provision of a cheap and relatively abundant workforce in low-skilled activities within global value chains; and c) lax environmental, fiscal, and labor regulations to be able to compete following the logic of "downward competition" – a product of globalization, free trade, and economic deregulation. "The first and third of these "advantages" are observed in nearly the entire

Latin American subcontinent; the second, on the other hand, is gaining strength in the countries with greater geographical proximity to the United States" (Cálix 2021).

Even countries that managed to integrate into global manufacturing production chains do not stop promoting extractivist policies. Both strategies contribute maliciously: they are incapable of generating important quality jobs and have few links in their internal markets, while investments are highly concentrated in a few business groups. This process does not exclude countries that, due to their demographics and purchasing power profile, have more favorable conditions for the development of their internal market since, in them, there is a notable concentration of productive sectors in the most profitable activities. The rest of the population competes for the precarious world of the informal economy, whether in agriculture – for countries that still have about a third of their population employed in that sector – or in the growing expansion of low-productivity urban services (Cálix 2021).

In turn, in the last four decades, this deepening of the cycle of natural asset exploitation has multiplied socio-environmental conflicts. Local populations – especially Indigenous and rural women – have been excluded from the decision-making processes on projects undertaken in the territories where they live. These extractive projects come into conflict with the worldview and life practices of the populations located there. Added to this is the historical contempt against these populations and, due to their role in supporting their communities, women are particularly at risk faced with new forms of appropriation of income from natural assets. Violence, the division of communities, and displacement are consequences of an economistic vision that seeks unlimited capital accumulation (Cálix and Blanco 2020).

In the context of land use, industrial agriculture or agribusiness has become the dominant model of agricultural development. International organizations and the agro-industrial lobby present this model as a key instrument to combat poverty and hunger in the world, and, consequently, promote it. Highly mechanized, specialized, and capital-intensive, the model – controlled by large corporations – is oriented toward large-scale monoculture and relies heavily on external industrialized inputs, such as agrochemicals, seeds, and machinery. The neoliberal principle of comparative price advantage and selective integration in the world market promote agricultural production's specialization for export. This takes place through complex and highly competitive global chains of primary products that are controlled by only a few multinational consortiums (Sandwell 2019).

The industrial transformation of agriculture in Latin America – first, through the Green Revolution; then, through the dissemination of hybrid and genetically modified seeds, as well as the agrochemicals adapted for them – has fundamentally changed not only land use but also labor exploitation and the appropriation of biological production. Continuing the ideas of Goodman, Sorj, and Wilkinson (1987), one can speak to a form of "appropriationism." This refers to a productive model in the agricultural sector that is constituted by industrial capital – and now financial

capital. In the process, the importance highlighted before of nature in rural production is continually reduced and technically controlled. This paradigm of agricultural production reduces – unacceptably – the great complexity of nature in order to achieve the necessary standardization of agriculture and silviculture for the industrial model. However, said biological simplification and appropriation require intensive and large-scale use of land for controlled monocultures and, therefore, cause the biophysical destruction of local ecosystems.

In this period of the Anthropocene in Latin America, farmers are increasingly dependent on genetically modified seeds, agrochemicals, and machinery. Financial industrial capital has captured agriculture, destroying the natural production process and its material base, considered incompatible with capital accumulation (Goodman, Sorj, and Wilkinson 1987: 156). However, all this biophysical elimination carries hidden costs that affect rural livelihoods, human health, and the environment. These surreptitious costs call into question a model that boasts of its supposed efficiency in corporate and political discourse. It is also a model that requires large territorial extensions, accelerating a process of deforestation and destruction in many biomes of the region. In the emblematic case of the Brazilian Amazon, the rainforest still retained 99 percent of its initial coverage in the early 1970s, but in the few decades that followed lost 20 percent (Pádua 2024).

Capital's transformation of agriculture, silviculture, and livestock in these decades has changed not only land use and ecosystems but also the social relations of production, property, and power in the rural world. Mechanization, standardization of labor processes, and the increasing use of external inputs have reduced the need for manual labor considerably. Small farmers have lost their lands and have been integrated into global supply chains of basic products through contract agriculture. This last is a new and subtle way of indirectly controlling land, labor, and natural resources on the part of agroindustrial consortiums (McKay, Fradejas and Ezquerro-Cañete 2022: 18). This production model was introduced by the so-called Green Revolution in the 1960s, during a time of agrarian reforms that modernized agriculture, and was deepened in the 1990s through transgenic crops and their agrochemical inputs. (Neo-)extractivism – the endemic evil that devastates Latin America – has been described as a mode of appropriation that points to the different ways of taking over diverse natural resources (physical materials, energy, and ecological processes) for capital accumulation in specific social and environmental contexts (Gudynas 2015).

If capitalism is understood as a form of social reproduction – not only as a productive form but as a framework of societal relations that necessarily course through the metabolism of man-nature relations – it is found that this same civilizational form of capital carries within it a contradictory form of reproduction. In other words, capital cannot reproduce itself without undermining the material bases of its own reproduction. The metabolic rift that Foster (2000) – with a refer-

ence to Marx – points out is the inherent condition of its own development (Pineda 2016: 204).

At the same time, the dismantling of non-capitalist forms of communal interaction relations (extremely important in the Latin American subcontinent) and other models of similar socio-environmental relations seems to be indispensable for the capital's unlimited expansion. These processes of separation, new enclosures, and monopolization are the form of concentration that allows domination over nature as a resource, the same nature that, in the hands of non-capitalist communities, is a means of survival and material and cultural reproduction. And at the same time, they represent an important obstacle, because, on countless occasions, communities, towns, and collectivities face the process of dispossession.

The land problem in Latin America is far from being solved, as it is the region with the highest concentration of land in the world. The agrarian reforms of the 1960s and 1970s have not fundamentally improved this situation, and since the 1990s, peasant and Indigenous movements have been involved in land ownership conflicts in many countries of the region. As a consequence of structural change in the agricultural sector, peasants have lost their land, and many families are now affected by extreme poverty, unemployment, and underemployment. In addition, the exploitation of natural resources and the destruction of ecosystems, as well as the contamination of soils and rivers, has advanced. Many essential strategies have been formulated to develop rural areas and combat poverty. However, an essential condition for development is the reorganization of agrarian property – not to confront an archaic system that is already extinct, but to enhance the productive capacities of the population and rationally take advantage of the available natural resources.

Finally, it is worth asking about the nature of the crisis: are we in the presence of the same critical situation for the entire planet? Of course, the Anthropocene is a global concern, since no region can avoid the current climate crisis, but it is also undeniable that each region faces different challenges. Latin America presents special particularities, given its historical trajectory of dispossession and destruction, and faces a challenge as an exporting region of natural resources plagued by social conflicts.

The land has been put at the service of the extractive model again and again, in the past as well as in the present. Extraction has not only created biophysical damage to the land where it occurs – whether in mining or agriculture – but has also had a proven brutal and harmful impact on populations, especially among the poorest and most marginalized. In this way, reflecting on the future of Latin America involves reflecting on the development models implemented and the effects of the Anthropocene on societies. From there, we must rethink the strategies and possibilities of facing the crises, to which we are and continue to be subjected.

Beyond the issue of agribusiness, urbanization and, the expansion of the material infrastructures of modern capitalist societies are important factors in the Great

Acceleration. With a massive rural-to-urban migration and notable demographic growth, Latin America is one of the most urbanized regions in the world. In the decades between the 1940s and the 1960s, megacities sprung up in all the major regions discussed here. Demands from urban populations for energy, infrastructure, consumption, etc. have had a significant impact on the socio-ecological metabolism of the different localities. The technosphere has also expanded due to infrastructure projects, especially highways. Also, a massive increase in the use of hydroelectric power in Latin America since the 1950s has vastly modified land use through the construction of enormous dam systems. Land use, in this sense, has fundamentally and comprehensively changed since the beginning of the twenty-first century, characterized now by transformations towards a supposedly green capitalism. In addition to hydropower, this shift includes wind and solar energy parks, as well as sugar cane plantations and similar crops for biofuels. Argentina was the first country in the world – after the United States – to introduce national parks, followed by Chile, Brazil, and Bolivia. (Kaltmeier 2021) Particularly since the late 1960s, there has been a boom in nature reserves in the whole region, especially in peripheral areas, which have significantly changed land use in terms of quantity and quality.

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Land Use in the Southern Cone from 1950 to the Present

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In order to analyze a specific region's presence in the history of the Anthropocene, it is necessary to give historical and geographical concreteness to the debate on the subject, which usually only occurs on a generic and global level. It is clear that the starting point has to be global, because the central idea is that there has been a change of scale in humanity's presence on the planet, in such a way that the aggregate action of human beings has begun to modify the macro-structures of the Earth System. In other words, human action, understood globally, has come to acquire the weight of a geophysical agent. In quantitative terms, moreover, this change in scale occurred mainly in the period since 1945 – which has been called the Great Acceleration – when there was a huge increase in the size of the population, the global economy, the extraction of natural resources across the planet, and the spread of the human-produced industrial technosphere (Bonneuil and Fressoz 2013).

However, from the perspective of historical analysis, these global statements are insufficient. The question is: what specific historical processes – at the socioeconomic, cultural, and environmental levels – brought about this drastic change in the scale of human presence on the planet? On the other hand, how did the different countries and regions participate in this process, actively or passively? It should be remembered that major historical processes – such as the emergence of capitalism, the fossil economy, or information technology – did not occur homogeneously across the globe. They began in certain regions and then became globalized, although unevenly, through complex processes of diffusion, imposition, copying, etc. At this point, there is a conflict between the geological and historical reading of the Anthropocene. According to geological stratigraphy, the planet is not entering a new epoch bit by bit. In history, on the other hand, it is necessary to understand how the scale of human presence has been modified in specific geographical and temporal situations to produce the aggregate effect mentioned above. It is not, therefore, a matter of abandoning the global perspective, but of combining it with differentiated analyses of social processes. In fact, if one stays only at the global level, the enormous inequalities that exist in the standards of living and consump-

tion in the current international system might be forgotten. It can be affirmed that no sector of humanity is outside or can escape the Anthropocene phenomenon, but participation in the movement of the construction and reproduction of the phenomenon is extremely unequal, which in turn produces flagrant injustices.

To better understand the above statement, it is necessary to define concretely what historical changes have marked humanity's entry into the Anthropocene and which countries/regions have dominated this movement. It can be said that there is a certain consensus on some of the historical components of the model that led several human societies towards the collective construction of the Anthropocene: a) a strong aggregate increase in the levels of material consumption, although internally unequal; b) the massive use of fossil fuels; c) the strong increase in the pace of urbanization and the degree of industrialization of the economy; d) the increase in CO_2 emissions; e) the intense diffusion of a political culture founded on the desire for growth. In other words, there is a certain dominant model of production, consumption, and culture that is associated with the historical constitution of the Anthropocene. The constitution of this model was particularly strong in some geographical areas of the planet – with Western Europe as the origin – and subsequently spread very unevenly and with varying intensities to other regions.

The participation of different countries/regions in this historical macro-movement, in turn, can be discussed at least at three levels: a) their degree of insertion in the production and consumption patterns that produced the global phenomenon of the Anthropocene; b) their role as providers of natural and human resources for other countries/regions to rely on; c) their role in the formulation and/or absorption of ideologies and thought patterns that build a "culture of the Anthropocene" (Pádua 2022).

The central argument of this chapter, therefore, is that it is necessary to think about the Anthropocene also in the specific context of a region such as the Southern Cone. On the other hand, the region's entry into the Anthropocene was complex and discontinuous in space and time. In other words, the historical transformations of the Southern Cone have produced different ways of connecting its multiple realities with the broader context of the larger planetary transformation.

Based on this premise, it is possible to ask about the presence of the Southern Cone in the history of the Anthropocene. Until the Great Acceleration, it can be said that this participation was relatively modest. Most of the economies and social formations in the region before 1945 were not based on fossil fuels and were essentially organic and rural, with a limited level of urbanization. It is important to underline that this is not to talk, in relation to the Anthropocene issue, about impacts on nature and the environment, but on the planet as a whole. In all places and times, humans have related to specific environments through interaction with specific places in planetary nature. In the case of the Anthropocene, this chapter speaks about macro impacts on the Earth System itself and not on some of its spaces. It is evident that

the societies of the Southern Cone, from the colonial period until the end of the nineteenth century, have produced environmental impacts, as in the case of deforestation, wool extraction, saltpeter extraction, artisanal gold and silver mining, cattle ranching, cereal agriculture, etc. But these were economies of consumption and exchange on a local and regional scale, which were not part of the great industrial transformation that in other countries/regions was the protagonist of the macroprocess that gave rise to the Anthropocene. Even at the second level mentioned – the supply of natural resources essential for the major transformation – the region's role was limited. It did not supply oil, mineral resources, or food at the international level that would make a difference in the transformation we are talking about. This reality changed considerably in the first half of the twentieth century, especially in the case of Argentina and Uruguay, which became international exporters of grains and meat.

Furthermore, in Argentina, during the 1930s, industrialization through import substitution was promoted. This compensated for the imbalances generated by the crisis of the agro-export model in 1929. As a result, industrial production surpassed agricultural production, and textile, food, and metallurgical companies were set up. Light industry also developed. In the Chilean case, the development of copper mining clearly has an essential importance in its economic model, as well as in the territorial and environmental impacts it generates.

In Brazil, despite some flourishing regional economies (such as the meat and lard industry, as well as wheat in Rio Grande do Sul, yerba mate in Paraná, and a small textile industry in Santa Catarina), the fundamental elements of anthropocenic transformations – such as export agriculture and industrialization – have occurred mainly in the southeast and, to a lesser extent, in the northeast or north. Since the decline of the mining-based economy between the late eighteenth and early nineteenth centuries, regional elites and rulers have introduced cattle, coffee plantations, and other crops. In the historical period prior to 1930, the average coffee exported by the country was between 50 percent and 70 percent of total export profits; rubber, due to the wars, represented 40 percent of total Brazilian exports in the 1910s, reaching its peak at that time; other fundamental products for the agrarian export economy were sugar, cacao, and cotton, keys for attracting capital that would later be invested in the country's industrial base. Until the 1950s, the textile, food, and footwear industries accounted for almost half of the country's total industrial production. The insertion of the Southern Cone into the global economy, with its various industries and agricultural industrialization, contributed significantly to the increase of regional participation in the Anthropocene, either as an exporter of resources or as a consumer. Therefore, this point will be addressed throughout the text.

In summary, in the context of the Great Acceleration, the Southern Cone experienced a significant increase in the region's participation in the Anthropocene,

whether as an exporter of primary resources or as a growing consumer of energy and manufactured products.

Geographic-Ecological and Socio-Historical Context

Although the concept of Southern Cone has been defined basically from a geopolitical perspective, it can also be thought of in terms of its territorial and socio-environmental dynamics. In this sense, the environmental history of the Southern Cone is largely associated with the evolution, transformation, and understanding of two regions that structure its geographical and biophysical profile. On the one hand, the La Plata Basin stands out on the eastern slope of the Southern Cone, as it constitutes a common socio-environmental space that unites and integrates an important part of the countries that make up the region: Brazil, Argentina, Paraguay, Uruguay, and Bolivia. On the other hand, the Andean mountain range structures the Southern Cone in its longitudinal north-south axis and, therefore, Chile and western Argentina, with its own unique and multifaceted environmental and territorial features.

To analyze the La Plata Basin, perhaps the most obvious approach would be to understand it as a centrifugal force, where the conflicts, diversities, and heterogeneities that seem to make up a territory are difficult to assimilate into a common space. Simultaneously, another force – deeper, less visible, but at the same time more powerful – unifies the diverse, unites the fractures that spread on the surface, and gives a homogeneous character to the heterogeneous. That force is related to the ways different societies established relations to the rivers and plains of the La Plata region in different historical situations. It is there where great common processes appear that transform the space and its people in the same direction, with nuances and heterogeneities, but still within the great common framework that is ultimately the La Plata Basin – and, therefore, one of the two most dynamic and substantial spaces of the Southern Cone.

This basin is formed by three main rivers: the Paraná (4,352 km), the Paraguay (2,459 km), and the Uruguay (1,600 km), which are among the longest in the world. The estuary of the La Plata River is the widest in the world (its outer limit measures 256 km) and the average annual flow of the river, when it flows into the South Atlantic, is about 23,000 m^3/sec. All this results in one of the most productive and diverse marine ecosystems. In addition, the water that infiltrates this basin produces the largest volume of recharge of the subterranean water system that makes up the Guarani Aquifer, one of the largest reservoirs of quality inland water in the world.

With 3,100,000 km^2, the La Plata Basin is the fifth largest in the world and includes most of the territory of Brazil, Argentina, Bolivia, and Uruguay, along with the entirety of Paraguay. Four of the five national capitals of the countries that

make up the basin – Buenos Aires, Brasilia, Asunción, and Montevideo – are located within it, and it is home to more than 50 percent of the total population of these five countries. The combined population of these cities went from 61 million in 1968 to 150 million in 2000.

The hydroterritorial network of the Paraná and Uruguay rivers is home to and source of many environmental resources and services that have a fundamental value in the region, the continent, and the world. There are several biomes or ecoregions, depending on the case, with particular characteristics, some already highly transformed or degraded and others in the process of degradation: the Alto Paraná Atlantic Forest, the Pantanal, the Brazilian Cerrado, the Yungas, the Altiplano, the Chaco, the Iberá wetlands, the pampean grasslands, the Delta, etc. are unique ecosystems in the world and of great ecological value. In addition, the largest wetland system on the planet is located there, including the recharge and discharge areas of the Guaraní Aquifer. Many of these conditions allow the region to be the edaphic substrate for a sector of agricultural production of major global importance.

The enormous environmental value of the basin is the basis of the largest urban centers in South America, hence its importance in the history of Latin America and the Southern Cone in particular. It is one of the largest freshwater reserves in the world, with exceptional biological and cultural diversity.

The Southern Cone is complemented, in territorial terms, by the presence of another region that plays a leading role in the processes associated with anthropocenic transformations: the axis of the Andes mountain range. In strictly political terms, it includes Chile and the entire western edge of Argentina. In this context, the social-ecological systems of the Andes support the livelihoods of millions of people and are essential for conserving and maintaining one of the most biodiverse regions on the planet. Here the most evident problems associated with the Anthropocene are the decrease in the scarce vegetation cover as a consequence of firewood extraction and overgrazing; the contamination and drying up of water sources, as a result of mining activity; and the decline in faunal diversity.

In turn, the part of the Southern Cone located within the Brazilian territory presents, as in the case of other countries, similarities and singularities in the context of the general features that define the bioregion. Boasting a great variety of reliefs – with plateaus, plains, mountains, and depressions – the geography of the region resulted from its diverse geological formations and the complexity of its morphogenetic agents, which exert a considerable influence on climate and vegetation (da Silva, Brandt, Carvalho, and Mundstock 2016).

In the case of Brazil, its membership in the Southern Cone also includes a particularly important region: the Cerrado, a vast tropical savannah ecoregion covering almost 2,000,000 km² that encompasses the state of Goiás, the Federal District, most of Mato Grosso, Mato Grosso do Sul and the state of Tocantins, the western part of

Minas Gerais and Bahia, the southern part of Maranhão and Piauí, and small parts of São Paulo and Paraná. Historically, cattle ranching is a major cause of savanna conversion to cropland, with an approximate total of 150 million acres (60 million ha) converted to date. Although the Cerrado was once thought to be unsuitable for agriculture, new technologies and techniques have allowed it to spread rapidly over the past forty years. Since 2000, soybeans, along with other crops such as corn, cotton, and sugarcane, have expanded over large areas.

Territorial Transformations

The territorial transformations, the profound changes in land use, and, in a broader sense, the variations promoted in the environment of the Southern Cone were not homogeneous, nor did they occur synchronously. Although nation-states in alliance with economic elites functioned as the epicenter of land use changes, such changes may have been slow in certain regions due to topography, climate, and infrastructure, among other aspects.

In the 1950s, itinerant cattle ranching continued to play an important role in integrating the region into the global economy, although to a lesser extent than the old connection between the gaucho mission ranches and the Sorocaba cattle fairs during the nineteenth century. Due to the precariousness of the roads, among other factors, mules traveled large territorial extensions on more recently opened roads between forests and fields, together with the muleteer trade of products from a given region –such as yerba mate– or even mule troops who were dedicated to agricultural work or human transportation. The route traced by the muleteer trade in its initial phase connected Colonia de Sacramento (present-day Uruguay) with the consumer center of cattle and mules in the southeastern region of Brazil, through the "camino de Viamão." Advancing in the twentieth century, the cattle *tropeo* (droving) connected the geography of the fields. Faced with the forests, the strategy consisted of creating roads that reached new fields as soon as possible, whose native pastures served as a base for the feeding of the cattle thinned by the days of travel. With the experiences of introducing exotic species, however, those of African origin predominated in the large territorial extensions of the time (da Silva, Brandt, and Carvalho 2016: 288). In 1950, instead, *tropeirismo* – based on a journey spanning months and reaching over 2,000 kilometers – gave way to movements of relatively small troops of mule, as already mentioned, as well as pigs (da Silva, Brandt, and Carvalho 2016: 276). This historical modification of tropeirismo is more or less linked to the incentives of Euro-descendant colonization – initiated in the southern states of Brazil during the nineteenth century (for example, with the German and Italian colonies in Serra Gaúcha and Santa Catarina). This option of settling a white peasantry in the region, based on small property and family labor, fostered a relatively new eco-

nomic dynamic in the limits of the current southern border region of the country, which connects the northwestern region of Rio Grande do Sul, western Santa Catarina, and the western/southwestern region of Paraná (Radin 2009). The promotion of this colonization system by state governments intensified after the resolution of the Cuestión de Palmas or Missiones, a conflict between Brazil and Argentina over disputed territory that today encompasses all of western Santa Catarina and part of (south)western Paraná. Subsequently, when in 1917 the states of Paraná and Santa Catarina signed an agreement on the territorial limits belonging to each unit of the federation, the small nuclei or villages created by the passage of cattle troops gradually became small municipalities or districts, occupied by a diversity of settlers of German, Italian, or Polish origin, who joined the "Brazilians" or caboclos and, to a lesser extent, the Indigenous people in the process of compulsory *aldeamento* (building and organization of settlements) (Werlang 2006).

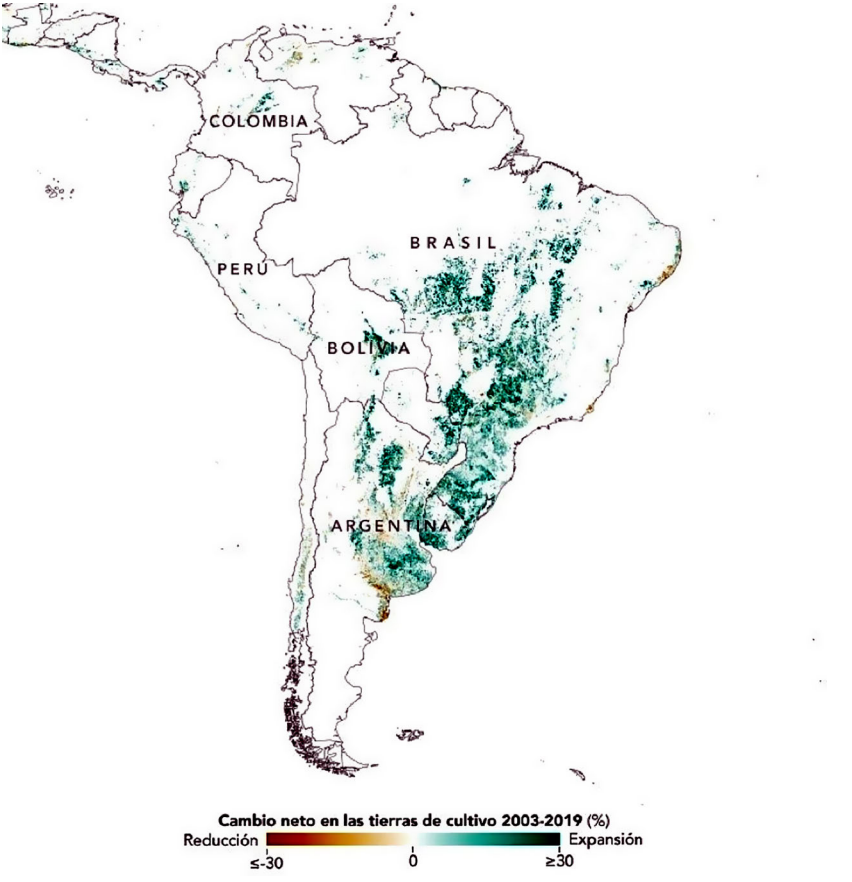
Thus, the political events that helped to define the boundaries favored the internal migration of Euro-descendants who, in turn, implemented an agro-industrial dynamic that can be observed especially in originally forested regions. The (mis)encounter between this new peasantry of European origin and the forests was, to a certain extent, mediated by mestizo groups such as the caboclos and, to a lesser extent, Indigenous peoples, the historical inhabitants of this border region. For example, the pigs raised by the caboclos – loose, feeding on seasonal fruits such as pine nuts or gabiroba – were gradually incorporated into the economic activities of the Italian descendants, who initially negotiated the purchase of herds of the animal from the caboclo breeders to supply the then incipient agro-industrial production of items such as salami or lard. The caboclos, in turn, were incorporated into certain historical economic activities such as the harvesting and processing of yerba mate or the timber industry (Valentini 1999). In a way, the settlement of caboclo populations historically followed the watersheds and the availability of the *Ilex paraguariensis* plant, practicing seasonal work from Paraguay and Northern Argentina to the three southern states of Brazil and part of Uruguay. Endemic to this region, this plant, whose crushed leaves give rise to the commercialized yerba mate, benefited ecologically from the forest dynamics of the region. Large trees such as the araucaria protected the *Ilex paraguariensis* from direct heat and thus preserved its leaves in a way that guaranteed good amounts of caffeine, among other properties. After World War II, however, stimulated by the growth of international trade and the emergence of the "yerba mate barons" – especially in Paraná –, herbariums related to the plantation model spread and, therefore, they were disconnected from the ecology of the araucaria forest and more linked to scientific and technological research laboratories. Wild yerba mate, whose ecological dynamic is not based in human interference like the plantation, remained as a place of ethical trade, drawing generations of caboclos for the "*yerbatera* struggle" – the confrontation with adverse forest conditions, seasonal encampments, and precarious conditions for workers (Renk 2006).

Livestock, especially important for the Southern Cone economy, began to share part of its vast territory with agricultural plantations previously relegated to second place, a change that was mainly due to the importance of grains and oilseeds in the international market after World War II. Gradually, these crops came to invade and intensify mechanized plantations in biodiversity hotspots such as the Gran Chaco plains, the Chiquitano forest in Bolivia, the Uruguayan Campos, and the Argentinean pampa. For example, the Argentine pampas play an important role in the country's soybean narrative, with a 1,500-fold increase between 1970 and 2021. In Argentina, different agricultural programs were developed, such as the Experimental Station of Córdoba, where experiments were carried out with soybean cultivation, working jointly with Brazilian farmers. The current scenario of soybean monoculture only began in the 1970s, with the progressive introduction of genetically modified soybeans and, later, during the 1990s, of transgenic crops (da Silva and de Majo 2022).

Soybean cultivation has become a common feature of the region, as not only has there been a process of expansion, but also soybean yields per hectare have undergone significant intensification, evidenced by the dramatic growth in yields between 1970 and 2021, from 1.2 to 2.5 metric tons per hectare, respectively. As a result of this expansion and intensification, the pampas have undergone a process of agrarian conversion in which other historical forms of land use and native ecosystems have been subsumed by the logic of soybean production. This agricultural reconversion is facilitated by the arrival of the soybean technology package, an input- and capital-intensive form of production centered on Monsanto's patented Roundup Ready transgenic soybean, which has become hegemonic in Argentina: since its introduction, the adoption rate has been practically 100 percent. The package is designed to control weed populations through the use of glyphosate (Roundup is its commercial name) and no-tillage cultivation; it is also argued that it improves soil health and increases productivity because it does not disturb topsoil (Mejia 2022: 186). Since 1996, when glyphosate-resistant transgenic soybeans were launched on the Argentine market, the popularity of this oilseed has grown exponentially, replacing other local crops such as sunflower and even the pampas in other regions of the country. Since 1961, cereals and oilseeds have always represented between 88 percent and 95 percent of the country's total cultivated area (Muzlera 2022). In Paraguay, the first generations of Brazilian migrants are linked to the expansion of cereals and, especially, soybeans, as they helped produce 1 million tons of grain in 1989, the same year that dictator Alfredo Stroessner was deposed. In 2008, Paraguay cultivated around 6 million tons on more than 3 million hectares. Currently, this figure has reached 10.2 million tons per year. The so-called "soybeanization," in this sense, can be represented through how soybeans have been mediating economic, political, and ecological relations in this region in recent decades: for example, in an Argentine agricultural region near Buenos Aires, soybeans accounted for 89 percent of the area devoted to agriculture

between 2013 and 2014. Similar agricultural patterns are observed in Uruguay and Bolivia, where soybean production is expanding rapidly. In Uruguay, soybean plantations have reached one million hectares since 2000, replacing the original fields (da Silva and de Majo 2022).

Fig 1: Soybean Planting in South America



Source: Ciencia NASA (2022).

The historical transformations in the interior of the Brazilian territory accelerated in several aspects after World War II – but in a heterogeneous manner, without homogeneously impacting the various regions. Thus, the degree of regional insertion in the production and consumption patterns that produced the global phenomenon of the Anthropocene can be analyzed on the basis of the elements intro-

duced or the processes that intensified these transformations. In the southern border region of Brazil, for example, one of the initial political strategies to integrate the region into the national economy was to create new municipalities from the old territories (Nodari 2012). In this part of southern Brazil, the development strategy of the governments of Rio Grande do Sul, Paraná, and Santa Catarina created an agricultural corridor along the borders with Argentina (Muraro 2016: 274), characterized by small and relatively nonurban municipalities, organized around regional poles such as Passo Fundo, Erechim (RS), Chapecó, Concórdia, and Joaçaba (SC), and Francisco Beltrão, Pato Branco, and Cascavel (PR). With the exception of Passo Fundo, the other municipalities were considered migratory frontiers; Brazilian state and national development plans have reinforced some of the local characteristics as a way of complementing the regional economy and contrasting the regions. In this sense, agriculture and extractivism forged regional images such as the "land of soybeans" in Santa Rosa (RS) or the "granary of Santa Catarina" in the western part of Santa Catarina. Thus, with timid urbanization process until at least the 1980s, agriculture and extractivism fostered a great acceleration in the region (Muraro 2016: 274).

Exemplifying this issue, meat packing plants – like the yerba mate factories, although to a lesser extent – promoted changes in the technological base and demanded changes in the regional infrastructure (Bavaresco 2003). In this new model, which emerged from the development plans drawn up at the national level during the 1970s by the civil-military dictatorship, the regions closest to the borders with Argentina, Uruguay, and Paraguay established themselves as leaders in the production of pork, poultry, and grains. While the regions closest to the coast were conceived as industrial, textile, mineral extraction or service poles in general, the capitalization of agricultural production intensified socio-environmental changes to an extent never before experienced. The small plants producing meat and lard, created in the 1930s and 1940s, later received government financial support and began to organize the region's productive structure. Meat processing companies, cooperatives, and agribusinesses, under brand names such as Seara, Perdigão, Sadia, or Chapecó, incorporated the region's small meat processors and, especially from the end of the 1970s, intensified the agricultural modernization relationship through strategies such as *Fomento* (Development) and *Integração* (Integration) (Bavaresco 2003). Both programs envisaged that the companies would provide swine, poultry, or grain matrices, technical assistance, and purchasing for the entire production; in this way, the farmer "integrated" into the system had to adapt to the technical and technological precepts put forward by the agribusinesses. In general terms, this meant, in addition to the alienation between small producers and companies, a significant impact on production, consumption, and, finally, the waste resulting from the process (Campos 1987).

Within two decades, livestock and the planting of creole seeds cultivated during the period known as the Great Acceleration were marginalized (Marconi 2013: 184) and in their place emerged hybrid corn, as well as wheat and soybeans adapted to the climatic conditions of the region. While the 1970s represented a turning point between traditional production and agricultural modernization, the following decades saw the intensification of land and water use through the clearing of forests, first, to increase the area of plantations and, second, to make way for the construction of dams. In this new dynamic, agribusiness established a process of circulation of exotic elements historically inserted in this territory: the planting of grains such as corn and soybeans and the growing production of poultry and pigs; in turn, up until the late 1990s, most of the waste from pig was dumped in the rivers of the region, contaminating a large part of the basin that shared space with pig farming. Similarly, slaughterhouses demanded a considerable increase in water use by incorporating techniques in accordance with sanitary standards and increasing the number of slaughter plants – conquering an important part of the European and Asian markets from the 1990s onwards. As small towns grew into medium-sized cities, the demand for highways and airports signaled the insertion of these once small agribusinesses into the global marketplace: transnational corporate giants such as BrFood and Bunge, for example, incorporated the slaughter plants and brands that emerged in this region. In the extreme south of the Brazilian border with Argentina and Uruguay, plantations advanced to a lesser extent than pastures: in the transition areas between the Atlantic Forest biome and the pampas, fertilization practices in soils naturally infertile for large-scale agriculture gave rise to corn, soybean, and wheat for the domestic market and, still in the 1950s, for export – in addition to horticulture, more recently. However, the modernization of pastures and livestock herds dominated and, to some extent, accelerated the circulation of elements characteristic of the Anthropocene. The regions of Campanha, Sul, and Fronteira Oeste, therefore, have larger farms, which specialize in cattle raising and rice cultivation. In Rio Grande do Sul, properties of more than 1,000 hectares account for only 0.6 percent of all agricultural companies, but control 27.2 percent of the agricultural area (Feix, Leusin, and Agranonik 2016: 7).

While the regions bordering Uruguay and Argentina were dominated by meat processing plants, plantations and pastures – alternating between large and small properties–, another dynamic of environmental and economic integration incorporated, to a certain extent, the interior of the state of São Paulo, the north and west of Paraná, as well as Goiás and Mato Grosso. An industrialization impulse initiated by the coffee cultivation in the interior of São Paulo influenced the construction of railroads that integrated Goiás with the southeast of Brazil at the beginning of the twentieth century; coffee plantations, in turn, extrapolated the territory of São Paulo towards the north of Paraná – finding, as in the pampas, an agrarian structure based on medium and large properties. In the northern and central re-

gions of Paraná, therefore, coffee, wheat, and soybean production has predominated in recent decades, with the support of state and national agricultural research institutions, such as the soybean division of EMBRAPA (*Empresa Brasileira de Pesquisa Agropecuária*). Finally, another dynamic – originating in the interior of São Paulo – integrated the interior regions of Brazil into the Anthropocene: sugarcane production. Taking advantage of the industrial structure of coffee – and at certain moments, of the decline of grain –, producers of European descent, such as the Biaggi family, invested in sugarcane mills and improved the varieties cultivated. In the 1970s and 1980s, the civil-military dictatorship favored the region through economic incentives originated in the Proalcool program, aimed at the biofuel production. Despite being plant products and not fossil fuels, this industry promoted a great transformation in the regional landscape by increasing the infrastructure for the production and distribution of products, in addition to the pollution of rivers (Eaglin 2022).

Finally, regions such as the south of Goiás, the northwest of São Paulo, and the east of Mato Grosso synthesize, in a certain way, the dynamics of economic insertion of the interior of the country in the national and international agendas of the post-1945 period. In the transition region between the Atlantic Forest and the Cerrados, soils considered naturally infertile influenced the low economic value attributed to these properties until at least the 1970s. At the same time, technological innovations in agricultural fertilization, research on pastures developed by EMBRAPA, and the transfer of the federal capital from Rio de Janeiro to Brasilia stimulated the opening of an agricultural and livestock frontier in the center-west of the country that, in a way, synthesized dynamics historically constructed in the south and southeast regions. In other words, based on a large property structure, the civil-military dictatorship initiated a process of attracting settlers of neo-European origin from the southern border of Brazil, while at the same time establishing new agreements for migration and Japanese immigration aimed at agricultural technification in the Cerrado regions of Goiás and Minas Gerais. Thus, during the 1970s and 1980s, programs such as *Polo-centro* attracted Japanese-Brazilian emigrants settled in the states of Paraná and São Paulo, while receiving assistance from Japanese and Brazilian technicians. From Mato Grosso and Mato Grosso do Sul, pastures and cattle herds advanced, expanding the territory dominated by breeds such as the zebu; finally, a large number of emigrants from the south exchanged their small properties for medium and large farms in the center-west of the country and, together with farmers from São Paulo and Minas Gerais, established an agro-export economic dynamic.

Therefore, the Brazilian part of the Southern Cone played a key role as a provider of natural and human resources for other countries/regions to build these patterns. In addition to the examples already mentioned, regions of Paraguay and Bolivia were dominated by Brazilian farmers, mainly soybean farmers and cattle ranchers – the "*brasiguayos*" in Paraguay. It is also worth mentioning as an example the cen-

ter-west of Brazil, more specifically the Cerrados region, which has developed a dynamic similar to that of other Brazilian regions, although with environmental and social singularities.

Finally, the role of these regions in the formulation and/or absorption of ideologies and thought patterns that build an anthropocenic culture can be explained by some data: in the southwestern region of Paraná, for example, each municipality has between 1,001 and 3,000 rural properties – representing 25 percent of the state's dairy production. Adding the various regions of Paraná, a total of 14.7 million hectares were used for agriculture in 2017 (Rossi 2021). For its part, in 2006, Rio Grande do Sul already occupied more than 20 million hectares, with 45 percent of the established area occupied by pasture – and 34 percent by permanent or seasonal crops (Feix, Leusin, and Agranonik 2016: 7). Therefore, the southern states of Brazil, together with Mato Grosso, are among the largest grain producers in the country: Mato Grosso (92.3 million tons per year), Paraná (44 million), Rio Grande do Sul (37.4 million), and Goiás (31.5 million) (Secretariat of Agriculture, Livestock and Supply 2023).

This drive for agricultural production, on the other hand, plays a central role in deforestation: according to the Mapbiomas report (2022), 97 percent of the loss of native vegetation recorded in 2021 was caused by the industrial agricultural model – generically referred to as agribusiness in Brazil – while urban expansion and mining occupy the rest of the statistics (Pajolla 2022). In fact, agribusiness was responsible for 97 percent of deforestation in Brazil in 2021. The agribusiness complex, consequently, contributed 72 percent of Brazil's greenhouse gas emissions in 2019. Although a large part of these figures – deforestation and gas emissions – are concentrated in the Amazon and Cerrado biomes, agricultural production in the interior of Brazil is interconnected from south to north – in the sertões. Due to this, a certain culture of the Anthropocene is shared among companies, governments, and civil society, whether in the promotion of an advance of industrial agriculture or in the promotion of alternative models.

In the Argentine case, the process of territorial transformation, land use, and expansion of agricultural frontiers has been a dynamic movement driven by favorable market conditions and the availability of suitable and cheap land.

Until the 1930s, the expansion of agriculture focused on the broadening of agricultural frontiers through the occupation of new land. Thirty percent of the total area dedicated to agriculture and livestock was located in the humid pampas. After almost three decades of agricultural stagnation from the 1960s onwards, expansion took place at the expense of land used for extensive cattle raising, and in recent years, agriculture has grown to occupy more than 50 percent of the productive surface of the humid pampas (Rabinovich and Torres 2004). This substitution dismantled an important share of the cattle raising infrastructure in *Núcleo Maicero* (an area of almost 5 million fertile hectares, which was the epicenter of the development of

agriculture in the modern period). Agriculturalization was first consolidated in the humid pampas, and from the 1970s onwards, this process also began to be implemented in other eco-regions of the country. Capital, production technologies, part of the beef production, and the grain and forage seed farms were transferred there (Morello 2005; Zarrilli 2010).

Despite these important transformations, the pampas region continues to be the productive center of the country. However, these transformations are also having a particular impact on other regions, especially in the Chaco, where a notable increase in agricultural and livestock activities is expected, both due to the productive potential of the land and to significantly lower land prices. As a result, profound and problematic changes are taking place in this space, affecting various areas and sectors. In the natural landscape, deforested areas are increasing as a consequence of the forceful advance of the agricultural frontier. In the agricultural landscape, there has been a sharp decrease in the area dedicated to cotton cultivation and an increase in the predominance of soybeans. Concerning livestock, there has been a strong increase in cultivated pastures, especially in large plots. The structure of land use is changing, with large and medium-sized farms replacing the former colonies of small producers. In general, there is also a sharp decline in the rural population, as soybeans require less labor than cotton. This is causing a massive exodus of the rural population to the poverty belts of large cities (Zarrilli 2020).

In this context, Argentina's total agricultural production quadrupled in almost three decades, representing an annual increase of approximately 2.5 percent. Increased productivity and technological change played a fundamental role in the growth of Argentine agriculture. This starts the above-mentioned agriculturization process, which is defined as the sustained and continuous use of land for agriculture instead of livestock or a mixed practice. It is also associated in the pampean region with the introduction of technological changes, livestock intensification (*feetloods*), expansion of the agricultural frontier into extra-pampean regions, a conflictive relationship with sustainability, and a permanent propensity to monoculture-oriented production, mainly soybeans or the wheat-soybean combination (Zarrilli 2020).

One of the substantial qualitative changes in this context is that the axis of farming is not centered on land ownership, but on the capacity of the producer-entrepreneur to organize and coordinate a network of contracts. Even in the cases of producers who own the land they work, the usual economic and financial strategy is that of a businessman who organizes contracts or a planting pool (*pool de siembra*) linked to various markets: capital markets, for financing land for leasing; and service markets, in which contractors are the bidders. This strategy has favored the combination of land tenure systems that tend to increase the area worked without necessarily increasing the scale of land ownership. Although the area planted with soybeans has been widely dispersed, the Parque Chaqueño eco-region is where its

explosive expansion has been recorded. The marked differential in land value is a consequence of the above, in addition to the biotechnological advances that make it possible to expand cultivation over new areas (Merenson 2009). This soybean complex has as its constituent elements the use of improved seeds, agrochemicals, and machinery with high operational capacity, as well as the continuous adoption of transgenic crops. More than 150,000 small and medium-sized producers have disappeared in little more than a decade, as they were unable to "adapt" to this macroeconomic situation with high taxes, high input costs, and dependence on international prices, all variables beyond their control. Nearly 400,000 people who depended on agriculture, not only for food but to keep their cultural identity alive, have migrated to large cities or remain in poverty on their own farms (Zarrilli 2010: 153).

In many cases, the fall in profitability and indebtedness led to the transfer of land to new economic players in agriculture: domestic and foreign investment funds, planting pools, and large transnational companies, which saw in Argentina's "industrial agriculture" an economic space in which it was possible to carry out profitable, secure, and short-term business. Given these economic actors' priority for short-term economic profitability, as well as the impact of their practices on natural resources, the development of an extractive type of agriculture in Argentina has been exacerbated. A system of "agriculture without farmers" (Pengue 2000) has developed, where short-term profitability and irrational use of resources are superimposed on sustainable use. One of its main consequences has been the concentration of land in an increasingly smaller number of companies and the growing importance of foreign capital. Economic concentration has also led to large vertically integrated monopolies (input supply, production, distribution, and processing) dominating the production scene, relegating producers to less profitable or riskier positions (Zarrilli 2010).

In addition to the loss of natural habitats, the explosive growth of soybean cultivation in Argentina has had other severe socioeconomic consequences. Food and dairy production for the domestic market plummeted, while agrochemical use, human poisoning, and water contamination increased. The combination of economic crisis and expulsion of small farmers and rural workers resulting from mechanized soybean planting has diminished food sovereignty and increased poverty and hunger (Maarten Dros 2004).

The socio-ecological differences between the humid pampa and the extra-pampean regions (northwest and northeast of Argentina) mean that the agricultural development model presents peculiarities for the latter that should be highlighted and that "pampeanization" is explicitly used to refer to an agriculturization based on the indiscriminate export of the pampean production model to extra-pampean regions. The main effects of Argentine agriculture on the environment include soil degradation, agrochemical contamination, deforestation, loss of biodiversity, greenhouse

gas emissions, and problems derived from the use of fresh water (Zarrilli 2020). This accelerated advance of agriculturalization occurs not only at the expense of other crops, but also through the clearing and elimination of forests that support a traditional timber economy. Ecosystem degradation is much more marked in these areas than in the pampas. These dynamics lead to the displacement of small farmers and the Indigenous population that lives in the forest with the resources it provides.

In the case of Chile, the main transformations in land use occur in the space associated with forestry production. The timber industry grew considerably in the 1950s, but was still focused on the local market. From the mid-1960s until 1973, the state timber industry expanded. Under the military-neoliberal dictatorship, the timber industry became a central pillar of the Chilean economy. Plantations were managed as monocultures. In October 1974, the dictatorship issued Decree 701, according to which the state would subsidize 75 percent of the costs for reforestation with fast-growing exotic species (mainly pine and eucalyptus). It is estimated that plantations of exotic species financed by Decree 701 caused at least 63 percent of natural forest loss in the period between 1985–1994 – corresponding to approximately 140,000 hectares (Kaltmeier 2022: 210).

The forestry industry established itself as one of the country's main export activities, after mining (Aylwin et al. 2013). In the period between 1990–1996, timber exports accounted for 12 percent of total exports. The counter-agrarian reform of the Pinochet dictatorship led to extreme oligarchization, so that only two groups – the Angelini Group with the Arauco company and, far behind, the Matte Group with Mininco – controlled the entire timber sector, from plantations to lumber and pulp mills. (Kaltmeier 2022: 212–3; Godoy Pichón 2017: 10).

Therefore, its profile is that of a conventional extractive industry, where the presence of the state in the distributive process or at the capital level is minimal. These companies are located mainly in the center and south of the country, a geographical area that coincides with the ancestral territories belonging to the Mapuche communities (Mondaca 2013). In this sense, a large proportion of the lands usurped from these communities became the property of forestry companies during the Pinochet dictatorship. In geographic terms, the VIII Region has the highest concentration of exotic species plantations in the country. On the other hand, the forestry sector has been widely resisted by local communities due to the socio-environmental problems it creates. In terms of surface area, the total national territory (75,658,443 hectares) is broken down into three levels for the forestry sector: the greatest extension is concentrated in protected wild areas (19.5 percent), then in native forests (18.9 percent), and, finally, in planted forests (3.2 percent).

The Biobío region has 926,530 hectares of introduced forests, the largest area in the country. As a result, this region is the only area in the country where the number of plantations exceeds the amount of native forest. In comparative terms, the next regions in terms of exotic plantations areAraucanía (483,482 hectares), Maule

(448,513 hectares), O'Higgins (127,306 hectares), and Los Ríos (186,883 hectares). In the analysis of planted area per year, by region, the Biobío region also leads the country (47,245 hectares per year). Followed by it are the regions of Maule (17,553), Araucanía (17,553), and Los Ríos (6,508) (Godoy Pichón 2017).

Looking at the national figures, there has been a trend towards native forest replacement that was encouraged especially during the government of Sebastián Piñera (2010–2014). In this regard, it should be noted that under current Chilean legislation the forest is perceived as a market good, equivalent to any other consumer product.

Therefore, the industry's profile is that of a conventional type of extractive industry, where the presence of the state in the distributive process or at the capital level is minimal. These companies are located mainly in the center-south of the country, a geographical space that coincides in part with the Wallmapu of the Mapuche people (Mondaco 2013). During Pinochet's agrarian counter-reform, Mapuche lands were usurped by forestry companies, causing serious socio-environmental and territorial conflicts. The forestry sector has a tendency towards concentration, benefiting large landowners to the detriment of small landowners. It also tends to appropriate usurped lands that have not been returned to the communities by the companies as a whole. In addition, monocultures have a profound ecological impact on communities. They consume surface water and also absorb groundwater. As a consequence, vital water stops reaching the communities; streams dry up, crops are lost, and farmers are forced to walk miles to fetch potable water. At the same time, timber plantations produce hardly any organic material to fertilize the soil, causing it to degenerate. Shrubs do not grow in the plantations, which accelerates soil degradation and has a negative impact on water retention. The massive use of agrochemicals in monoculture timber plantations leads to the disappearance of local flora and fauna. Aerial spraying also affects Mapuche crops and causes health problems in the communities. After a few years, the soils of pine and eucalyptus plantations reaches such a degree of acidification, oligotrophy, erosion, desertification, and water depletion that their productive use is no longer possible (Kaltmeier 2022: 213–4). In recent years, forest fires have also increased in intensity and quantity. The state's response to this situation has been, on the one hand, the promotion of a developmentalist model, incentivizing entrepreneurship and productive transformation to silviculture in the Mapuche communities, and on the other hand, the adoption of repressive policies and the criminalization of social protest, independent of the government in office (Kaltmeier 2022).

In the case of Uruguay, important territorial transformations have been taking place in rural areas for at least four decades. The traditional production system in the country, which combines extensive mixed livestock farming with extensive agriculture for the production of food and raw materials to supply the domestic market and produce stock for export, has been transformed. The neoliberal economic policy

promoted by successive governments has deepened the agro-export model based on specific items required by the international market. Thus, three monocultures have developed in the territory and are the most dynamic items in the primary sector of the economy: forestry, soybeans, and rice.

In the process of anthropocenic transformation of Uruguay in the context of the Great Acceleration, extensive cattle industry and the main traditional cereal crops, aimed at satisfying domestic demand and producing stock for export, were progressively displaced territorially by new crops: fast-growing forestry crops, transgenic crops (soybean and corn), and the expansion of the agricultural rice frontier. The increase in the area devoted to these crops has had – and continues to have – a strong impact on the transformation of the Uruguayan agrarian landscape (Gautreau 2014).

Towards the end of the 1980s, rural land use began to change as large areas traditionally used for livestock production were converted to forest. Silviculture is seen as a highly dynamic, state-driven, and strongly concentrated economic activity in terms of business. Most of the soils used in this way (72 percent of the total forested area) had a low productivity index in meat and wool and, for this reason, were considered a priority for forestry due to a law promoting the sector (Achkar, Domínguez, and Pesce 2006).

At the same time, since the end of the twentieth century, another form of agricultural production has introduced changes in the space traditionally occupied by cereal production. With the introduction of agroindustrial soybean cultivation on a large geographic scale, large extensions of soybeans have been planted on the west coast of Uruguay in areas with highly productive agricultural soils. These plantations and forest plantations with fast-growing species (especially eucalyptus and pine), both new production systems in Uruguay, are causing profound socioecological and economic changes both in the new growing areas and in the surrounding urban and rural areas (Achkar, Domínguez, and Pesce 2006).

Similarly, the expansion of the agricultural frontier in the border regions of Brazil associated with rice production has transformed the landscape and land use. One can speak of the extension of the distinctive rice basin located on the east coast of Uruguay, towards the center and north of the country, delimiting in this way three rice regions. The transfer of agricultural technology originating in Brazil and the foreignization of land are reflections of these regions' dependence on the Brazilian market, which imports 80 percent of rice production (Achkar Domínguez, and Pesce 2006).

The expansion of the agricultural frontier in the context of the Great Acceleration – with its consequent processes of deforestation, desertification, and loss of biodiversity – also meant the aggravation of socio-environmental conflicts, especially affecting the most disadvantaged social sectors.

In this sense, Paraguay is another example of the process of anthropocenic transformation of the Southern Cone. In the case of Paraguay, the power of agribusiness

has led to the ousting of a democratic government. Having seen the soybean expansion process in the Brazilian-Argentine space, the similarity in behavior of the crop expansion model in Paraguay to those previously mentioned can be noted.

At the beginning of this century, soybean already occupied 44 percent of the cultivated land in Paraguay. As in the case of Argentina and Brazil, this expansion was supported by high international oilseed prices, and by 2004, the area planted with soybeans reached almost two million hectares, much more than half of the area cultivated in Paraguay, representing 2 percent of the world crop. The annual growth of the area under cultivation was higher than 8.5 percent per year and, as in the case of Chaco, occurred at the expense of the peasant economy. Associated with a deforestation process and chaos in Paraguay, this episode was to the general benefit of large Brazilian producers (Fogel and Riquelme 2005). These three departments – Alto Paraná, Itapúa, and Canindeyú – accounted for 84 percent of the area under soybean cultivation and 83 percent of Paraguayan production as a whole, but represent no more than 11 percent of the area of Paraguayan national territory. In 2002, the estimated growth of the oilseed crop area was close to 130 percent compared to 1991, reaching 1,282,855 hectares (Fogel 2018).

The consequences of this process of crop diffusion, with the matrix of industrial agriculture, produced strong impacts on land use in Paraguay. These consisted – among others – in the massive destruction of the scarce remaining native forests and the elimination of numerous areas of peasant production as well as land for cattle raising. Similarly, in the evaluation of the environmental impact of deforestation, the loss of biodiversity should be highlighted, due to the irreversible reduction and deterioration of valuable plant and animal species every year (Fogel and Riquelme 2005). This socio-environmental transformation mechanism produced profound changes, with an intense reorganization of the territory, altering pre-existing economic relations.

As in Argentina, both the new productive dynamics linked almost exclusively to transgenic soybeans and the new survival strategies developed by the expelled peasants in the Paraguayan soy model took place in the context of new socio-economic relations and networks of relations in the territory. In Paraguay, as in the Chaco, small producers and peasants linked to traditional agriculture were displaced to other (often urban) spaces and in many cases became an impetus for social movements that lead new forms of socio-environmental conflicts (Fogel and Riquelme 2005).

As Fogel and Riquelme point out, soybean production in Paraguay was incorporated into the world market through a productive framework associated with an enclave model, which, as in the twentieth century, was associated with forest extraction and occupied available land, affecting the peasant system and production for the domestic market. In addition to the decomposition of this traditional economy, there is the destruction of the productive capacity of the land, the environmental

impact and the scarce occupation generated, and a loss of sovereignty vis-à-vis the dominant transnational groups (Fogel and Riquelme 2005).

The "Soybean Republic:" an Example of Territorial Metabolism

A transformational process that marks an excellent example of the Southern Cone as a unit of analysis is given by the integrating role played in the region by its historical character as a supplier of primary goods, which in recent decades has increased notably through the expansion of industrial agriculture. This activity has meant the disappearance of a significant portion of the forest cover that was a determining factor in the functioning of ecosystems and hydrology. These features constitute what some analysts have called the "Soybean Republic," a huge agrarian front encompassing five nation-states, a voracious green spot of the most important monoculture in the region. This phenomenon of intensive agriculture is probably one of the most significant changes in the basin in its environmental history.

Although soybean cultivation has been developing since the 1980s, it is in the first decade of the twenty-first century that its spatial growth became notable and impressive. Brazil increased its soybean area by 70 percent, Argentina by 120 percent, Bolivia by 66 percent, and Paraguay by 125 percent. These increases are the result of both land use change expressed in the replacement of other crops and livestock and the annexation of land that was not previously used for agriculture, provoking enormous environmental problems across the border region (Zuberman 2014: 21).

Throughout the Southern Cone, there has been striking deforestation due to the agro-boom of the last decades. According to FAO data (2005), Argentina lost 150,000 hectares per year between 1990 and 2005, Bolivia 270,000, Paraguay 179,000, and Brazil almost 3 million hectares. In Paraguay, of the 8,000,000 hectares that the Alto Paraná Atlantic Forest had in its eastern region before the introduction of industrial agriculture, today only 700,000 hectares remain. This deforestation is taking place in ecosystems of great importance for the region and the world. As a result, valuable environmental services are being lost. Environmental problems such as water and wind erosion have occurred on a large scale. The water cycle, especially in the extensive wetlands of the Guaraní aquifer, has been profoundly altered.

Agro-industrial land use is also causing a process of decline in faunal biodiversity that is modifying important ecological processes and whose consequences could span evolutionary periods of several million years. In the Argentine Chaco alone, 97 tetrapod vertebrates have disappeared, almost all due to habitat loss (Zuberman 2014: 25).

Due to the expansion of soybean, there have been drastic reductions in the area of native forests in Brazil, Argentina, and Paraguay, a process that accelerated towards the end of the century. The exposure and use of soil for industrial agricul-

ture has provoked soil compaction and erosion. In particular, water erosion has increased. As surface runoff has accelerated, less rain seeps into the groundwater and runoff peaks increase in a shorter period of time. This is accompanied by increased sedimentation in rivers, which impairs their navigability. In addition, the siltation (accumulation of sediment) of reservoirs has gone up measurably, leading to a reduction in their energy potential.

The enormous increase in production generated by the process of diffusion of industrial agriculture model in the La Plata Basin is a clear example of an intensive process of historical-environmental transformation that eludes national borders and covers, in this case, a large part of the Basin that is used here as a unit of analysis. Industrial agriculture as the predominant agricultural production model is characterized by a large-scale production structure, high energy and chemical input costs, a focus on the export of commodities, and relatively low employment generation. This implies that, in these areas where land clearing and agriculture are spreading, the use of all types of biocides is increasing.

Conclusion

The Southern Cone region is different from other regions in Latin America that are characterized by the strong presence of a particular biome – as in the case of the Amazon region in relation to its huge forest complex or the Brazilian coast in relation to the Atlantic Forest. The Southern Cone, on the other hand, presents a considerable diversity of ecological landscapes.

The diversity of the Southern Cone has stimulated the establishment of different types of socioeconomic life and different levels of entry into the Anthropocene world. The acidic soils of the greater Cerrado region, for example, in addition to its remoteness from the coast, discouraged export-scale agricultural activities. Small-scale agriculture for local consumption or livestock farming for trade on a regional scale were possible activities in the context of interaction with the biophysical world. However, it is important to remember that this interaction is not static, as new factors have appeared over time, such as technological changes. EMBRAPA's research, created in 1973, found technical means to open the Cerrado to large-scale agriculture, turning the center-west of South America into one of the great agribusiness frontiers of the contemporary world. It should also be remembered that technological transformations always have environmental costs.

The Southern Cone is home to ecologically complex biomes. The Atlantic Forest, for example, is characterized by a variety of forest ecosystems within its bounds. It also has some non-forest landscapes (such as restingas and altitude fields). However, the historical development of the Brazilian coast has been marked by the omnipresence of the rainforest, through economic activities such as monoculture plantations

for export or logging for infrastructure. Even the mining methods implemented in the region were defined by the abundant use of wood from the forests in the creation of an infrastructure for surface gold mining (Dean 1995).

Nevertheless, it is not just a matter of considering environmental factors. Political and geopolitical factors are important in the system of interactions that define the forms of occupation and exploitation of resources in the different regions. The Brazilian part of the pampas, for example, was far from the centers of political and economic power in Brazil (established in the southeast of the country). The Argentine pampa, on the other hand, was in the geopolitical sphere of Buenos Aires, having suffered a much more intense economic occupation.

In any case, some parts of the Southern Cone entered the universe of the urban-industrial world and the international market earlier. Various regions, especially in Argentina, were earlier and more intense in their appropriation of the new technical means that emerged in the context of the industrial revolutions – such as railroads and refrigerated ships –, participating more directly in the process that led to the Anthropocene's formation. In contrast, other areas established less intense economies, focusing production more on the local and regional market. This movement brought about important environmental transformations, such as deforestation in the mountains of Rio Grande do Sul, driven by waves of German and Italian immigrants. However, nothing is comparable to what has been happening in the context of the Great Acceleration. The Southern Cone has become one of the hot spots of the Anthropocene. Its primary production has become essential for the production of grains and minerals that are bulk commodities on the international market. On the other hand, the growth of large and medium-sized cities in the region – whether national or regional political centers – is seen in the market for industrial goods, in addition to their own manufacturing, which fully inserts this South American space into the universe of production and consumption patterns of the Anthropocene. The future of the Southern Cone, therefore, can no longer be thought of only in terms of South America. It is a macro-region that – in a socioeconomically and ecologically diverse way – has become "planetarized" and important for the debate on the very future of an increasingly globalized humanity that is pushing the limits of planet Earth.

Changes in land use patterns, based on regional dynamics or economic insertion in the export market, have given rise to conflicts that still persist. The expulsion of native peoples and their descendants has been observed in all regions of the Southern Cone; some intensified with the Great Acceleration which, on the other hand, also deepened forms of peasant and Indigenous resistance, as in the case of the Kaingangs in Rio Grande do Sul and Santa Catarina or of the Mapuche and their historical resistance against the actions of the Argentine and Chilean states. With the emergence of national or regional peasant movements, land use from a capitalist and export perspective began to be questioned; therefore, the Southern Cone is

also a region of alternative land use, with experiences of linking social and academic actors in the proposal of more sustainable models of territorial use.

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Land Use in the Andes from 1950 to the Present

Debates on Access to Land and Acceleration of the Transformation of Land Uses

María Fernanda López Sandoval and Évelyne Mesclier

From the perspective of the Anthropocene, the transformation of land cover and land use, at the current acceleration stage, is a main driver of global environmental change (Foley et al. 2005). Underlying climate change, the loss of biodiversity, and the degradation of natural ecosystems, this transformation contributes to the generation of greenhouse gases, limits carbon capture, affects flora and fauna, and modifies the circulation of surface and groundwater, among other effects.

Such transformation is especially critical in the intertropical Andean region, because it is considered a biodiversity hotspot (Myers et al. 2000) where high levels of biological diversity and endemism are under significant anthropic pressures. At a theoretical level, the different forms of environmental exploitation, which translate into different degrees of ecosystem artificialization, depend on the organization of land access (Le Meur and Rodary 2022: 865). In the recent history of the countries that comprise this region (Bolivia, Colombia, Ecuador, Peru, and Venezuela), changes in land use are associated with conflicts over control of access to land. These conflicts have occurred both in the mountain range itself and its western (Pacific and Caribbean coast) and eastern (Amazon and Orinoco) foothills, as well as in rural and peri-urban areas.

Thus, for the period from the mid-twentieth century onwards, this chapter proposes that land use, as an element of the environmental crisis, should be understood through the debates on land access, based on the analysis of the socioeconomic context in which various problems concerning these debates have developed, from the 1950s to the present. In this period, access to and/or control over land defines land use decisions – including land cover change for anthropogenic uses –, and contextualizes social and economic inequalities that are crucial for understanding its evolution. Furthermore, it allows for making land use decisions that may be more sustainable, as well as defining production, management, or conservation alternatives.

The first part of this chapter situates the land issue in the context of structural changes that took hold from the mid-twentieth century in the Andean region. These

changes, albeit characterized by their own patterns, occurred within global trends: demographic and urban growth, technological innovations in agriculture, social conflicts, and civil wars, and discussion of various political and economic models. It then addresses two moments in the construction of the debate on land access since the 1950s and shows how environmental aspects are integrated into the critiques without radically modifying existing policies on the land issue. The second part presents the outcome of the acceleration of the intensification of land use change according to three axes: the expansion of the agricultural frontier, of urbanized land, and the extraction of natural plant, fossil, and mineral resources. For each of these processes, the relationship between the types of control over land access and the spatial forms they present is specified. Finally, the chapter looks at the question: could changing the forms of control over land access modify the course of land use trajectories? A response is outlined in the conclusions, based on theoretical aspects and experiences studied in the Andean region.

Dispute over Land and Gradual Appearance of the Environmental Issue in Debates

The issue of land has been an analytical entry in the social sciences in Latin America for analyzing structural problems of inequality, poverty, and productivity; therefore, the debate has focused on social and economic issues rather than environmental ones. However, with the rise of extractivism in the context of globalization, since the end of the twentieth century, environmental debates have become central.

Structural Changes and Exacerbation of Land Scarcity during the Twentieth Century

The Andes have suffered the demographic effects of the conquest of the Americas and, despite the arrival of European, African, and Asian populations, probably did not return to the demographic levels of the pre-Hispanic era until the nineteenth century (Dollfus et al. 1990: 447; Mesclier 2006: 20, 37). In 1900, Ecuador had less than 1.5 million inhabitants, Bolivia less than 2 million, Venezuela slightly more than 2 million, and Colombia and Peru less than 4 million each (Sánchez Albornoz 1976; Chevalier 1993: 129). Therefore, the "demographic transition" and "urban transition" of the twentieth century occurred in low-density human populations, when compared to other continents (Dollfus et al. 1990).

These transitions did not occur in the same way in all countries of the Andean region (Cosío Zavala 2011). Colombia has had faster population growth than Peru; by the early 2020s, it has more than 50 million inhabitants (DANE 2018). For their part, Peru and Venezuela had around 31 million inhabitants each at the end of the

2010s (INEI 2023); however, since 2017, the Venezuelan population has decreased by at least two million due to current emigration, according to data by ECLAC (CEPAL n.d.). Ecuador had more than 17 million inhabitants in 2020 (INEC). In Bolivia, the decline in infant mortality has been slower; the country had only about 12 million people in the early 2020s, still more than six times its 1900 population. This population growth has been much greater in urban areas than in rural areas. In 1950, the urban population had a slight majority only in Venezuela whereas in other countries, it was between less than a third and 40 percent of the total. By the beginning of the 2020s, the proportions grew, with urban dwellers now constituting between 66 percent (Ecuador) and 90 percent (Venezuela) of national totals (CEPAL n.d.). During this period of demographic transition, children and young adults were predominant in the population.

These changes began in a context of profound social inequality, particularly in terms of the distribution of land access and the control of its modalities. In the first half of the twentieth century, large private estates dominated the rural land tenure structure. In the hacienda system, whose origins date to colonial times, many tenant families survived on borrowed land in exchange for precarious forms of labor and exploitation without any control by the public authority to limit the power of the owners (Mannarelli 2018). The lands still occupied by the communities or groups of peasant families, many of ancient origin, had been further reduced as a result of the liberal reforms of the nineteenth century and economic processes that led to the formation of large agrarian estates (*latifundios*) (Luna 2023: 138; see also Piel 1983; Fajardo 1998).

This system, however, was under a lot of stress. On the one hand, in some latifundios, the ongoing technological modernization had led to the expulsion of dependents, who were replaced by machinery, or in other cases, to the prohibition of peasant families owning native animals that could interbreed with the improved livestock (Martínez Alier 1977). On the other hand, population growth meant that labor, scarce in previous centuries, became more abundant, allowing landowners to replace dependents with temporary or waged workers.

At a more general level, the development of critical thought in Latin America, as well as international pressures since the agreements of Punta del Este (1961) and the Alliance for Progress for the modernization of national economies (Mertins 1979), rendered precarious forms of servitude unacceptable. In the context of the Cold War and revolutions, such as the one in Cuba, the United States pushed for agrarian reforms in an effort to limit the influence of radical movements. The incorporation of traditional haciendas into capitalism was also perceived as essential to optimize agricultural production (Barsky 1984). For their part, the peasants organized themselves. In Bolivia, an "integration of the great social forces of the countryside, the city, and the mining center" took place (García 1973: 118). In Colombia, the civil war of the 1950s was partly a consequence of land monopolization (Fals Borda 1975; Fa-

jardo 1998). In Peru, the increase of peasant movements (see for example Gutiérrez 1986; Monge 1989; Degregori 1990; Degregori 1992; Revesz 1994; Rénique 2004) came together with the growing influence of trade unions and a political party, the APRA (Klarén 1976).

Finally, the growth of cities, driven by population growth, expanded the consumer market and the political concern for food security. Thus, the context became very favorable for new debates on the social, demographic, and economic issues surrounding access to land and its resources. In contrast, environmental problems did not attract attention at that time, despite a growing dynamic of occupation, both by peasant families and haciendas, of the tropical lowlands – often covered with forests. Despite the reality, these areas are strategically described as vacant or "wastelands" (*baldías*), i.e., without inhabitants (Serje 2017), with state control over their access. The territorial occupation of the Amazon became a target for the governments of Bolivia, Ecuador, and Peru, particularly after the rubber boom of the late nineteenth century (García Jordan 2001), a target that was reaffirmed with a different nuance during the agrarian reforms of the second half of the twentieth century.

Agrarian Reforms and the Beginnings of a Critical Debate on the Modernization and Expansion of the Agricultural Frontier

Agrarian reform, i.e., the modification of the distribution of land access among social groups, was the focus of debates between the 1950s and 1970s. The reforms took various forms: structural, when they attempted to modify society, power relations, and institutional norms; conventional, when they resulted from a negotiated operation between old and new social forces and focused on a sectorial issue; and marginal, when they aimed at preserving latifundio structures, diverting peasant pressure towards the colonization of vacant lands (García 1973: 25–26). Broadly speaking, the reforms in Bolivia in 1953 and Peru in 1969 were radical, while the Ecuadorian reforms of 1964 and 1973 were conventional and the Colombian reform marginal, all marked by contradictions and complexities.

The options to respond to both social problems and the growing demand for food were diverse. Although the motto "the land is for those who work it" was present, as in other parts of the world, the debate remained whether lands should be given to the permanent and temporary workers of the haciendas, to its dependents, or to the neighboring communities stripped of their lands over the centuries. There were also extensive debates about the possibility of replacing haciendas with collective forms of organization, such as communes, associations, and cooperatives (Barsky 1984). In Peru, the decision was made to preserve large production structures in the form of agrarian production cooperatives (CAP, for its initials in Spanish), social interest agrarian societies (SAIS, for its initials in Spanish), and sugar cooperatives, in whose

management the state intervened (Matos Mar and Mejía 1980). For its part, Bolivia opted to "incorporate Indigenous communities into the market economy and open a new growth pole – within the framework of the plantation economy – in the tropical plains of the East" (García 1973: 38). In Colombia, as in Ecuador, the reforms did not suppress haciendas nor their dominant role in agricultural production, although they did facilitate their expropriation.

Land access policies were complemented by the idea of modernization of agriculture, and green revolution strategies were employed: use of selected varieties of food crops, importation of pedigree livestock, and promotion of the use of chemical fertilizers and pesticides, especially for mass consumption crops such as potatoes and rice.

The governments were not concerned with limiting the expansion of the agricultural frontier. On the contrary, internal colonization complemented redistribution policies. In this sense, the state supported access to supposed "wastelands," either to propose a solution to peasant families or to open new spaces for large properties – as in Bolivia.

However, in the 1980s, some of the spatial patterns of land use changes sparked debates in the academic world, combining criticism of their environmental, cultural, economic, and social effects. Thus, in Peru, researchers such as Klaus Urban (1986, cited by Assies 1988) were concerned about the low profitability of irrigation projects, their high costs, and their poor durability. Other authors pointed out the low fertility and high vulnerability of Amazonian soils, as well as the social problems generated by internal colonization (e.g. Aramburú 1986, cited by Assies 1988). Still, others addressed the problem of how to promote the knowledge and practices of Andean agriculture, compromised by the expansion of the Green Revolution and the importation of foreign technologies (Claverias 1986; Hibon 1981; Morlon 1992). Although peasant farms gained greater specialization, the risk in terms of production increased, as well as the environmental consequences, such as the degradation of soil fertility and, with the overuse of chemical inputs, the impacts on human health and water and soil contamination.

At the same time, the urban transition continued. Agrarian reforms made it possible to absorb part of the peasant labor force, and the rural population continued to grow, albeit slowly, until at least the end of the twentieth century, and even into the twenty-first, in the case of Bolivia and Ecuador (CEPAL n.d.). However, mainly young people continued to migrate to the cities for the quality of their educational and cultural services and access to better jobs. Migration added to the natural growth, which was also high due to the predominance of reproductive age population. This phase was also marked by the national elites' fear of a "popular overflow" (Matos Mar 2004) and the almost total absence of state policies to plan housing complexes, for example.

In the academic discussion, urban growth did not appear as an environmental problem, but a social one, focused on the key roles of the popular classes, labor markets, public policies, and city planning (Carrión and Dammert Guardia 2016: 245). The concern about food security emphasized quantity, rather than quality, due to the total population growth, while the number of peasants stagnated (Fajardo 1998: 58).

End of Agrarian Reforms, Globalization, Extractivism, and Environmentalist Turn(s)

The debate on land access has taken new directions from the late 1980s and especially in the 1990s. Agrarian reforms must be considered "in a dynamic perspective" due to the evolution of markets, demographics, and the political context (Léonard and Colin 2022: 851–852). Cooperative or state schemes of agrarian production often did not meet the social and economic expectations that were projected; therefore, peasant families opted for parceling, private property, and the formation or expansion of communities in which individual access to land was granted. Neoliberal policies challenged these results. The cooperative organization had seen itself discredited; there were criticisms of the violent land struggles around the communes in Ecuador; and suspicions were placed on the peasants during both the internal war in Peru in the eighties and nineties and the Colombian conflict. Against this backdrop, another criticism arose from the press and the economic elites regarding the poor technologies, the lack of capital, and the fragmentation of family farms. Private investment was promoted against the "peasant path" (Mesclier 2000; Van der Ploeg 2013). The debate became more acute in the face of production uncertainty due to climate change, the problem of rural depopulation, international migration, and generational replacement. Thus, the viability of the peasantry itself as an economic and political segment of Andean society was questioned.

This discourse is reflected in policies promoting the privatization of community and cooperative lands and the formalization of private property, as "neoliberalism" distinguishes itself from liberalism by the determined intervention of the state to adapt society to the market (Stiegler 2019). The laws of the 1990s confirmed the end of land reforms. The Ecuadorian Agrarian Development Law (1994) replaced the Agrarian Reform Law, promoting the possibility of privatizing communal lands; the affectation of land ownership, as a form of expropriation, was maintained, but in very particular cases. Colombian Law 160 of 1994 gave the land market a preponderant role as an alternative for land redistribution (Suárez 1999). In Peru, the agrarian reform was terminated and laws were issued to facilitate the sale of community lands and oblige sugar cooperatives to transform themselves into corporations (Del Castillo 1995; Del Castillo 1997; Chaléard et al. 2008; Mesclier 2000). At the same time, the dynamics of world trade changed, with a new boom in commodities, non-

traditional exports (fruits, vegetables, etc.), and agro-industrial business development based on the idea of "comparative advantages" granted by natural resources or the existence of cheap labor. The intensification of agriculture was encouraged, thus increasing the need for capital intermediation by incorporating financial entities in the production chain. According to business discourse, technological sophistication (e.g. computerized drip irrigation) also leads to productive efficiency and environmental care, justifying the consolidation of large farms. The same discourse indicates that "traditional" agricultural production techniques are no longer adequate. The loss of agrobiodiversity is justified by the global discourse on competitiveness and the need to feed the planet, leading to the exclusion of peasants from productive lands and the denial of their traditional knowledge. Extractive practices are associated with an alleged national interest in achieving development and are thus politically legitimized (Burchardt and Dietz 2014).

The model of the "(neo-)extractivism" (Gudynas 2009) promotes an accelerated search for new resources, mostly in under-exploited areas. The actors involved in defining the rules are very diverse, including transnational corporations and development finance agencies linked to the World Bank. Likewise, the nation-states' intermediation is substantial in this model, as they are constitutionally the owners of the subsoil resources in Latin American countries. In this context, the control exercised by transnational capital grew towards the end of the twentieth century. The state played an intermediary role between the demands and interests of the companies and the specific territories – particularly by facilitating access to land and water – and developed regulations to define how to access land and negotiate with the population (e.g., concessions, prior consultations), regulations that are not always respected. Therefore, the state also became an accomplice to violent and illegal forms of land dispossession. When land access is linked to other resources, such as minerals, oil, water, timber, and wildlife, the situation becomes even more conflictive.

The same voracious search for land appeared in the development of cities. The mobilization of real estate capital through private actors produces urban space, extracts and manages urban wealth; the central state, as well as the municipalities, facilitate this access to urban land through the development of policies and other mechanisms aimed at reducing investors' risks (De Mattos 2002; De Mattos 2007). Access to the city for a new middle class with sufficient resources to integrate into the peripheries' legal housing market is promoted, favoring economic growth and the real estate business (Prévôt-Schapira 2013). The process is mostly based on purchase and sale transactions with private owners. However, conflicts and illegality also persist: opaque transaction methods arise to obtain access to land, especially in areas belonging to peasant communities, as seen in Lima (Huamantinco and Mesclier 2016; Diez Hurtado 2023). In other cases, people have been pressured to

sell their land through municipal regulation, as occurred around the new Quito airport (Bayón 2016).

In this context, politics increasingly included nature and Indigenous cultures in the debate. On the one hand, the so-called progressive governments in Ecuador, Bolivia, and Venezuela introduced a partly environmentalist discourse, promoting "*buen vivir*" (good living), a concept that includes the environmental protection and food sovereignty. At the same time, national legislation handed over control and regulation of natural resources defined as strategic (oil, minerals, water) to the state, limiting land access and other resources to Indigenous or peasant populations located in areas also defined as strategic. In countries with neoliberal governments, academia and civil society stressed the irregularities that accompany the attribution of public markets for infrastructure construction and land acquisition. Some institutions, such as the *Centro Peruano de Estudios Sociales* or the *Instituto del Bien Común* in Peru, denounce the inertia of governments and support farmers' associations and peasant and native communities in their land titling efforts, as well as their territorial claims. In Colombia, conflicts were also numerous, particularly in the face of extractivism (Rodríguez Maldonado 2017).

An international initiative also arose to protect the collective rights of Indigenous and Tribal Peoples through ILO Convention 169, ratified by, among others, the Andean countries (Bolivia and Colombia in 1991, Peru in 1994, Ecuador in 1998, and Venezuela in 2002). A large part of the convention is devoted to "lands" and "territories," i.e., the "totality of the habitat" occupied by these peoples. Article 14 recognizes "the rights of ownership and possession of the peoples concerned over the lands which they traditionally occupy" and, according to Article 15, governments must organize consultations "before undertaking or permitting any programs for the exploration or exploitation of such resources pertaining to their lands" (ILO 2014). However, since it is a consultative and formal process, it is often not even carried out. Since then, the environmental issue has mainly focused on the question of Indigenous territories. With regard to cities, the preservation of public spaces, environmental issues – particularly those related to climate change adaptation –, and new forms of participatory democracy have become important objects of reflection (Metzger and Rebotier 2016). Finally, the emergence of the Anthropocene concept in recent years has generated greater attention to the acceleration of land use transformation in all geographical contexts.

Access to Land and Spatial Forms of Land Use Transformation

The history of the land question in the Andean countries has made possible three major processes of accelerated land use transformation since 1950: the expansion of agricultural activities, urbanization, and the exploitation of natural resources. Each

process generates its own spatial and temporal forms, as well as particular social and environmental dynamics.

The Acceleration of the Expansion of the Agricultural Frontier

Promoted as a complement or replacement of agrarian reforms, the state distribution of access rights to vacant land was carried out to the detriment of primary vegetation. To the detriment of the plant cover of the diverse ecosystems of the Andean countries, the intense human mobility produced by colonization directly expanded the agricultural and livestock frontier, the human habitat, and the urban area.

In the Ecuadorian case, the expropriation of haciendas in the Andean Mountain Range was complemented by the colonization of coastal and Amazonian "wastelands" (Gondard and Mazurek 2001). In Peru, the cultivated area expanded toward the arid coastal piedmont with the creation of new irrigation perimeters in the 1970s; while the settlement of farmers in the Amazon region became more important when the expropriation of the haciendas was interrupted in the early 1980s (Assies 1988). The latter process was carried out gradually through family farming systems with a focus on collective organization. The settlers were assigned lots that they cleared at the pace that their manual labor allowed them. The opening of roads to transport material needed for extraction and the establishment of oil wells contributed to colonization in the Andean countries by facilitating access to more remote areas from the 1970s and especially into the 1980s and 1990s. This phenomenon was associated with an important deforestation process in the Andean Amazon (Myers 1994).

The liberalization of land access in the 1990s aided an investment boom, which grew globally between 2005 and 2011, with investors of very diverse profiles and origins directing capital towards the cultivation of products with strong international demand, such as oil palm, soybeans, or sugarcane. These investors also pursued projects such as groundwater extraction for vegetable or cereal production and forest exploitation (Burnod 2022). Since the twenty-first century, the expansion of agro-industrial crops such as oil palm or soybeans in Ecuador, Bolivia, Peru, and Colombia has entailed the loss of forests, mainly in the Amazon (and to a lesser degree the Pacific Coast). For example, in the context of the development of projects linked to Malaysian agribusiness groups, the cumulative area of oil palm cultivation quadrupled in Peru's Amazon basin between 2000 and 2013, reaching an area of 60,000 hectares (Dammert Bello 2015). This generated concern in social and environmental organizations about the dynamics of deforestation and dispossession of peasants, mainly colonists settled in the areas of said projects.

The increase in oilseed crops throughout the region reached 170 percent between 1970 and 2019 (Tab. 1), the Bolivian case showing the highest growth. The soybean model could explain why Bolivia is currently one of the countries with the greatest forest loss in the world (Colque 2022). Recently, the use of fire in clearing large

areas of forests for the expansion of agro-industrial crops has heightened the risk of wildfires, an aggressive form of destruction of nature, violent in all dimensions, whether environmental, human, or social. The 2019 fire, which affected forests in the Brazilian and Bolivian Amazon, destroyed almost 5 million hectares of forest in the Bolivian regions of Chiquitania, the Amazon, and the Pantanal (Colque 2022).

Tab. 1: Harvested Area of Oilseeds (Thousands of Hectares), 1970 -2019*

	1970	1980	1990	2000	2010	2019	Change in surface area 1970–2019
Venezuela	250.35	156.72	337.84	116.85	229.19	132.48	-117.87
Colombia	372.9	346.8	440.01	223.84	300.17	592.75	219.85
Ecuador	61.25	95.21	195.6	193.32	262.21	254.3	193.05
Bolivia	15.28	76.32	168.21	852.13	1422.57	1676.04	1660.76

* This includes both annual crops and perennial plants whose seeds, fruits, or mesocarp are mainly used to produce edible or industrial oils that are extracted from them. Some crops of this type are soybeans, oil palm, and sunflower seeds.
Source: CEPAL n.d.

Between 2002 and 2022, according to data from Global Forest Watch (n.d.), the net change in tree cover in the Andean countries was -276,000 hectares (-1.5 percent) in Ecuador, -1.74 million hectares (-2.2 percent) in Colombia, -1.37 million hectares (-2.5 percent) in Venezuela, -762,000 hectares (-0.97 percent) in Peru, and -3.32 million hectares (-5.6 percent) in Bolivia. The mountainous Andean cloud forests in Colombia and Ecuador also sustain the expansion of the agricultural frontier, pastures, or illicit crops (Armenteras et al. 2011, Tapia-Armijos et al. 2015). In Colombia, Rodríguez Eraso et al. (2013) observe important evolutions towards crops, pastures, and secondary vegetation, related to violence and population displacements. Deforestation and, above all, the fragmentation of these forests, unique on a planetary level, result in the remnants of relic vegetation with limited ecosystemic functions, which will probably soon be subject to protection as natural heritage or to complete disappearance.

Other forest ecosystems also have high levels of biodiversity and/or endemism. The seasonally dry tropical forest of the Tumbesian region in southern Ecuador and northern Peru is being replaced by pastures or maize (Rivas et al. 2021). Since the end of the twentieth century, agribusiness has also expanded into these areas. The Peruvian coast, whose fragile and unique ecosystems due to its location at the foot

of the mountain range and the alternating absence and abundance of precipitation with El Niño events, has been occupied by agro-industrial crops that rely excessively on the use of groundwater resources (Whaley et al. 2010; Oré and Damonte 2014). Communal lands are part of those affected, based on legislation from the 1990s (Marshall 2014; Burneo de la Rocha 2020). In Ecuador, according to Beitl (2016), between 1970 and 1998, about 26 to 27 percent of the original mangroves were destroyed by shrimp farming. This led to the loss of unique and endemic biodiversity (e.g. fish, crustaceans, and shells), accompanied by population impoverishment, the disappearance of livelihoods based on harvesting and fishing, and agrochemical water pollution.

In Colombia and Ecuador, the páramo has been affected mainly by the expansion of the peasant agricultural frontier. This especially includes intensive potato cultivation and livestock production (López Sandoval 2004), which also alter hydrological production (Buytaert et al. 2005). Recently, the pine forestry agroindustry has developed in high Andean spaces such as the Peruvian *jalca* (Raboin and Posner 2012) or the páramo of Ecuador (Farley 2007). In the latter country, it is estimated that the percentage of páramo coverage, which amounted to 5.8 percent in 1990, could be reduced to 1.5 percent by 2030 (PNBV 2013).

One of the most important transformations in the inter-Andean valleys of the northern Andes is attributed to the flower industry, which expanded from the late sixties in the surroundings of Bogotá and reached Ecuador in the early eighties. Knapp (2015), citing producer organizations, indicates that there were fifty-two producers in 1991, growing to 678 by 2014. The intensive use of greenhouses and agrochemicals has resulted in environmental damage and harm to human health (Tanenbaum 2002).

Deforestation due to the settlement of peasant families continues to occur in parallel, and sometimes even in conjunction with the development of agroindustry (as shown in a case study by Siron 2019). Certainly, the rural population is now tending to decrease in almost all Andean countries; however, this does not necessarily mean a reversal of anthropization. "Deagrarization" (Carton de Grammont and Martinez 2009), i.e. changes in peasant productive activities, remittances, and human mobility, generate local urbanization phenomena (growth of hamlets and small and medium-sized towns). The sale of lots and construction of secondary residences scattered in the countryside is also observed, especially in the vicinity of metropolises and communication axes. This contributes to the expansion of urbanized land.

Uncontrolled Expansion of Urbanized Land and Associated Resource Degradation

The urban sprawl has two major dynamics associated with land use transformations: first, the expansion of the urban infrastructure itself (e.g., housing, service infrastructure, commerce, roads, etc.), characterized by extreme social differences and struggles over the access to land; second, the management of population growth, waste, and water and energy consumption, i.e., intense changes in urban metabolism. Urban sprawl generates the loss or displacement of other uses. In contrast, the concept of land *occupation* within urban use helps to problematize how urban functionality occupies spaces in a segmented and fragmented manner (Borsdorf 2003).

Cities expanded in the outer peripheries. In the second half of the twentieth century, migrants were able to settle by building their own homes, following an "oil-spill" logic. Lima is a paradigmatic case: the "barriadas" occupied agricultural or pastoral lands. These lands, located in the valleys, the desert pampas, and on the hillsides, were partly ceded (or directly urbanized) by landowners threatened by expropriation, sold by family farmers, or corresponded to the property of peasant communities or the state (Calderón Cockburn 2006). According to Driant and Riofrío (1987), in the mid-1980s, one third of Lima residents lived in this type of neighborhood, occupying 31.7 percent of the usable area of Metropolitan Lima. On the other hand, throughout the region, urban elites abandoned the historic centers to monopolize privileged peripheral areas, close to the central business districts or with favorable environmental conditions.

The dynamics of the twentieth century generated strong asymmetries between affluent and working-class neighborhoods (Deler 1992). In contrast, in the twenty-first century, metropolitan expansion within the economic paradigm of neoliberalism, fueled by globalization, has led to a more fragmented city. First, the location of residential and industrial/business areas in sectors distant from the traditional center, the reduction of direct state intervention, privatization, and deregulation have allowed investors, planners, and citizens greater freedom to organize the city and to appropriate spaces. This, in turn, has influenced the high differentiation of spaces. Second, the location of functional infrastructure in a dispersed manner has caused the structure of consumption in the urban center to lose predominance, with malls, shopping centers, and urban entertainment centers with multiple locations currently becoming more attractive. Originally oriented to upper-class neighborhoods, today this infrastructure is dispersed throughout the city and conurbated areas. In this process, the importance of placing infrastructure in specific locations diminished for the industrial sector. A wide range of locations can be the site of new industrial parks, as well as business parks.

In this context, plots of land acquire a significant economic value, attracting the interest of a wide range of players. For example, in Lima, in the absence of real protection, ecosystem formations such as the *lomas,* formed thanks to the winter mists, are threatened by illegal occupations organized by mafias that create a context of violence (Nieuwland and Mamani 2017). Gated communities arise as a response to insecurity, both in the city limits and the peripheries. Within this development of urban functional infrastructure, the growth of the technosphere, the complex system of objects and elements created by humans, is evident, characterized by the acceleration of the Anthropocene. In the last twenty years, as part of this urban technosphere, the development of road, hydroelectric, and port infrastructure has been critical, precisely in connection to the demands of the population and urban activities, as well as to access to extractive resources and trade.

As a result of this complex history, Latin America and the Caribbean today constitute the second most urbanized region on the planet, with 81 percent of the population concentrated in cities (United Nations 2018). Despite notable growth in all cities, the urbanization dynamics vary. Bogotá and Lima are the most populated agglomerations in the region. According to DANE figures, Bogotá generates a quarter of the country's GDP and, in terms of population, it registered 6,763,325 inhabitants in the 2005 Census and 7,181,469 in the 2018 Census, explaining the increase in densification and in the urbanization of areas of development (Holguín et al. 2021). According to the 2013 study by Parés-Ramos et al. (Tab. 2), in Bogotá, Cali, Medellín, and Guayaquil – cities where the population grew considerably between 1992 and 2009 (Bogotá ∼2.5 million, Medellín ∼1 million, Guayaquil ∼1 million and Cali ∼680,000) –, urbanization with a development pattern of high-density compacted areas is evident. In contrast, the dominant pattern in Quito and Santa Cruz has been an expansive development with a more rapid growth of the urbanized land area, but with lower population densities and smaller compact central areas. Lima had less than 2 million inhabitants at the beginning of the sixties. Its expansion recently overflowed from the central area in the Rímac valley and the port. Today, the city has around 10 million inhabitants and has incorporated two other valleys, as well as the interfluves (Matos Mar 2004; Mesclier et al. 2015). Much of the expansion area of La Paz is located in the neighboring municipality of El Alto, progressively urbanizing locations that were rural until recently. In this context, population density decreases as one moves away from the center (Hardy 2013).

Tab. 2: Growth and Density of the Main Agglomerations of the Andean Countries, 1992–2009

Country	City	Urban Population in 1992	Urban Population in 2009	Annual Population Growth Rate 1992–2009	Google Earth Image Year	Urban Area (Extension)	Urban Population Density (per/km²)
Bolivia	La Paz/ El Alto	1,189,000	1,847,000	2.6	2009	200 km²	9,235
	Santa Cruz	710,000	1,584,000	4.8	2009	221 km²	7,167
Colombia	Bogotá	5,030,000	7,609,000	2.5	2009	364 km²	20,904
	Cali	1,976,000	2,664,000	1.8	2007	132 km²	20,182
	Medellin	2,199,000	3,231,000	2.3	2008	151 km²	21,397
Ecuador	Guayaquil	1,711,000	2,732,000	2.8	2009	209 km²	13,072
	Quito	1,372,000	2,165,000	2.7	2008	331 km²	6,541
Peru	Lima	6,106,000	8,462,000	1.9	2009	760 km²	11,134
TOTAL		20,292,000	30,294,000	2.4			

Source: Parés-Ramos et al. (2013).

The Direct and Indirect Consequences of the Extraction of Non-Agricultural Natural Resources

The extractivist model seeks locations with specific resources obtained through land access; however, land use change does not always represent a large absolute area. There is an extensive development of the extractive technosphere: mining camps and settlements, open pit mines, oil wells, roads, ponds, waste dumps – particularly in large-scale mining areas –, in addition to rubbish. This process completely alters ecological and water cycles that cause loss of ecosystem functionality.

The Mirador project in the Cóndor mountain range in Ecuador, covering 9,928 ha. under concession, represents the first large-scale mining project since 2012, developed amidst constant resistance from local populations (Sánchez-Vázquez et al. 2017). The Cerrejón coal mine, in La Guajira, Colombia, an open pit mine considered one of the largest in the world, has resulted in the displacement and resettlement of several Afro and Indigenous communities in its more than thirty years of operation (CINEP and Programa por la Paz 2016). In other cases, such as the Toromocho mine in the Peruvian Andes, an entire city had to be displaced in order to access the resources.

In the Andean region, a well-known example of small-scale mining occupying large areas is gold mining in the department of Madre de Dios in southeastern Peru, on the border with Bolivia and Brazil. This mining area has been around for decades, but its expansion has accelerated in the twenty-first century. Sánchez-Cuervo et al. (2020), in an analysis of land use changes between 1993 and 2013, show the acceleration of deforestation produced by this activity, which reached a total area of more than 37,500 hectares in 2013. Furthermore, the consequences of river pollution are serious, similar to what has happened in the historic mining settlements of Nambija, Ponce Enriquez, or Portovelo in Ecuador (Mestanza-Ramón et al. 2022), where several studies have been carried out on the health consequences of mercury contamination in children (Counter et al. 1998). This type of mining promotes a change in land use, as well as the development of human settlements and urbanization in residual spaces in conditions of social precarity, poor health, and violence.

In addition to metal mining in Peru, for example, sixty-four concession areas for oil and gas companies covered more than 70 percent of Amazonian lands in 2009: at least eleven of these overlap with protected areas, seventeen with reserves of Indigenous populations in isolation, and fity-eight with recognized Indigenous territories. Similar situations exist in Ecuador and Bolivia, as well. Likewise, timber extraction has led to the privatization of collective lands (Bebbington 2009). Nevertheless, while disputes until the end of the twentieth century were over large or medium-sized areas, the conflict over land access in the twenty-first century also includes small areas that are privileged because of their location or the strategic resources they possess.

This conflict is not only over access to land but also to these resources and locations; the disputes are also for the protection of ecosystems and environmental care.

Despite the different development policies and visions implemented in Venezuela, Bolivia, and Ecuador – in contrast to Peru and Colombia – the role of the state appears to be similar, playing a key role to a greater or lesser degree by facilitating access to land and strategic territories, soil and subsoil resources, and other ecosystem services. It is claimed that the aim is to move towards a modern and technological, private and controlled business production, with mining and oil extraction projects and control of water sources for energy production, irrigation, and urban consumption. This also justifies displacements, expulsions, and relocations of populations. A revaluation of marginal lands and wastelands – *baldíos* – is promoted through technological innovations, e.g. irrigation. The debate on land access continues, but new concepts are developed to refer to new environmental and political dimensions of the debate, such as territorial dispute and resistance; the notions of dispossession and waste become significant to contextualize the importance of the concept of environmental justice.

Conclusions: Access and Control of Land as a Possibility of Reversing Anthropocene Processes

The processes of deforestation, fragmentation and transformation of unique Andean ecosystems, urbanization, the development of the technosphere, and the functional changes of ecosystems in extractive zones are signs that the limits of the current growth model are near, which is a central idea in the Anthropocene debate. What alternatives are proposed?

From the analysis carried out, the control of and access to land are seen as key elements in the possible responses to the environmental crisis. The state is a central actor due to its capacity to modify laws, generate economic incentives and intervene in negotiations between actors at various scales. Historically, the creation of protected areas within national conservation systems has been a state mechanism for controlling land use to maintain natural plant cover and biodiversity. Currently, in response to international commitments to confront global environmental change, especially climate change, countries must incorporate environmental legislation into their national legal systems for the development of programs and mechanisms – especially financial – for conservation. Their implementation requires international cooperation for financing, making cooperation agencies key actors in the context of alternatives. The state must strengthen and prioritize its position. It must also mediate between local communities and international conservation programs and between the economic interests of extractive exploitation and these same local actors so that

these alternatives can develop in these territories. Uncertainty about the viability of state power to confront the environmental crisis in the Andean region is evident.

The issue of city management and planning becomes urgent due to the concentration of population in these spaces. The process of decentralization has allowed large agglomerations to have authorities with a certain decision-making power and the ability to devise innovative projects; the examples and discourses indicate that the strategy is to reinforce inclusive urban governance that focuses on environmental issues. At the same time, the sustainability discourse points to intermediate cities as the most viable context for a transition.

The alternatives that arise from organizations or groups, especially urban ones, in civil society revolve around options such as agroecology, urban agriculture, short marketing circuits, or responsible consumption, as well as strategies that combine food production, conservation, and the solidarity economy. Citizen consultative mechanisms such as referendums have been used, for example in Ecuador, to include more citizens in environmental advocacy. Populations, especially Indigenous, who maintain collective ownership over "autochthonous" or "ancestral" territories could also produce alternatives to the accelerated changes in land use. Many of them mobilize with the insignia of autonomy in order to extend their capacity for action and decision-making to protect their territories. Although Indigenous autonomy is gaining strength in the political debate, environmental and territorial issues are also prioritized as much as human rights. Added to this dynamic, national and international social movements have supported the defense of Mother Earth.

Peasants, who control the soil but not the subsoil, support the struggles against mining and oil extraction, not only for social reasons but also for the preservation of nature (Grieco and Salazar-Soler 2013). They emphasize their own capacity to care for it through traditional technology and ancestral knowledge, for example in water harvesting, irrigation management, and promoting soil care agriculture. However, the prospect of developing extractivist projects causes division among local communities that are in precarious economic situations and, therefore, prioritize access to employment (Alvarado Vélez and Rebaï 2018).

In the context of the Anthropocene, the underlying debate on land use changes and environmental limits is compounded by the power dissymmetry of the actors who decide on such changes. Eguren (2019) emphasizes responsible land governance, in which democratic political systems would eventually meet the demands of society; for her part, in the face of growing vulnerabilities, Bernex (2018) proposes that "society as a whole" should appropriate a "culture of care." It is about creating new "commons," i.e. links between organized human groups and environment that are not limited to resource management.

The Andean countries, like many countries in the Global South, set the need for economic development against the need to protect ecosystems. As a framework of analysis, the Anthropocene not only raises the existence of limits, but also demands

a broader reflection, one that considers the consequences of said limits in time and space. It incorporates into the environmental, social, and political debate the historical notion of dynamics that are centuries old and will have consequences for many future centuries; it considers actors of all spatial scales, from local to global, involved in convergent and divergent dynamics. In this sense, contextualizing future reflections within the framework of the Anthropocene can help societies modify their general perspective on the rules of land access in relation to land use transformations.

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Land Use in the Amazon from 1950 to the Present

Re-examining Contemporary Land Use and Land Cover Transformations from an Anthropocene Perspective

Santiago Lopez

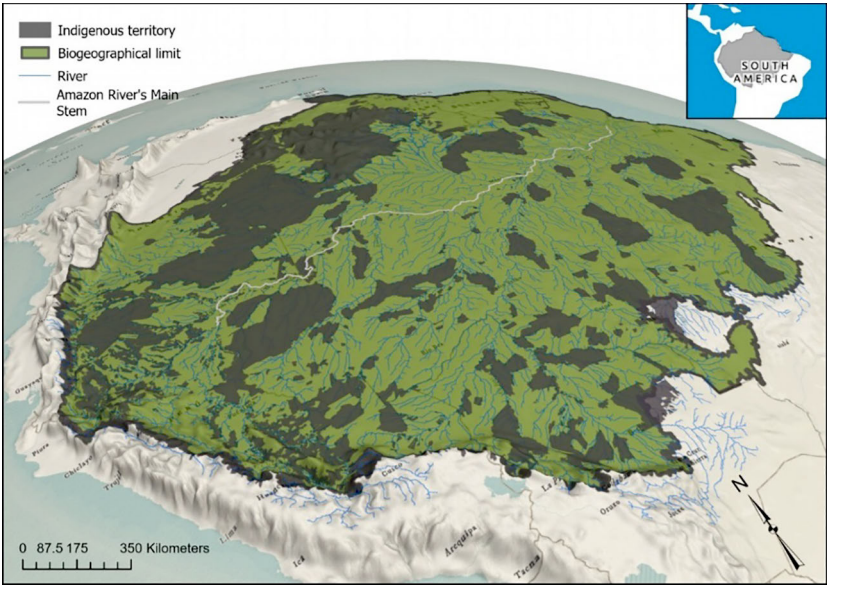
Carrying out a comprehensive and systematic analysis of contemporary land use changes in Amazonia is challenging given the spatial extent, the heterogeneous nature of its diverse ecosystems, the wide variety of land use systems, and the diversity of cultures and land management practices that spread over this region. The Amazon River basin alone is roughly four-fifths of the continental United States (~7,000,000 km²), and vast expanses of its forests have not been studied (Franco-Moraes et al. 2019). Amazonian landscapes are extremely diverse, encompassing *terra firme* (interfluvial) and flooded (riverine) forests, along with wetlands and savannas. Additionally, the Amazon is home to more than 300 ethnic groups, and Indigenous territories occupy about 2.3 million km² of the Amazonian bioregion, about 32 percent of the whole extent (RAISG 2020) (Fig. 1). There is robust evidence that these landscapes have been occupied starting at least 13ka (calibrated years before the present) (Shock and Moraes, 2019; Morcote-Ríos et al. 2020). Despite this diversity and socioecological complexity, popular views of the Amazon River basin continue to push forward two simplistic and opposite but pervasive understandings of this region: widespread deforestation and environmental devastation on the one hand and intact or pristine wilderness on the other. However, both are inaccurate, yet the persistence of these views hampers a more nuanced understanding of a very complex, culturally, and biologically diverse region (Winkler Prins and Levis 2021).

Using the Anthropocene as an analytical framework, this chapter attempts to debunk notions of contemporary devastation of Amazonia and the decline of its pristine forests due to recent human entrepreneurship. Here, I examine contemporary landscape changes in the Amazon region through its land use and land cover dimension, departing from the notion that many of the landscapes that have experienced increased and accelerated transformations in recent decades were not pristine environments in the first place. The Anthropocene view acknowledges that human-modified ecosystems and landscapes currently dominate the Earth and have resulted from centuries, even millennia, of human interventions (Ellis

and Ramankutty 2008). Amazonia is not an exception. The Anthropocene lens also allows us to reflect on the "safe operating space" (Steffen et al. 2015: 736). An operating space is here understood not as a tipping point, but rather as a buffer between the boundary and the threshold within these ecosystems that would allow societal development without affecting the resilience and accommodating state of the Earth system. Through this view, researchers acknowledge that most landscapes are in continuous change and have been subject to domestication. In this context, domestication is conceptualized as deliberate human activities that have altered the ecology and demographics of plant and animal populations making large areas of the Earth's lithosphere more productive and hospitable for people (Harris 1989). These areas include significant portions of the Amazon basin as shown by the anthropogenic characteristic of some Amazonian soils (*terra preta*) that resulted principally from pre-1492 human-environment interactions (Woods et al. 2009). The Anthropocene lens also allows us to generate new inquiries and understandings about how, where, and to what intensity social and ecological systems interact (Ellis and Ramankutty 2008), when those interactions are the most intense, and the repercussions of those interactions on the Earth system. Such a framework may also help us understand the non-linear evolution of landscape changes and the carrying capacity of ecosystems, which have generally shown phases of stasis and accelerated change.

Contemporary research on anthropogenic transformations of Amazonian landscapes has focused on the quantification of LULC changes and the factors that induce forest cover reduction (Brown and Pierce 1994; Wood and Porro 2002), a process that results in the loss of biodiversity and forest resources, significant changes in the global climate, and eventually the instability of the Earth system. Because tropical deforestation is caused by humans rather than natural processes, the search for anthropogenic explanations for why this type of human impact has increased in the late twentieth century, and why it has varied in extent from place to place, leads directly to theories familiar to social scientists that still seek answers to these questions in the twenty-first century. Changes in rural populations, their social structures, and their connections to the larger global system are a reasonable place to start (Rudel 1994) in the search for the causes of LULC transformations in contemporary Amazonia. These changes typically lead to a range of intensities of socioecological interactions that affect both natural and social systems and shape Amazonian landscapes.

Fig. 1: The Amazon River Basin Bioregion and Indigenous Territories Covering about 32 Percent of its Extent



Source: RAISG (2022).

Human interactions with Amazonian ecosystems are inherently complex and dynamic (Folke, Holling, and Perrings 1996; Rindfuss et al. 2004) and can result in very different land cover change configurations, ranging from patterns associated with the relatively low impact of subsistence cultivators and hunter-gatherers to the high-pressure exerted by urban dwellers who have replaced pre-existing tropical ecosystems with built environments and permanent infrastructure. Extreme cases of such interactions in places like the city of Iquitos in the heart of the Peruvian Amazon, with almost 500,000 urban dwellers engaging in intense commercial exchanges, the region of Caquetá, Colombia, with more than 400,000 peasant farmers engaged in different forms of cultivation, or the Northeastern Ecuadorian Amazon where remote temporary settlements of uncontacted hunter-gatherer groups with less than 300 members like the Taromenane exist and still rely on hunting, gathering, and basic forms of swidden cultivation for food production, exemplify the broad range of pressures that have transformed and continue to shape Amazonia. These types of interactions have led to characterizing Amazonian landscapes based on the ecological footprint of or pressure exerted by the human groups that occupy these spaces.

The analysis of peasant or colonist farmers (and their agricultural practices and industries) living in relatively new settlements in frontier lands, who are frequently thought of as the main agents of land cover change, particularly during the second half of the twentieth century (Walker et al. 2004; Tritsch and Le Tourneau 2016; Murad and Pierce 2018; Vasco et al. 2018), provides much of the contemporary evidence of the high-intensity impacts of Amazonian inhabitants due to the extent of landscape transformations. However, about a third of the Amazon forests are in Indigenous territories, and there is scant evidence that the impacts of Indigenous peoples or long-term dwellers equate to those impacts caused by recently arrived non-Indigenous agents or that these are subject to the same drivers of change. Many Indigenous territories in the Amazon region lack formal markets, are not bounded by private property concepts, and are rather regulated by common property rules. As a result, the production efforts of Indigenous agents are not necessarily oriented toward profit maximization, as is the case with colonists and urban dwellers. With different production goals, Indigenous households engage in land management practices, behaviors, and interactions that are distinctively different from those found in frontier areas. In this case, the human impact is not necessarily measured by short-term individual agency, but rather the accumulated pressure of several family units transforming the environment over long periods of time.

In this chapter, the Amazonia LULC change processes are described through an Anthropocene lens by examining forest ecosystems as "anthromes" – the term "anthrome" or "human biome" was introduced by Ellis and Ramankutty (2008) to refer to human modified landscapes that have been shaped by direct human interactions with ecosystems. These anthromes are shaped by varying levels of intervention determined by the characteristics of the people who inhabit them, their social structures (endogenous characteristics), and their ties to the larger socioecological system at the national and international levels (exogenous conditions). Through this view, this chapter provides a broad characterization of LULC changes between 1950 and the present based on two coarse, but distinctive landscape arrangements: the ones left by long-term residents and those generated by peasant colonists. However, to better understand this separation, this chapter starts its analysis with how these general patterns of land use emerge in the first place from the overlap of three major conditions: 1) population growth, 3) the need for technological innovation, and 3) integration into the market economy. It is through these differences that a more nuanced understanding of contemporary land use changes and the strategies local populations use to face environmental crises is possible, without falling into dichotomic, simplistic, or stereotypical views of Indigenous peoples as the natural stewards and protectors of pristine tropical forests and peasant colonists as the external encroachers and destroyers of those ecosystems.

Population Growth as Common Driver of Landscape Domestication and Contemporary Land Cover Transformations

The literature on the effects of population growth on landscape transformations from natural to anthropogenic systems in the tropics is abundant (Bilsborrow 1987; Meyer and Turner 1992; Skole et al. 1994; López-Carr, Suter and Barbieri 2005; Sellers et al. 2017). Particularly in the agricultural change narrative, the Malthusian view has dominated much of the early 1900s debate about agricultural transformation worldwide due to changes in population structure and food production caused by world wars. This view has also played a role in shaping the narrative about agricultural change and its impact on the forest anthrome in Amazonia for a big part of the twentieth century. In *An Essay on the Principle of Population* (1798), Thomas Malthus claimed that population growth would soon outstrip food supply because population grew exponentially, and food supply increased arithmetically. In this view, Malthus pointed out that socioecological transformations in general, and changes humans bring to food production in particular, approach tipping points that promise to slide humanity into starvation and conflict (Kates 1995). In this scenario, the state of technology (an exogenous and fixed condition) determines the levels of cropping intensity and their physical manifestation on the lithosphere. With precarious technology and growing populations, the most obvious and only response to procure nourishment for people is agricultural extensification through the incorporation of new land into the production system. Once agricultural systems reach their carrying capacity (i.e., by the exhaustion of land resources) human populations face starvation, war, or lack of employment opportunities in agriculture, in addition to a consequent pressure for migration to other areas. This situation could lead to environmental alterations that promise to threaten people's survival because according to Malthus' view, the carrying capacity of the environment is also fixed (Ehrlich and Holdren 1988; Kates 1995).

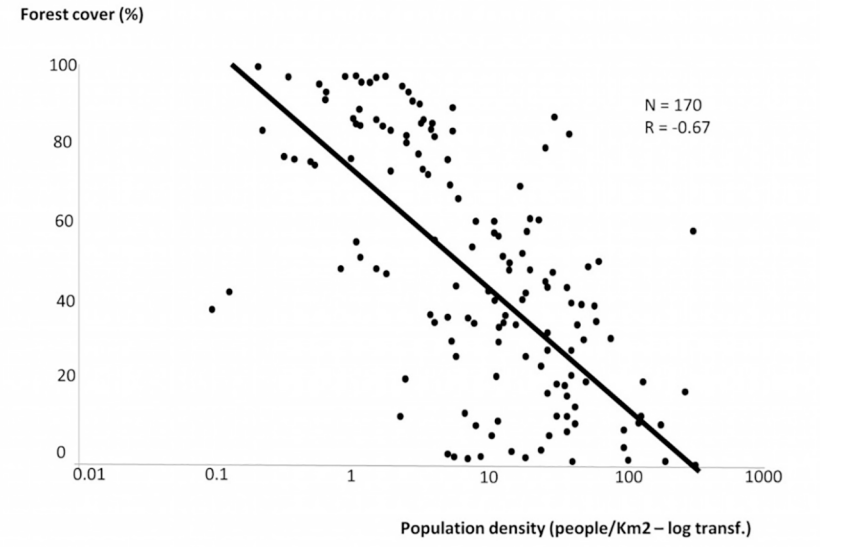
A more recent view that has led to forecasting less gloomy outcomes about the relationship between agriculture change and population growth was introduced by Esther Boserup in her book *The Conditions of Agricultural Growth* (Boserup 1965). Boserup contended that population increases trigger agricultural growth when human groups switch from extensive to intensive practices, as changes in population factors (mostly population pressure or density) push for innovation and technological shifts (an endogenous outcome), which in turn allows for the growing population. For Boserup, food production systems evolve from extensive to intensive forms, which could translate into LULC transformations (e.g., when land use changes from pastures for cattle raising, requiring a low amount of labor per unit of area, to soybean or African palm cultivation, requiring significantly more). This transition could be better explained as the result of differences in population growth and the capacity of human populations for technological innovation, which in turn,

increases the human carrying capacity of the environment. This can be achieved not only by extensification (i.e., increasing the area under cultivation but keeping yields constant per unit of area) but also by intensification (i.e., increasing yields per unit of area and keeping cultivation area constant), with the adoption or development of new technologies. In general, land use extensification can be thought of as an indicator of labor efficiency and only occurs in systems where land is abundant and available, with relatively low population densities. Increases in population, and thus in the amount of labor, allow extending agricultural area first (i.e., to clear forest and prepare land for cultivation). An extensive agricultural system may be an efficient means of land management since increases in labor input reduce the time required for clearing larger areas. As frontier lands are reached and marginal land is brought into cultivation, the returns to labor from extension of area decrease. The result is a shift from extensive to intensive cultivation strategies, such as from rotational to more permanent types of land use systems (e.g., from forest fallow to annual cropping systems) (López-Carr 2004). Several researchers have studied this type of evolution and specifically pointed out the positive linkages between population growth and agricultural intensity (Turner II and Ali 1977; Ruthenberg 1980; Pingali, Bigot, and Biswanger 1987; Smith et al. 1994; Tiffen, Mortimore, and Gichuki 1994). Although these authors noted that population density accounted for most variation in agricultural intensity, other factors such as market integration, cultural pressures, and environmental constraints also merited consideration.

Although Malthusian and Boserupian theories may seem to lie at opposite ends of the agricultural change spectrum, Lee (1986) and Turner and Ali (1996) suggest that they do not necessarily contradict each other. They still share various assumptions about the relationships among population, technology, and resource use intensity, but differ in their views of the origin of technological innovation. Malthus implies that technological innovations are exogenous in that their development is not necessarily ingrained in the population pressure condition. Boserup grounds this development directly into that condition. Thus, technological change is endogenous to the socioecological system. Furthermore, because population growth (i.e., a key variable for both Malthus and Boserup) is common in regions experiencing agricultural change like the Amazon region, it is currently accepted in the literature as a significant driver of forest cover change in the tropics (Geist and Lambin 2001). However, it adds little explanation to how and why changes occur in the first place. In fact, the general existence of population growth and human mobility in these regions can confound interpretation, as they are frequently the only shared traits across separate regions (Keys and McConnell 2005). Thus, contemporary explanations about LULC changes in areas with varying population densities like Latin American countries in general, (Fig. 2) and the Amazon region in particular, usually point at population pressure as a major force but usually concatenated to a series of interacting politi-

cal, economic, and ecological factors acting across different scales (Geist and Lambin 2001).

Fig. 2: Negative Correlation between Forest Cover and Population Density using a Sample of 170 Observations collected in the Second Half of the Twentieth Century in Subnational Districts across 13 Latin American Countries



Source: Palo (1994).

The general acceptance of multi-factor causation of LULC in the neotropics has led to an explosion of studies investigating the proximate causes and underlying forces of LULC change in the tropics and elsewhere (Rudel and Horowitz, 1993; Brown and Pearce 1994; Angelsen and Kaimowitz 1999; Lambin, Geist, and Lepers 2003; Grainger 2013).

Although it is now well understood that proposing single-factor causation explanations of land cover changes in tropical environments is naïve to say the least, using the population growth framework as a departure point for explaining land use change processes in the Amazon region in contemporary times is still a worthwhile exercise, particularly in the context of the Anthropocene. Population growth theories applied to environmental change allow for 1) meaningful characterizations of anthropogenic landscapes at different stages of intervention, 2) identifying links with technological innovation and the adoption of intensive or extensive cultivation practices, and 3) connecting aspects of market integration and demography. This

framing also restrains popular subjective views of pervasive devastation of pristine landscapes by some human groups or promotion of environmental stewardship and protection by others based on cultural differences despite their ecological importance. The following sections focus specifically on the Amazonian case and the role of population growth, technological innovation, and changes in economic behavior and demography in shaping LULC changes in a complex socioecological region. The section starts the discussion with a rather simplistic separation of spatial patterns associated with the length of human occupation of landscapes with a particular emphasis on their evolution since the second part of the twentieth century.

The Indigenous Land Use Footprint and Environmentalist Narrative

Until the 1950s, most indigenous Amazonian groups such as the Jívaro (Ecuador and Peru) Huaorani (Ecuador), Campa (Peru and Brazil), Asháninka (Peru and Brazil), Záparo (Ecuador), Tsimane (Bolivia), Yanomami (Venezuela and Brazil), Machiguenga (Peru), and Tikuna or Tukuna (Brazil, Peru, and Colombia) still lived in dispersed, temporary, and very low population density settlements (Moran 1993; Taylor 1999; Godoy 2001; Doughty Lu, and Sorensen 2010). Although there is robust evidence that the dispersed, temporary, and low-density characteristic of Indigenous settlements was not necessarily the norm in the Amazon basin at the time of arrival of European settlers to the Americas in the late 1400s and 1500s (Denevan 1992; Moran 1993; Clement et al. 2015; Levis et al. 2018), most contemporary land use changes in Indigenous territories have been linked to accelerated nucleation (or re-grouping) processes of relatively isolated, dispersed, low-density, and semi-nomadic populations during the second half of the twentieth century. The relative isolation and dispersion of native groups that characterized "wild" Amazonian landscapes until the 1950s resulted from decades and even centuries of persecution of Indigenous peoples who fled into forested areas to escape the violence unleashed by European settlers and their descendants. The impact of epidemic diseases introduced during the European conquest, which decimated up to 95 percent of native Amazonians in the first century of contact, also contributed to the low-density and dispersed characteristics of contemporary native Amazonian societies (Porro 1994). The nucleation of Indigenous Amazonians after the arrival of Europeans was mostly induced by missionaries and slave owners as a strategy to group natives around missions to facilitate catechization and secure labor. These processes are not new, and the literature suggests that such efforts started in the 1600s as part of the assimilation strategies imposed by European rule (Taylor 1999). However, the transition from dispersed and semi-nomadic Indigenous settlements to nucleated and permanent villages in the past five or six decades is probably the most important characteristic associated with long-lasting landscape transformations in

ancestral territories in contemporary times (Descola 1994; Sirén 2007; López, Beard, and Sierra 2013). In the modern history of Amazonia, for example, these changes correlate with population growth and the increased influence of external agents (e.g., religious missions, urban markets, agro-industries, or national development policies) that have continued promoting the grouping of families and production areas in clustered arrangements (Rudel, Bates, and Machinguiashi 2002; Taylor 1981). By adopting a nucleated living and production arrangement, population pressure has significantly increased in and around settlements, which has led to patterns of land use distinctively different from those that originated under conditions of dispersion and low population densities in the previous centuries.

Nucleation is slowly transforming Indigenous people from mobile resource users to sedentary cultivators, causing permanent changes to Amazonian ecosystems and a more distinctive contemporary footprint. Some Indigenous groups like the Kichwa, Shuar, Achuar, and Machiguenga of Western Amazonia have also adopted extensive production strategies like cattle raising, which has prompted the incorporation of newly cleared land (i.e., increased deforestation) into the production system and triggered the conversion of old swidden cultivation areas and fallows into pastures. Raising livestock has contributed to the sedentary character of today's nucleated settlements because, unlike the swidden agricultural plots, pastures are more likely to remain in the landscape for a few decades, given the significantly high costs of labor, time, and agricultural inputs of creating them (Lopez, Beard, and Sierra 2013).

But why would Indigenous people now embrace nucleation if it was used as a social control and indoctrination mechanism by external agents and is also causing a more permanent mark on the landscape? As stated earlier, nucleation is not new but has accelerated since the 1950s because of external factors. It is currently a general strategy adopted by Indigenous groups to regain control over their territory and resources through evolving sociopolitical structures and new production strategies (Lopez, Beard, and Sierra 2013). Indigenous populations in Amazonia are growing (McSweeny and Arps 2005) and most live in permanent or semi-permanent nucleated settlements. Changes in social structures allow Indigenous people to access resources inside and outside their controlled territories, and in many cases, facilitate easier integration into the market economy (Jackson et al. 2001; Diamond 2005) since nucleation allows for territorial claims, land control, and all the benefits associated with land access (e.g., improved communication with the outside world, or access to resources). Entering the market economy allows Indigenous households to increase their level of food consumption, reduce variability in food consumption, access foreign goods and innovate (Godoy, Reyes-García and Huanca 2005). The market economy, especially since the 1950s, has taken a different shape as global trade started to show a higher share of merchant production, a significant growth of the trade in services, the rise of production and trade by multinational firms, and

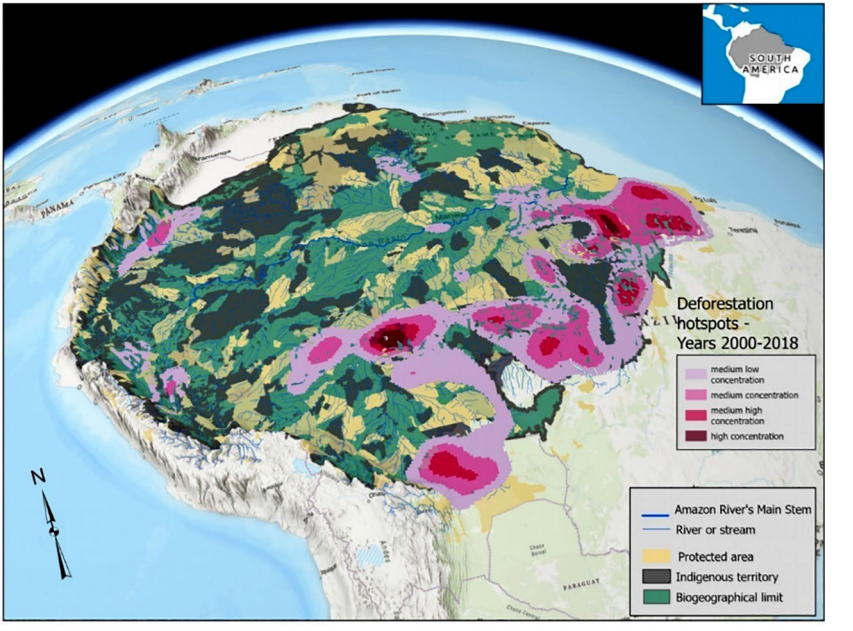
a continued removal of obstructions to the movement of goods and services to create perfect conditions in which international trade can expand (Blouet 2004: 7). All these changes have affected economic relationships globally, including those with and within rural areas, which is slowly affecting how and for what purpose Indigenous peoples produce. The re-orientation of production from subsistence to market-oriented, from low-yield to high-yield, with the adoption of modern technologies (e.g., modern machinery, communication infrastructure, or improved weeding techniques) has been associated with distinctive LULC patterns in Indigenous Amazonian territories since the 1950s.

Despite these transformations, the impacts of contemporary Indigenous agents on land cover have been generally low in comparison to their non-Indigenous counterparts for most part of the twentieth century. Because of this and the extent of many ancestral Amazonian territories, current debates about the fate of their territories and the forests within have been bound with aspects of conservation, pushing forward the notion of Indigenous peoples as the stewards of the rainforest and their important role in the global conservationist agenda. However, a purposeful and deliberate collaboration between Indigenous movements and environmentalist organizations is partly responsible for this type of narrative (Davis and Wali 1994). In 1990, a year of re-evaluation of the relationships between Indigenous and Non-Indigenous peoples after 500 years of the arrival of Europeans in the Americas (Dietrich 1992), the *Coordinadora de las Organizaciones Indígenas de la Cuenca Amazónica* (COICA) organized the First Summit of Indigenous Peoples and Environmentalists in Iquitos, Peru. Later international agreements, including the Rio Convention on Biological Diversity, made it clear that these linkages were relevant in tandem with the "close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations, and practices relevant to the conservation of biological diversity and the sustainable use of its components" (United Nations 1992).

Presently, most of the territorial claims made by Indigenous peoples are based on such a conservationist ideology, which many groups have purposedly appropriated. This link to environmentalism, an important social movement that started in the 1950s and 1960s in the Global North, is questionable and has, to some extent, also jeopardized the legitimate claims of Indigenous peoples to their ancestral lands and natural resources since the 1960s, regardless of its ecological significance. Indigenous peoples, however, have some unalienable rights to the land and other natural resources because of their previous territorial occupation, which nation-states normally see as their exclusive rights. While their views on conservation and sustainable development frequently diverge from those of environmentalist groups, the environmental agenda considers the fact that Indigenous peoples depend on the preservation and management of their environments for their survival (Redford and Stear-

man 1993). At the same time, robust evidence exists that Indigenous Amazonian territories currently serve as *de facto* protected areas since they still contain significant amounts of forests and biodiversity and that most significant land cover changes in the past fifty years have occurred mostly outside these areas (Fig. 3).

Fig. 3: Concentration of Deforested Areas (in red and pink tones) in the Past Two Decades. Most intense Land Cover Transformations have occurred outside Indigenous Territories and Protected Areas in the Amazon Region



Source: RAISG (2020).

Although protecting Amazonian landscapes is a noble goal with significant socioecological benefits for the Earth system and humankind, the way environmental organizations, particularly those from the Global North, have framed these conservation efforts in the past sixty years has been and is problematic. The rights of Amazonia's long-term residents to their territories and natural resources are essentially being undermined when conservation programs treat the region as a "pristine" ecosystem or as the ultimate wilderness frontier. The Anthropocene lens could contribute to reframing this perception by promoting the view that Amazonia, despite being a humanized landscape, is still worthy of conservation. In fact, beta diversity of some living forms, especially plants, has increased as a result of various

kinds and degrees of human modifications of Amazonian ecosystems (Odonne et al. 2019). Moreover, food resources and agrobiodiversity are usually highly concentrated in domesticated forests, a condition that is valued by both human and nonhuman populations (Junqueira, Shepard, and Clemente 2010; Levis et al. 2020). As noted earlier, the Anthropocene framing allows for a meaningful re-conceptualization of the conservation and development in Amazonia through the eyes of its long-term residents.

The Colonist Farmer Footprint and the Frontier Land Narrative

The most intense socioecological interactions in the Amazon region during the last six to seven decades have been driven regionally by processes of frontier land occupation. Frontier land occupation has been a strategy used by governments in Latin America to advance their development and geopolitical agendas with different levels of success. In-migration to frontier areas is perhaps the main source of population growth (Lutz 1996) and a precursor of agricultural extensification and intensification. Frontier lands encourage in-migration because they open up possibilities for land accessibility, tenure, and material production. These processes are of particular interest to researchers because they usually lead to fast and ubiquitous biophysical transformations including forest loss (Tab. 1). Because of their celerity, these changes threaten the integrity of rainforests and the ecological services they provide if no enforceable restrictions to clear forests are applied. Recent efforts to identify areas at risk of significant forest loss due to concerns of environmental degradation caused by anthropogenic activities in the Amazon have concentrated on the identification of deforestation fronts and hotspots. The term "deforestation hotspot" has been used in the LULC change literature to define areas with particularly high rates of deforestation in a given time period. A deforestation front can include one or several deforestation hot spots (Kalamandeen et al. 2018; Pacheco et al. 2020; RAISIG 2020).

Tab. 1: Deforestation Extent by Amazonian Region/Country between 2000 and 2018

Country	Original forest cover extent (km²)	Cumulative deforestation until 2000 (km²)	Percent of the original forest 2000–2013 (%)	Cumulative total (%)
Bolivia	333,004	14,035	3.1	7.3
Brazil	3,587,052	458,500	4.8	17.6
Colombia	465,536	34,673	2.4	9.9
Ecuador	97,530	9,343	1.2	10.7
Guyana	192,405	3,097	0.9	2.5
French Guyana	83,195	1,539	1.0	2.8
Peru	792,999	55,649	2.0	9.1
Suriname	150,254	5,664	0.4	4.2
Venezuela	397,812	8,914	1.0	3.3
TOTAL	**6,099,788**	**591,414**	**3.6**	**13.4**

Source: RAISG (2020).

In the Amazon basin, deforestation fronts have been shaped by in-migration processes that share common characteristics. López-Carr (2003) asserts that these have been, for instance, led by peasant farmers who migrate to live in a remote, disease-ridden forest frontier, and cultivate crops with little to no public infrastructure or services with limited technology and unstable environmental conditions, leaving behind better-paying and more diverse labor markets, public education, health care, and community infrastructure. The fact that these migrants, perhaps paradoxically, assert that their current circumstances are better than those in their home regions or countries (López-Carr 2002; Billsborrow, Barbieri, and Pan 2004) emphasizes the strength of the one attraction that frontier environments have to offer compared to other possible destinations: land. Land accessibility provides a sense of security and is an attractive investment, especially when accompanied by government or individual promises of land tenure or ownership. Examples of fast forest conversion as a result of this phenomenon include: 1) The Northern Ecuadorian Amazon, where population grew at annual rates exceeding six percent through the 1970s and 1980s, and slightly decreased to about five percent in the 1990s and 2000s (Southgate, Sierra, and Brown 1991; Bilsborrow, Alisson, and Pan 2004). Here, the agrarian reform of 1964 and its subsequent expansion in the 1970s generated significant in-migration to the Napo region, in the provinces of Sucumbíos and Francisco de Orellana. This in-migration was both spontaneous and planned and resulted in thousands of people from impoverished areas in the Andes moving into

the Amazon basin. 2) The Brazilian Amazon where high deforestation was closely linked to high levels of in-migration in the 1960s and 1970s (Wood and Porro 2002). Frontier land occupation was formally labelled as Operation Amazonia (Wood and Schmink 1993; Dias 2019) and promoted during the military dictatorship in 1966 due to national imperatives to incorporate the Amazon region into the national economy and gain geopolitical sovereignty. Similar processes have been also observed in the Bolivian Chapare region and more recently near Madidi National Park (Cordona Locklin and Haack 2003), Peruvian Central Amazonia (Machiguenga territory) (Emlen 2020), and Colombian Caquetá River region (Holmes, Pavón, and Gutiérrez de Piñeres 2020), to name some of the most significant examples.

Amazonian frontier lands in the twentieth and twenty-first centuries have been characterized by rapid transitions from extensive to intensive, and sometimes intensive to extensive land use systems depending on the evolution phase of frontier households. Contrary to Boserupian theory, recent case studies from more developed frontiers in the Amazon basin typically show increasing extensification and forest loss along with agricultural intensification caused by population growth (Pichón 1997; Angelsen and Kaimowitz 1999; Perz and Walker 2002). For example, in a recent national level study in Brazil, Tritsch and Le Tourneau (2016) found that agricultural extensification occurs in areas with low population densities, and areas with quite high population densities experienced the contraction of agricultural land use. In certain cases, this latter dual process at the farm level appears to be driven by the relatively wealthy households that are able to afford intensification in the form of hired labor, agricultural inputs, tools, and equipment, as well as able to expand agricultural land holdings (López-Carr 2003).

Frontier land in-migration commonly happens simultaneously with other development strategies like road expansion and the consequent opening of local and national economies (Chomitz and Gray 1996; Pfaff 1999; Lopez and Maldonado 2023). In Brazil, for example, the construction of roads since the 1950s has been commonly identified as a proximate factor of LULC change, and it is well known that most deforestation in Brazil occurs in areas within 50 km from a road (Chomitz and Thomas 2001; Asner et al. 2006). Barber et al. 2014 found that nearly 95 percent of all deforestation occurred within 5.5 km of roads or within 1 km of navigable rivers. Similar patterns have been observed in Peru, Ecuador, and Bolivia (Gallice Larrea-Gallegos and Vázquez-Rowe 2017; Lopez 2022), with intense deforestation processes happening at even shorter distances. The construction and expansion of road networks since the mid-1950s also led to the slow opening of South American national economies, giving place to an agro-industrial period. This transition pushed forward economic agendas with development plans for the Amazon that not only focused on establishing human presence in sparsely populated areas and providing food for nourishment purposes of local populations, but on augmenting agricultural production (licit and illicit) for commercial purposes (e.g., soybeans, African

palm fruit, pastures for cattle raising, coca leaves) in a market-oriented and more globalized economy. For example, in cases like Bolivia (Santa Cruz) mechanization processes took place in the 1960s to reach industrial production levels of soybean, sugarcane, and rice, and in Brazil (Mato Grosso) in the 1970s, soybean was introduced as a cultivar alternative to overcome the issue of impoverished soils, particularly in the forest-savanna transition region in the south. In Brazil alone, soybean production extent increased 57 times between 1961 and 2002, while production volume increased 138 times. Since the year 2000, soybean harvested area in Brazil has increased by 160 percent (FAO 2019), most of it in the Amazon basin. Since the early 2000s, at the Pan Amazon level, forest reduction associated with other industrial-level processes like large-scale cattle ranching for meat and milk production following phases of frontier land occupation has constituted a significant human impact more recently. The contribution of cattle ranching to the overall forest loss in the Amazon, for example, probably reaches around 80 percent (RAISG 2020), particularly in transitional regions and savannas in Brazil and Bolivia, where soybean monocultures dominate the agricultural landscape. Soybeans are commonly used as animal feed worldwide.

In addition to soybeans, the increased production of other agricultural commodities in the Amazon region and the associated LULC transformations in the past couple decades respond to current global demands in the agricultural sector (Lopez 2022). African palm cultivation, for example, is another important agro-industry affecting land cover and driving accelerated land use changes in the Amazon in the past two decades, particularly in Upper Amazonian countries like Colombia, Ecuador, and Peru. The expansion of African palm cultivation is another conspicuous land cover transformation that has intensified since the 1980s due to not only the development of road infrastructure in the region but, more importantly, the increased global demand for palm oil. Global palm oil production has doubled every 10 years since the 1960s and has become the world's dominant vegetable oil (Gaskell 2015; Butler and Laurance 2009) followed by soybean oil (Song et al. 2021).

In the early 1970s, important regions of the Meta, Guaviare, Putumayo, and Caquetá departments in Colombia became production centers of coca to satisfy the global demand for illicit drugs like cocaine (Holmes, Pavón, and Gutiérrez de Piñeres 2020). Large areas of Peru, like the Valle del Alto Huallaga, were quickly integrated into this illicit global economy during this time, and the extensification of coca production led to significant landscape transformation in the valley (Paredes and Manrique 2020). Similarly, in the Chapare region in Bolivia, a well-defined coca frontier was established between 1940 and 1990 with the in-migration of thousands of colonist farmers (Millington 2020). Other industrial operations that have also led to frontier land occupation in the Amazon include oil production, mining, and logging, processes that in most Amazonian countries also started on a larger scale in the 1970s, facilitated by the construction of roads.

These cases exemplify a regional trend in which states promoted large-scale settlement projects to occupy frontier lands by developing roads and expanding the agricultural frontier. With road infrastructure in place, the penetration and expansion of industrial resource extraction activities of different kinds was possible. In most cases, these investments involved international development agencies and donors and ultimately opened the Amazon frontier – a contested space incorrectly conceptualized as "empty" – to millions of poor landless Andean peasants. The long-term impacts of these processes are now visible from space, and land change researchers in the late twentieth century and early twenty-first century have spent significant efforts trying to infer transformation processes from such ubiquitous spatial patterns (Arima et al. 2013; Simmons et al. 2016; Ball et al. 2022; Lopez 2022).

With population growth, changes in social structures and household life cycles usually follow. Such changes have been identified as important drivers of land cover transformations in the late twentieth century and twenty-first century in Amazonia (Walker et al. 2002). In this context, Chayanovian theory (Chayanov 1986) has been a useful framework to analyze land use cover changes associated with household demographic factors in the Amazon basin. According to this perspective, the age and sex composition of households affects labor and, therefore, land use and forest conversion. By accepting that household effects are universally important, the difference between Indigenous and colonist ecological footprints shortens. In both cases and despite the considerable geographic variation, a general land use change process associated with household demographics appears to recur throughout the Amazon basin as a product of sedentarization. The family cycle begins with migration to either a new farm plot or human settlement. New arriving families tend to have household heads and spouses in their twenties and thirties, typical reproductive age, with no or small children. Forest clearing and cultivation expansion occur during the first several years of settlement as forest is initially cleared for the opening of cultivation plots, gardens, pastures, demarcate land occupancy, and claim resource use rights. As families grow and the relationship between household consumers and producers change, the pressure on forest will also change, with higher consumer-to-producer ratios demanding more agricultural production, which could be obtained through extensification if technological innovations are not possible (e.g., in autarkic Indigenous territories) or intensification if technology is available (e.g., inaccessible frontier-lands). As the household evolves, the increasing labor supply of maturing children and financial stability induces further expansion into new cultivation efforts (Perz, Walker, and Caldas 2006). Larger households may opt for more intense land uses as available forest land is diminished on the farm or community, and increased labor may encourage intensification. Conversely, smaller households with higher consumer-to-producer ratios may be encouraged to purchase cattle due to the low labor demands of maintaining pasture. As children become adults and the consumer-to-producer ratio drops due to out-migration of

young adults to other forested areas, villages, or cities, the demand for crops also decreases locally, which will eventually result in LULC changes.

Studies in both colonization frontiers (Pichon 1997; Brondizio et al. 2002) and Indigenous territories (Godoy 2001; Lopez, Beard, and Sierra 2013) in the Amazon have shown the effect of household life cycles and demography on land use and land cover not only in the aftermath of large-scale frontier occupation projects but also after small, nucleated settlements are formed. Household life cycles have played an important role in shaping contemporary landscapes across the Amazon basin and partially explain the non-linear characteristic of LULC changes. Of course, household life cycles account for demographic changes that, at the same time, are affected by other underlying institutional and political drivers acting at different scales.

Conclusions: The Anthropocene as an Analytical Framework of Contemporary Landscape Transformations in Amazonia and Beyond

The Anthropocene perspective allows us to understand Amazonian landscapes as places of significant human transformations and pressures in continuous evolution, in contrast to a perceived "intact," "pristine," or "in balance" wilderness. By adopting this view, the divide between notions of culture and nature is to some extent arbitrary. For Kawa (2016: 19), for example, within Amazonian landscapes "the separation between the human and non-human [...] has grown increasingly fuzzy, to the point that it is rendered almost meaningless." What the Amazon region experienced in the past 60 to 70 years is the intensification of human-environmental relationships, mostly triggered by population growth, but concatenated to a series of economic, demographic, technological, political, and institutional pressures acting at different spatio-temporal scales. Both Malthusian and Boserupian theories of agricultural change have played a significant role in explaining contemporary LULC changes in the Amazon region. These theories do not contradict but rather complement each other, as they allow the description of transitions from extensive to intensive systems and vice versa, depending on the developmental stage of households. Contemporary patterns of LULC change in the Amazon are a reminder that landscape transformations are not linear, but correlate to cycles of population growth, social changes, political processes, and institutional reforms in a more globalized economy.

From a development point of view, the Amazon region must be reconceptualized as a dynamic *anthrome* or humanized landscape, with different levels of intervention. The region is dominated by LULC arrangements in continuous change, with periods not only of intense transformation, like those experiences in the last few decades, but also of stasis (Denevan 1992). The pristine forest narrative has undeniably led to the "empty land" discourse used by governments and developing agencies since the

1950s to justify planned and spontaneous occupation of Amazonian frontier lands by external agents. This discourse has been the base of not only nation-states' strategies to gain control over large territories but served as a tool to undermine Indigenous peoples' rights to their ancestral lands and their natural resources. The pristine forest view has also been used by environmentalist groups to put forward conservation agendas that exclude people or do not take into account people's needs, through the promotion of Amazonia as a biome of mostly ecological value essential to maintain critical ecosystem services for the Earth system (i.e., as a global climate regulator), a storehouse of yet to be discovered biodiversity that could eventually lead to unprecedented breakthroughs in Western medicine and other sciences, and as the last wilderness frontier waiting to be discovered by intrepid explorers or modern researchers (Winkler Prins and Levis 2021). Amazonian landscapes are not untouched or just waiting to be revealed to the outside world; rather, they are humanized environments that will be further transformed by ever-evolving human-environment interactions. This does not mean that they are not worthy of conservation, but what needs to be considered and what makes the Anthropocene a constructive framework is that conservation efforts should not be built upon un-revised notions of a wild Amazonia. The Anthropocene also highlights the need for conservation strategies to consider human needs and well-being as integral components of any protection and management initiative of Amazonian landscapes. This could lead to more inclusive and long-term solutions that address both social and ecological challenges simultaneously.

As Indigenous landholders and frontier settlers gradually become incorporated into the national economies and their needs become fully articulated in development plans, a careful examination of the structure of their production systems and emerging social structures can contribute to the formulation of adequate regional land development and conservation policies. These efforts should include diverse understandings of natural resource management and food production, in addition to grounded interpretations of the socioeconomic needs of local communities, their organizational socioecological structures, and their adaptive capacity. This step may be an important condition toward guaranteeing the sustainability of Amazonian socioecological systems in the long haul.

In conclusion, the Anthropocene framework challenges conventional ways of understanding the lithosphere, development, and conservation paradigms by highlighting the interconnectedness between humans and the environment. This framing enables an understanding of Amazonian ecosystems as humanized landscapes while promoting a more integrated and flexible approach that prioritizes the conservation of socioecological systems, as opposed to pristine biomes in the face of accelerating environmental change. This can be done through the integration of techno-scientific and traditional ecological knowledge systems, considering both ecological and social elements simultaneously. The Anthropocene framework also

contests notions of a fixed carrying capacity with well-known planetary boundaries and tipping points. With new technologies and changes in human behavior on a global scale, such limits may be hard to delineate or accurately quantify since they may be modified over time. Still, regulation and continuous evaluation of human impacts should be framed in the context of "safe limits," in which both ecological and human systems continue to thrive and develop (Steffen et al. 2015). Further work to monitor land cover changes and their impacts on ecosystems is needed to be able to determine what these buffers are and the anthropogenic pressure thresholds below which the probability of the Earth system becoming unstable remains low.

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Land Use in Mesoamerica from 1950 to the Present

Environmental Violence and Land Appropriation

Wilson Picado-Umaña, Pedro Urquijo Torres and Diana Alejandra Méndez Rojas

Since the 1950s, the objectives of public policy and the basic vocabulary of governments and economists have been defined by notions of economic growth, technological modernization, improvement of the standard of living, and social inclusion. There has been no other national project stronger than that of turning every country into a prosperous and democratic society. The aim of this chapter is to show, through the analysis of land appropriation in Mexico and Central America, that the strength of the "developmentalist conviction" has historically been contradicted by reality: rather than development, these regions have experienced "maldevelopment" (Amin 1990; Tortosa 2009). This text is divided into five sections. First, it provides a theoretical introduction using the concepts of Plantationocene and environmental violence as tools to address the issue in question. Second, it examines the differences between Mexico and Central America in terms of the weight of the state in the rural sector. Third, it describes the main transformations in land use that occurred in the region between 1950 and 1980. Fourth, it points out the most important changes that have taken place since the 1980s, in the context of the rise of neoliberal policies. Fifth, it considers the role of social and community resistance to the advance of new forms of mining and agrarian extractivism in the region. Brief conclusions at the end of the text discuss the importance of these tendencies for the understanding of the Anthropocene and its impacts on land-use in the region.

Plantationocene and Environmental Violence

This chapter replaces the concept of land use with that of land appropriation to refer to the changes that have occurred in the territories of Mexico and Central America since the post-war period. The category land use, although obviously functional to describe this process, carries the risk of making invisible the power relations that at different scales have been behind the territorial transformations experienced in this region since 1950. Rather than the result of a territorial lottery, the spatial dominance of monoculture in the countries under study – to cite just one example –

should be understood as a dynamic of land, technology, and resource appropriation by elites and other social actors. The action of these groups, through the market, state policies, repression, or assassination, has led to the marginalization of the poorest populations, their labor exploitation, their displacement to other regions and countries, as well as their condemnation to marginal lands.

The concept of land appropriation places our analysis in the context of the current debate on the so-called Plantationocene. As is well known, the discussion around the Anthropocene has opened the door to the creation of alternative notions and narratives that adjust, as well as broaden, the semantic scope of the term. The most well-known has emerged around the Capitalocene, which defines modern times as an era dominated by the market, industry, and the pursuit of profit through the exploitation of human labor as well as the extraction of natural resources (Moore 2017; Moore 2018). Recently, the concept of Plantationocene has been proposed, understood as the transformation of agricultural areas, pastures and forests into monoculture and extractive plantations, using slave or controlled labor under some kind of coercion that uproots individuals from their places of origin (Haraway 2015: 162). According to Haraway, there is some consensus in understanding that the colonial plantation system has been one of the foundations of the modern, mechanized, energy-hungry industrial system. As Wolford suggests, the plantation, that is, large-scale, export-oriented agriculture dependent on forced labor, has played a determinant role in the formation of modernity through the expansion of Western power in the Americas, Asia, and Africa. The concept of Plantationocene pinpoints the racialized component behind the systems of production and social relations that marked the origin of capitalism in the modern world, further describing its effects on the simplification of landscapes, as well as on the transcontinental movement of people, plants, and species (Wolford 2021: 1622–23).

Although the original term refers, strictly speaking, to the slave (and post-slave) plantation economy, some authors have reinterpreted the plantation in light of the contemporary monoculture boom in the tropics. Thus, for example, for Wang and Xu, in their study of sugarcane production in Guangxi province, southern China, the Plantationocene refers to the existence of plantations as a predominant form of production, characterized by large-scale monoculture under the control of corporations through intensive exploitation of labor. According to these authors, these are vast tracts of land dispossessed from peasants and local communities by transnational corporations and large landowners, where local inhabitants are displaced or become wage laborers. Plantations represent simplified landscapes, established through the alienation of land and labor (Wang and Xu 2022: 2).

Although it is not a specific tool for our analysis, the modern meaning of Plantationocene frames, in the planetary context, the changes that have occurred in the landscapes of Mexico and Central America since 1950, in five aspects in particular. First, in the sense that the great devices behind land appropriation and use in the re-

gion have been linked to the control of land and productive resources, exercised by the elites, corporate agriculture, and the state. Second, this control has meant the displacement, expropriation and territorial dispossession of peasant, Indigenous, and Afro-descendant communities. Third, these processes have led to the formation of masses of wage-laborers responsible for cultivating and harvesting the production on entrepreneurial farms. Fourth, in addition to the above social consequences, it has meant a homogenization of agrarian landscapes due to the extension of monoculture associated with Green Revolution technology, contributing to deforestation as well as the loss of biodiversity. Fifth, in the same way, such simplification has led to the formation of territorial units dependent on a fossil-based energy matrix, with high consumption levels of chemical inputs that for decades have altered soils and waters, as well as environmental and human health. In this last sense in particular, the expressions of the Plantacionocene in the study area have also been linked to the development of the Toxiconocene, a productive growth sustained by the introduction of toxic substances to the agricultural activity. In the words of Jason W. Moore (2016), this is a type of negative value accumulation that not only generates impacts on the landscape and bodies, but also calls into question the viability of industrial agriculture in the future.

These processes have occurred, for the most part, upon a framework of violence, which will be referred to as environmental violence. In recent years, new interpretations have been made of the relationship between environmental alterations and violence. This is expressed in notions such as "violent environments," "environmental violence," "slow violence," and "violence of development", among others (Peluso and Watts 2001; Nixon 2011; Mowforth 2014; White 2018; Marcantonio 2022). Although written with different objectives, these approaches coincide in identifying the existence of a specifically environmental violence, derived from the various forms of exploitation of natural resources predominant in capitalism. Environmental violence can be understood as a set of practices and processes of appropriation of natural resources that affect the human condition, preventing the satisfaction of the vital needs of the entire population, hindering the right of access to nature for the poorest populations, and in general, affecting the common good through the aggressive alteration of landscapes. Environmental violence comprises a set of socially constructed devices that facilitate the exploitation of resources in favor of a particular elite or social group. These devices, such as agricultural technology, allow the accumulation and reproduction of capital, while at the same time having narratives that legitimize their development through the externalization and invisibilization of environmental consequences.

Environmental violence is not exceptional in that it occurs within a specific framework of social and power relations, as is the case with other types of violence. In this sense, environmental violence is part of structural violence. It is distinguished by the fact that it arises in the process of the social appropriation of nature,

expressing itself through critical factors such as resource scarcity, environmental degradation, inequality, social conflict, environmental injustice and ecological vulnerability, among others. This is why its marginal impact is greater for the most disadvantaged groups in society. In summary, the dynamics of land appropriation in Mexico and Central America since 1950 have been, essentially, a process mediated by environmental violence.

It is worthwhile to make an observation regarding the exercise of power, state building, and sovereignty. Despite the similarities in the historical-environmental processes of Mexico and Central America, it is important to consider the contrast in the shaping of state policies. While in the case of Central American nations, since the mid-nineteenth century and throughout the last century, the state had been characterized by systematic subordination to transnational markets; in Mexico it was consolidated by a persistent regulatory presence between the 1920s and 1980s. In general, according to a definition that holds a certain consensus, this chapter understands the state as the material condensation of power relations, which are expressed in the capacity for autonomous action of the institutional players (Poulantzas 1978).

The State as a Major Catalyst of Development Violence (1950–1980)

In Central America, the state was constituted in a subordinate manner to the agro-export model dependent on the international market, characterized by a concentration of capital and credit (Pérez-Brignoli 1988; Fonseca Corrales 2013). In the early twentieth century, the agro-export model shifted from the hegemony of the nineteenth-century coffee oligarchies to the expansive presence of transnational companies, a pattern of mono-export and land grabbing whose most visible representation was the United Fruit Company. Between the 1960s and 1970s, the vulnerability of the regional economies subjected to the agro-export model became particularly evident with the crises in international markets and the absence of strong national states that could provide alternative mechanisms of containment to the exertion of power from abroad. It was precisely in this decade when the first attempts at productive articulation based on the common market were glimpsed (Bulmer-Thomas 1989; Guerra-Borges 1993), although the fragmentation and weakness of the states in the region has prevailed.

Overall, the state was an architect of territorial transformation in Central America throughout the period under study. Even in agrarian-based economies, the state acted as a catalyst for the expansion of capital in the rural world, consistently sponsoring agricultural modernization (Guerra-Borges 1993). To this end, it was essential to direct investment and credit to the most thriving productive sectors, expanding the territorial coverage of banking agencies and other state, parastatal or private

credit systems. Access to this financial capital was necessary to promote the adoption of new cultivation, harvesting, and processing technologies required for monoculture production. Due to the growth in the level of investment in this industry, it was also necessary to create crop insurance systems to protect capital against the impact of extreme hydro-meteorological events, such as floods and droughts. Such insurance was backed by public funds and, in general, constituted a hidden subsidy to the richest producers such as rice growers.

In post-revolutionary Mexico, the new state was constituted through the creation and unification of diverse institutions, strengthening of the political bureaucracy, and establishment of protectionist administrative, legal, and fiscal apparatuses. The official discourse legitimized social demands and sovereignty, supported by visible public investment in hydraulic and road infrastructure and the exploitation of subsoil resources. The process of nationalization and state domination was particularly important in a society whose social pact rested on loopholes that escaped the control and influence of the market and capital, exemplified by the *ejido*, a form of collective land ownership, constitutionally recognized since 1917 (Roux 2005). At different times, either by strengthening the collective ownership of ejidos and communities – as occurred in the economic cycles of 1934–1940 and 1970–1976 – or by limiting it in favor of individual ownership, as occurred between 1940 and 1970, the Mexican state wielded direct power in a manner that defined the development process.

From the 1930s until 1980, the state was reorganized from a complex state apparatus and an agrarian regime founded on the patronage of the one-party government of the Institutional Revolutionary Party (PRI) – from the perspective of peasants and rural peoples – to large agro-industrial regions with transnational interests (Urquijo Torres 2017). To this end, it made use of different corporate organizations, which incorporated the great masses of producers and workers whose subordination was decisive in the design of an authoritarian-corporate model that offered rights in exchange for political loyalty. This formula of construction and representation of the Mexican state began its decline in the early 1980s, when it gave up its hegemonic and sovereign role, in compliance with the structural adjustment and economic stabilization programs demanded by the International Monetary Fund and the World Bank.

Transformations in Land Use (1950- 1980)

The Agroexport Boom and Developmental Capitalism in Central America

The second half of the twentieth century in Central America saw the rise of export agriculture (Pérez-Brignoli and Samper 1994), a process that shaped the social dy-

namics and the regional landscape. The bonanza was common in coffee and bananas between the post-war period and the 1970s. Grain production increased even in countries with a weaker agrarian tradition, such as Honduras and Nicaragua. This expansion, especially in Costa Rica and El Salvador, occurred thanks to the adoption of chemical fertilizers and the introduction of high-yield, low-input varieties that proved to be very productive. The old polyculture coffee plantation gradually gave way to full sun coffee with controlled shade (Samper 1993). In the case of bananas, the transportation crisis during World War II and the impact of diseases such as the Panama Disease, impeded production of the fruit in the region, but it managed to revitalize itself by the 1950s. Although the Panama Disease led to the relocation of the crop from the Caribbean to the Pacific, as was the case in Costa Rica, renewed varieties made it possible to increase yields per hectare by replacing the Gros Michel variety with Cavendish and Giant Cavendish. In addition, there was an increasing presence of national producers in the fruit production and marketing chain (Ellis 1983; López 1986; Viales Hurtado 2001).

Cattle raising was another of the dominant activities in the regional landscape. After the post-war period, Central America became a beef exporting region to the United States, due to the expansion of the fast-food market in that country. As is well known, the foot-and-mouth disease quarantine, established by the United States for South American meat-producing countries, increased the quota for meat exports from Central America. Under these circumstances and thanks to funds linked to the Alliance for Progress, national governments promoted the construction of roads and other public infrastructure works, facilitating the transport of meat to the ports. In Central America, a modern agribusiness made up of dozens of processing plants was built with technology and refrigeration systems that ensured the quality and safety required by the U.S. market. This meant the expansion of pastures at the cost of forest clearing and the displacement of peasant farms. In other words, the export of animal protein to rich countries pivoted on the profligate appropriation of plant tissue by livestock elites (Williams 1985; Edelman 1992; León, Barbosa, and Aguilar 1982; León 2012).

Cotton and sugar cane were other crops characteristic of this agroexport boom. Central America experienced a brief but impressive cotton boom between 1950 and 1970. Although cultivation has been important since the 1930s in El Salvador, Guatemala, and Nicaragua, since 1950, the activity has increased dramatically in agricultural areas, especially in the Pacific. Supported by the government and various World Bank programs, cotton was the first "breakthrough" of Green Revolution technology in the region. In addition to the concentration of production under large-scale landowners, possibly the most distinctive feature of this expansion was its dependence on the use of chemical inputs, specifically for pest and disease control, leading to contamination of water, soil, and human bodies. The expulsion of Cuban sugarcane from the U.S. market after the Revolution in 1959 led to the

expansion of Central America's participation. A higher export quota and rising prices favored the growth of the cultivated area in the region until at least the mid-1970s. Irrigation and the increase in milling capacity favored the increase in production, as well as the introduction of new varieties, especially in the case of Costa Rica. Sugarcane was also favored after the cotton crisis of the 1970s. Declining international prices for this product motivated the substitution of many cotton lands for sugarcane lands, as well as the reuse of mechanical technology in sugar production (Guerra-Borges 1993).

Maize, beans, and rice showed mixed performances across the board. Maize and beans prevailed throughout the period as typical peasant crops, concentrated on hillside lands with degraded soils. Although efforts were made by national and international institutions to improve the technological resources, both crops showed fluctuating trends in production and yields per hectare. An aspect that complicated their situation, especially in the case of maize, was the growing importation of grain from the United States through programs such as PL-480 (Public Law 480), which filled Central American markets with products at subsidized prices, affecting the competitiveness of local production. Rice was one of the crops where the technology of the Green Revolution was fully adopted. Located in the Pacific lands of Panama, Costa Rica, and Nicaragua, it received strong support from the state and international organizations for the promotion of technification, as well as for the establishment of crop insurance systems. This favored the expansion of production from the 1970s, when new crop varieties were adapted from the International Center for Tropical Agriculture in Colombia. Rice, unlike maize and beans, was predominantly produced by agribusinesses, protected by the state and under the control of large landowners (Picado-Umaña 2013).

In social terms, the extension of pastureland displaced the poorest population, a circumstance that coffee, sugar cane, and banana producers took advantage of to employ the masses of landless farmers in harvesting crops and other temporary jobs. The adoption of Green Revolution technology increased social inequality in the countryside and favored the migration of the poorest families to the cities. In the cities, this resulted in the formation of marginal and precarious squatter settlements, lacking public services and located in areas of environmental risk. Industrial growth, especially important between 1960 and 1970, benefited from this labor force, although most of it was incorporated into the informal urban economy. In ecological terms, beyond the productive dimension, technological modernization created an environment of toxicity in agroecosystems due to the intensive and uncontrolled use of agrochemicals; a phenomenon little understood by the agrarian and health authorities of the time, which in many cases affected the bodies of workers, homemakers, and even the mother's milk that nourished infants.

Other processes contributed directly and indirectly to the transformation of the Central American territory and landscape. The first of these was the so-called

agrarian reform. With the exception of the reform promoted by Jacobo Arbenz in Guatemala, as well as that implemented during the Sandinista regime in Nicaragua, the reforms in Honduras, El Salvador and Costa Rica did not lead to a radical and direct transformation of the land tenure structure. In these cases, the reforms were redistributive, as they focused on alleviating the land conflict and its aggravating factors, and not on attacking the structural causes of the conflict: the unequal distribution of land between the agrarian elite and the peasantry. In this context, the creation of colonies and peasant settlements was the predominant policy adopted by the state to avoid expropriation processes that were unacceptable to large landowners. In general, none of these reforms threatened the land dedicated to export (Mora Alfaro 1990; FAO 1990).

The other major process was the creation of protected areas. In the midst of the global debate on tropical deforestation, a hallmark of the 1970s and 1980s, the formation of national parks became increasingly important in the region (Parsons 1976; Evans 1999). Changes in economic policy in the 1980s and the expansion of the tourism economy in the following decade solidified the ecological and economic relevance of these conservation areas (López and Granados 2016; López 2020). It is important to note that, as the case of Costa Rica shows, land policy and conservation policy often came into conflict, with the *precaristas* (squatters or landless peasants) and conservationists as fundamental – and often antagonistic – actors in this drama (Picado-Umaña and Botella-Rodríguez 2022; Picado-Umaña and Botella-Rodríguez 2023).

The Uneven Development of the Mexican Agricultural Sector

The 1950s marked a boom in Mexico's agricultural sector which, thanks to innovation and government intervention, brought stability to exports and allowed for food self-sufficiency in basic products. To a large extent, this was the result of the investment and planning that structured agriculture in the context of World War II and connected it to the U.S. war economy. On the one hand, protection was provided to producers of raw materials destined for foreign markets – such as rubber, guayule, henequen, ixtle, and cotton – and on the other hand, the intensification of maize and wheat production for domestic consumption was established as a priority (Torres 1979). The "battle for production," as this intense period is known, led to an unequal development of the rural environment that favored producers dedicated to crops that were highly valued in international trade, or to a growing market of grains for national consumption supported by the incorporation of Green Revolution technology (Fujigaki 2004). The so-called *pequeña propiedad* (small plot) was then placed at the center of economic planning, which caused agrarianism to lose the management of production and the possibility of retaining the political centrality with which it was positioned during Cardenismo (Méndez Rojas and Hernández

2023). In other words, control of production remained mainly in the hands of businessmen rather than of *ejidatarios* (De la Peña and Morales Ibarra 1989).

In line with the incentives conferred by the state, agriculture continued to be a primary factor in the regional formation of the territory (Bassols Batalla 1992). Intensive cotton production can be considered as the monoculture farm that best expresses the terms of this occupation in the northern states, specifically in areas linked to irrigated agriculture such as the Comarca Lagunera, the valleys of Mexicali, Yaqui, Mayo, Culiacán and El Fuerte, as well as in the districts of Delicias and Anáhuac. In the first cycle of expansion, which took place between the 1930s and 1950s, cotton cultivation led to population growth, urbanization, cultural identification and labor organization that was sustained by the economic boom represented by its transfer to the international market. This also increased the number of producers in the form of private companies, partnerships with the state and workers' organizations that managed their occupation from unions and confederations (Aboites Aguilar 2013).

The productive integration of the northern part of the country with the rest of the economy, however, came at the cost of a mercantile dependence on the United States. It was precisely this factor that caused the million hectares devoted to cotton to spiral into a strong crisis, when at the beginning of the 1960s the Mexican product ceased to be competitive due to the granting of economic support to U.S. production and the introduction of dumping. These circumstances were compounded by other factors that, depending on the area in question, were aligned in different orders: the fall in the international price of fiber, substitution by synthetic derivatives, soil salinization, soil erosion, the presence of pests, and the indebtedness of producers (Carrillo Rojas 2013). The result was a 60 percent decrease in total production (Aboites Aguilar 2013). In this scenario, corrective measures were undertaken, such as the promotion of work in the *maquiladoras*, which proved ineffective in containing the pauperization of inadequately planned cities, the spread of a climate of violence encouraged by drug trafficking that occupied key areas and an accentuated migration to the neighboring country (Aboites Aguilar 2018).

The 1970s represented a turning point in agricultural production, as exports lost momentum due to the fluctuation of international commodity prices and the protectionist measures adopted by the United States in relation to Mexican crops, which, in addition to cotton, had an impact on the trade of tomatoes and some fruits. At the same time, and without being sold in the U.S. market due to a quarantine imposed in 1914, avocados were consolidated as a monoculture in the Purépecha plateau in Michoacán, with the planting of the *Hass* variety, which allowed California to emerge as its main producer (Hernández Fernández 2021). The spread of avocado trees led to the replacement of endemic species such as pine and oak, which was not only encouraged by the profitability of their production,

but also as a result of a productive diversification strategy on the part of the state towards coffee-growing areas, such as Apatzingán.

As in the case of cotton, avocado producers made use of the various options that the state opened up for them, from cooperative organization to the creation of transnational companies that gained predominance by mobilizing one-fifth of world production. Despite this, it was the peasants and ejidatarios who were the first to face the effects of environmental degradation, biodiversity loss, and widening technological gaps. In fact, these groups were able to enter avocado production until the 1980s, due to the risky investment involved in starting avocado cultivation and changing the region's former forestry vocation (Hernández Fernández 2021). These transformations implied rearticulations in the exercise of power and the uses of violence that at the local scale determined land management and shaped national politics by transcending agrarian violence for the properly rural (Piccato 2022). It was not until 1997 that Michoacan avocados were able to move seasonally to the United States.

As far as consumer commodities are concerned, it is important to note that the technology of the Green Revolution, together with a strong investment in research and education, access to hydraulic works, and orographic conditions conducive to mechanization allowed the development of specialized wheat agriculture in northern areas of the country, such as Sonora, which enabled the country to achieve self-sufficiency in the mid-1950s and even generate exportable surpluses (Méndez Rojas: in press). Maize production did not demonstrate growth comparable to that of wheat, due to the heterogeneity of its producers, the biology of the grain that was less malleable due to the hybridization technique, and the lack of access to credit for small producers and ejidatarios (Gutiérrez Núñez 2017). In spite of this, the trend of the period shows a transfer of the largest volume of production from rainfed to irrigated land in the Bajío, central Jalisco, and the Mexico-Toluca-Puebla-Tlaxcala valleys. By 1970, both wheat and maize reported a drop in productivity and self-sufficiency was lost.

Within the framework of these transformations, livestock farming was shown to be a stable contributor to the Gross Domestic Product, after overcoming the effects of the foot-and-mouth disease epidemic that broke out in 1946. Its management was linked to political uses that affected small organized producers, such as those in the state of Morelos, more than those linked to national and international supply chains located in Chihuahua, Durango, Coahuila, Nuevo León, and Tamaulipas (Padilla 2015). The extension of fodder crops, such as alfalfa, and the inclusion of varieties that transformed the agricultural landscapes of entire regions also contributed to the strengthening of livestock farming. This was the case with the replacement of maize by sorghum in the Bajío region, which addressed both the need to explore options capable of achieving adequate yields and incorporate crops resistant to drought cycles (Gutiérrez Núñez 2020). The sum of these elements allowed

some sectors to increase their meat and dairy consumption in the following decades, despite the fact that the general panorama in rural areas was one of caloric and protein underconsumption. Because of this, in the 1980s the government-initiated programs such as the Mexican Food System, aimed at achieving food sufficiency and rooting rainfed producers in the cultivation of basic grains (Pedroza Ortega 2018).

The Neoliberal Shift: The Appropriation of Globalized Land (1980-present)

At the end of the 20th century, Latin America experienced a series of structural changes through national policies that, linked to globalized capital, altered the forms of land access and use (Offner 2019). The adoption of the neoliberal model projected that the countries of the region, being developing economies, required the support of large international investors in order to articulate capital, markets, and technologies. In general terms, the strategy applied was the same in Mexico and Central America: elimination of state agencies and subsidies for the countryside; cancellation of taxes and withholdings for exports; advantages for competition and the international market; and the signing of free trade agreements, among other aspects. Ultimately, the neoliberal model had a negative impact among small and medium rural producers, who were unable to compete with large agribusiness companies, due to the consequent fall in the prices of their products in local markets (Urquijo 2017).

In Mexico and Central America, the hegemonic neoliberal model was favored by transnational public policies in which the different governments acted jointly. In 2001, the heads of state of Mexico, Guatemala, Belize, Honduras, Nicaragua, El Salvador, Costa Rica, Panama, and Colombia launched Plan Puebla Panama (PPP) with the aim of providing solutions to social marginalization and poverty. The agreement contemplated eight strategies for the exploitation of natural resources, the promotion of tourism, the facilitation of trade, road integration, energy interconnection, and the linking of telecommunications services (Cedeño 2002). In 2008, the agreement was restructured as the Mesoamerican Integration and Development Project. In reality, the initiative strengthened the conditions of dependence of the countries in the area on large corporations and governments in the United States, Europe, and Asia (Capdepont Ballina 2011). With the terrain marked since the late 1980s, the first decades of the new millennium were marked by an unprecedented strategy of regional unity aimed at facilitating the free intervention of transnational markets, especially in the areas of agriculture and access to natural, mineral, and energy resources.

In Mexico, the 1990s opened with an economic reform that allowed the commercialization of agricultural land by encouraging the disintegration of the ejido. This

accelerated a process of transnationalization of nature, with the consequent loss of the state's management capacity, which resorted to new intermediaries following the crisis of the organizations in charge of the agricultural sector. It was in 1992 that constitutional reform to Article 27 and the issuance of a new Agrarian Law established the idea of the predominance of private property over social property. However, in contrast to what was anticipated by the promoters and critics of the constitutional modification, the ejido was not completely privatized. The transformation of the property regime took place in areas oriented to tourism development and urban growth. To date, about 50% of the rural area is still under the social property regime (Torres-Mazuera 2020: 50). The dynamics of land use concessions in recent decades contrasts with the post-revolutionary history, which was marked by political arrangements that granted certain social protection to the groups that inhabited and sustained themselves from these territories.

At the height of neoliberalism, activities such as mining returned to a privatized status for both national and international capital (Garibay and Balzaretti 2009; Garibay et al. 2014). Likewise, legal modifications favored the promotion of tourism, which resorted to plundering the Caribbean and Pacific coasts through the construction of large hotel consortiums (Cañada 2015). New markets, such as water, were opened to speculation as they became necessary inputs for neo-extractivist activities. Today even the deep ocean is a source of finance for minerals (Núñez Rodríguez 2020).

In Central America, the oligarchic model and massive foreign investment placed the forces of capital at the center. The displacement of community or collective land management forms increased during the most violent periods in the region. As indicated above, except in the case of the reformist attempt in Guatemala in the 1950s and the Sandinista experience in Nicaragua, most countries experienced late and partial agrarian reforms (Pino and Thorpe 1992). The common denominator of the situation in Central America is the weakness of the sovereignty of the state. With the nuance of Costa Rica, all the states of the isthmus operate as mediators of the great global capitals and the territories in dispute. This situation leaves governments as the architects of land management in favor of companies seeking to promote electricity or mining projects. A telling example happened in Honduras when concessions were granted to the Inversiones los Pinares mining project in a protected area that includes tributaries of the San Pedro and Guapinol rivers. To this must be added the fragility of the economies that are exposed to the vagaries of the world market, which, in times of falling prices, generate migratory exoduses.

The long-standing neoliberal policies in Central America did not affect the evolution of agricultural production for export the same way as in Mexico. Crops such as sugar cane, coffee, and bananas have maintained their territorial weight since the 1990s, although with moderate growth compared to what occurred between 1960 and 1970. Maize and beans, still associated with family farming, are barely withstanding

the onslaught of the food import market, while rice remains strong, especially in the south of the region. Cattle ranching, once dominant in the flats and lowlands, went into crisis starting in the 1980s, freeing up pastures that would later be reforested or used to grow crops such as pineapple and oil palm. Indeed, the great territorial change that has taken place since the 1980 crisis and trade liberalization has been the emergence of non-traditional activities; in addition to oil palm and pineapple, these include melons and forestry plantations. These crops put increasing pressure on land dedicated to basic grains and intensively consume resources such as water and nutrients, under a new form of agrarian extractivism. Oil palm in Honduras and pineapple in Costa Rica are evidence of this new extractivism, which in addition to degrading soils and polluting aquifers with agrochemicals, favors the exploitation of the labor force of poor peasants and immigrants and is the cause of violent social conflict that is made invisible by the states. The greatest poverty in the countries is concentrated in these growing areas, clearly defined as female and indigenous, which also affects millions of children (State of the Nation 2021 Program).

Resistance and Conflict (1980-present)

In both Mexico and Central America, the persistence of forms of plundering of labor and nature has led to the emergence of antagonisms anchored in the struggle for access to land and other natural resources, which have resulted in mobilizations in the defense of territory and the construction of autonomy. The region as a whole has been affected by forms of violence – including environmental violence – associated with the new criminal economies that have escalated their volume of production and circulation. In Mexico, this process was supported by the practices of selective repression applied to armed groups in the 1970s (Aviña 2018). This environment corresponded with a growing corruption of the state framework that led to an escalation in territorial defense that gained visibility in the community police in Guerrero and the self-defense groups in Michoacán (Castro Soto 2005; Hernández Navarro 2014). Meanwhile, in Central America, open conflict settled after the desolate panorama at the end of the cycle of civil wars in the 1990s, which were particularly intense in Guatemala, El Salvador, and Nicaragua.

After the climate of mobilization associated with agrarianism and with the advent of neoliberalism, one of the most persistent social responses to the irruption of the North American Free Trade Agreement was the uprising of the Ejercito Zapatista de Liberación Nacional (Zapatista Army of National Liberation, EZLN) in 1994. Its appearance in the state of Chiapas marked the radicalization of the autonomist option. In its formation, it abandoned the theoretical moorings of the left and immersed itself in the indigenous world, which provided it with the necessary referents for a radical critique of capitalist modernity and the homogeneous nation. In addi-

tion, it incorporated women as a fundamental subject in the defense of the territory (Millán 2014). Rebellious social organization was also encouraged by the emergence of megaprojects with local impacts. Examples of these are the construction of the thermoelectric plant in Huesca, Morelos, the International Airport in Texcoco, State of Mexico, the dam in La Parota, Guerrero, and the settlement of Canadian mining companies in San Luis Potosí (Boni, Garibay, and McCall 2015). Along with the defense of the territory, the rural movement acquired another route of articulation around resistance to the cultivation of transgenic crops in the country, which added the defense of biodiversity (Boege 2008; De la Torre 2019).

In Central America, resistance has taken on more dramatic tones. Societies exhausted by civil wars and processes of repression paved the way for a less conflictive consolidation of neoliberalism, to which was added the defeat of the only triumphant revolution in the region in Nicaragua in 1990. However, with the new century, rearticulations took place that gave impetus to mobilization around the territory and its defense. New coalitions have positioned themselves against extractivist megaprojects, while disputing the management of natural resources. In Costa Rica, in 2011, several organizations demonstrated from San José, the capital, to Miramar, in the province of Puntarenas, in opposition to the Bella Vista-Miramar mining project. The same was done in 2010 by a social front united against gold mining in Crucitas, bordering Nicaragua. In 2014, different groups protested from the municipality of La Libertad, Chontales, Nicaragua, to Managua against the Libertad mine; in Guatemala, coalitions in defense of territory carried out the Marcha Indígena, Campesina y Popular (Indigenous, Peasant and Popular March) in 2012 and the Marcha por el Agua (March for Water) in 2016 (Bran-Guzmán 2017). Some of these actions find their organizational antecedents in experiences linked to the democratic management of production, as was the Salvadoran case in which the cooperative organization in places such as Chimaltenango favored peasant politicization and empowerment to confront hydraulic projects (Chávez 2017; State of the Nation Program 2021).

In Mexico, the electoral triumph of Andrés Manuel López Obrador in 2018 opened a new juncture in which the anti-corruption discourse took an ascending course that became a questioning of the political and economic model (Concheiro Bórquez 2022). The policy towards the agricultural sector chose to break the cycle of corporativism, which has generated a schism among the peasant groups that encountered limits to their role as intermediaries in the representation and management of resources. The new government has assumed the direct and individualized distribution of incentives as part of a plan that contemplates the transit from intermediation to peasant self-management, without this implying the ejido and its communities as a territorial base (García Jiménez 2019; Hernández García 2022). The principles of the *Sembrando Vida* (Sowing Life) program, which aims to

combat rural poverty and environmental degradation through the implementation of agroforestry production systems, are an example of this shift.

The Fourth Transformation, as the self-named process opened by *obradorismo* maintains broad links with the agrarian world from where it assumes practices pointed out by its critics as evidence of the persistence of a neo-developmentalist model. Autonomist leftists, for example, denounce the construction of the Mayan train in the Yucatan Peninsula as a reiteration of projects based on territorial dispossession and the commodification of nature. Despite this political shift, the lack of state protection for environmental leaders, who are targets of persecution, and assassination in Mexico is condemned. In Central America, the same has occurred to the detriment of leaders such as Berta Cáceres in Honduras, who have succumbed to violence, which is one of the contemporary expressions of land appropriation. These episodes evoke the worst moments of past repression, under the auspices of territorial and environmental disputes.

Conclusions

Since 1950, the lands of Mexico and Central America have shown the characteristics of violent development. On the one hand, territorial transformation in these environments has occurred at the same time that various processes of insurgency, civil war, and political protest in general have taken place in their societies (Torres-Rivas 2013). In this sense, development as a political aspiration has coexisted with violence as a social reality and practice. War and insurgency were variables that undoubtedly altered spatial dynamics, especially among the most marginalized populations in each country. This meant not only impacts on agricultural production but, above all, the mobilization and forced displacement of thousands of families to other regions and countries (Morales 2007; Vargas et al. 1995). But this is not a simple relationship of parallelism or simultaneity. Development has been one of the causes of the social and environmental violence that has marked the history of these territories since World War II. The developmentalist policy in the rural sector, obsessed with increasing productivity through the Green Revolution, widened social inequality, favoring support for the richest producers, exploiting peasant labor, and expelling thousands of landless families to the city. Recent development, disguised under the banner of sustainability, has been dedicated to the abuse of land and natural resources, promoting the expansion of crops such as avocado, oil palm, and pineapple at the cost of the exploitation of migrant labor, as well as the degradation and chemical contamination of commons such as soil and water.

Despite the modernization of economies, which are increasingly focused on the service and technology sectors, the countryside is still a space of power and conflict in Mexico and Central America. The assassinations of the women and men who lead

environmental causes, or of Indigenous people defending their lands, call into question the role that states play as protectors of the rights and living conditions of the most vulnerable populations. Rather, they highlight a function that this institution has had as a priority since 1950: to favor the expansion of capital in the countryside, ensuring its reproduction and viability. In this context, a phenomenon has emerged in recent decades that, without calling into question the capitalist structure in our countries, is certainly changing the territorial dynamics in many ways, integrating land, land use, poverty, police repression, violence, and social armament in a single transnational space, even on a global scale: namely, drug trafficking. Drug trafficking causes the forced displacement of populations just as it did during the civil war between the 1970s and 1980s, while taking advantage of protected areas and seas for unimpeded transit. This is, however, a territorial variable of violent and virtual land appropriation that is still under study.

In Mexico and Central America, land appropriation has been a dramatic indication that, rather than development, this region has experienced maldevelopment. Despite the wealth generated by agro-exports since the 1950s – now expanded by new crops such as avocado, pineapple, and oil palm – social inequality prevails in the territories under study. Poverty is often rural, Indigenous, and Afro-descendant, and particularly affects women and children. Moreover, increases in food production occurred at the same time that malnutrition dominated the Mexican and Central American countryside, affecting children, especially between the 1960s and 1990s. Finally, the uncontrolled use of agrochemicals for decades has caused persistent contamination of soils, water, and human bodies. There can be little doubt that the dynamics of land use in Mexico and Central America over the last three quarters of a century show a representative and well-defined trace of the impact of the Anthropocene on the Earth system.

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Land Use in the Caribbean from 1950 to the Present

Johannes Bohle, Yann-Olivier Kersaint and Kevon Rhiney

On September 23rd 2017, only a few days after the two major hurricanes Irma and Maria in quick succession caused vast devastation across the Caribbean, Roosevelt Skerrit, then prime minister of Dominica, addressed the 72nd session of the General Assembly of the United Nations, beginning his speech by stating that: "I come to you straight from the frontline of the war on climate change." He further elaborated: "We in the Caribbean do not produce greenhouse gases or sulphate aerosols. We do not pollute or overfish our oceans. We have made no contribution to global warming that can move the needle. But yet, we are among the main victims, on the frontline" (Skerrit 2017). These remarks highlight two important aspects of the current era, often framed as the Anthropocene: First, the Anthropocene is characterized by global (environmental) change, which leads to a state of severe crisis. Current observed and projected changes for the Caribbean include an increase in land and sea surface temperatures, rising mean sea level, and shifting seasonal rainfall patterns (including, most notably, a decrease in wet season precipitation). There is also a strong possibility of a higher frequency of major hurricanes in the region (Bender et al. 2010; Karmalkar et al. 2013). Second, the causes and effects of global (environmental) change in the Anthropocene are unevenly distributed. In the Caribbean, these observed changes have serious socioeconomic implications, because the capacities to adapt and cope with the effects of global change vary at both the national and sub-national levels and are more often than not characterized by high levels of vulnerability (Bohle 2021; Rhiney 2015).

In analyzing the Anthropocene as a multiple crisis, one needs to consider the importance of temporal and spatial characteristics of human-environment relations. One area where these characteristics merge is land use. Land use can be seen as a materialization of human-environment relations; it is primarily defined by socioeconomic practices and environmental conditions. The most important of these practices and conditions in the Caribbean are the uneven distribution of arable land, the high coastal concentration of human settlement, as well as the economic disparities within Caribbean societies. The main process discernible out of such an analysis is the longstanding consumption, or "use," of Caribbean land(scapes) and its people (Sheller 2003). Land use is strongly embedded in the colonial history of

the region, the foundation of land use being the colonial plantation, which continues to shape contemporary land use practices across the region. It is, therefore, no surprise that land use is linked to ethical questions about (climate) justice (Perry 2021; Sealey-Huggins 2017) and reparations (Rauhut 2018), as highlighted by another prominent reaction in the aftermath of hurricanes Irma and Maria, in which Beckles (2017) makes the explicit connection between land use and the Anthropocene: "Irma-Maria blew away the roof of the long and ongoing imperial cover-up, and critically, was revelatory of the horrific history that dwells in the ruins of the present. […] The persistent loss of black life and the dereliction of poor peoples' materialism in a backward built environment that was designed for the sole purpose of servicing imperial sugar plantations reside squarely at the core of their respective metropolitan capitols." These two interventions highlight long-standing lines of thought of the Caribbean's place in modernity (Mintz 1966, 1986; Scott 2004) and hint at today's pressing challenges, both defined by the colonial-globalized past and present that shape the (im)possibilities of the region's future. As Sheller (2018: 971) puts it: "The devastating impacts of Hurricanes Irma and Maria across the northeastern Caribbean not only bring closer a world of immediate climate disaster and halting recovery, but also cast a long shadow of slow disasters and impossible futures for small island states in the face of significantly unstable and unpredictable climate patterns."

These interventions in the wake of immediate destruction by extreme climate events and fear of what futures might hold for the Caribbean also point, on an epistemological level, to blind spots of the Anthropocene discussion. From this standpoint, it seems indispensable to question "the racial and colonial logics of the abstract universal *anthropos* embedded in the notion of Anthropocene. Importantly, such critique has emphasized the uneven causes and consequences of global environmental change, as well as the unmarked whiteness and Eurocentricity of Anthropocene discourses" (Davis et al. 2019: 3). Thinking about the Anthropocene is an ethical venture in which the framing and conceptualizing of the analytical lens is important because the chosen framework (e.g., Anthropocene vs. Capitalocene vs. Plantationocene; Moulton and Machado 2019) renders in/visible where the causes and effects of ecological crises are to be found. The notion of the Anthropocene must be sharpened to fundamentally understand ecological crises regarding land use in the Caribbean. Land use in the Caribbean, therefore, needs to be understood within a framework that rejects universalizing, and, in this way, apolitical and naturalizing claims about an unspecified, all-encompassing "humanity." In view of this, the notion of the Plantationocene should be integrated in the debate on the Anthropocene, as it "points to the ongoing socioecological consequences of plantation agriculture and the permutations and persistence of the plantation across time and space" (Davis et al. 2019: 1). This chapter, therefore, uses the concept of the Plantationocene as an analytic to trace the ways the plantation logic extends into the

present moment through continued processes of extraction, land dispossession and racial capitalism across the Caribbean.

Along the same lines, this chapter rejects any ontological understanding of "the Caribbean" as a fixed entity. Rather, the authors propose to think with the Caribbean as an analytical space by discussing selected examples which highlight certain important changes in land use in the Caribbean with reference to the Plantationocene. While these empirically grounded examples cover a diverse range of Caribbean territories and manifold processes of land use change, many territories and processes are not covered here. The endeavor to explain quantitative and qualitative land use change in detail covering the vast area of the Caribbean as well as a timeframe of more than seven decades seems impossible given the length of this handbook entry. One of the few examples of such an endeavor is the book *Die Westindischen Inseln* by Blume (1968), which gives an extensive overview of the status quo of land use in the Caribbean in the mid-sixties. In contrast, due to changes in available data collection technologies, more recent literature often focuses on detailed small-scale surveys. Rienow et al.'s (2022) study *Detecting land use and cover change on Barbuda before and after Hurricane Irma with respect to potential land grabbing* being a case in point.

The question in this chapter is: How can the Caribbean help us understand the ongoing multiple crises unfolding in the contemporary era of the Anthropocene? In this sense, Gray (2004: 358) stresses that the central problem lies in the difficulty to capture the Caribbean's relationship "to capitalist civilization, to modernity and also how to address these issues in order to achieve an emancipated existence." Putting emancipation, or in other words, social and environmental justice, at the heart of an analysis of post-war land use change in the Caribbean, leads to a non-essentialist and relational understanding of land use of the Caribbean. Thinking with the Caribbean is an active practice that "may in fact be a form of post-Anthropocene experimentation" (Sheller 2018: 979). In this chapter, these processes and their effects on human-environment relations in the Plantationocene are accentuated through the lens of three axes of land use in the Caribbean since the 1950s: agriculture, urbanization, and services.

Land Use Patterns

Analyzing land use patterns in the Caribbean through the lens of the Plantationocene points to two distinct sets of human-environment relations. On the one hand, there is the capitalist-extractive mode of the cash-crop-plantation fueling manifold processes like industrialization, racial oppression, and ecological degradation. Mimi Sheller (2018) traces this from the Caribbean's initial forceful insertion into the world economy under European colonialism that led to indigenous genocide, African enslavement, the establishment, and expansion of the plantation

complex and its accompanying systems of indentured labor, imperialism, and racial capitalism spanning more than 300 years. In the second phase, Sheller describes the deepening and extension of this global system of power from the nineteenth century that was based almost entirely on extractive practices ranging from coal mining to the extraction of tar, guano fertilizer, and ultimately bauxite, oil, and natural gas.

On the other hand, the resistant-resilient mode of subsistence agriculture, as well as common land and collective practices outside the plantation, show that alternative forms of socio-ecological relations have long existed alongside and in opposition to the plantation. Small-scale farming, predominantly but not only for subsistence, is a major factor in land use in the Caribbean and of great economic, social, and cultural importance (Mintz 1985). While the historical plantation ceased to exist, these two modes are the basis for land use in the Caribbean. In this regard, thinking through the Caribbean also entails challenging notions of the human-nature divide and foregrounding the entangled character of human-environment relations (Bohle and Littschwager 2015; Ferdinand 2019).

Since the 1950s, land use in the Caribbean has been characterized by a general shift away from plantation agriculture, first towards primarily futile efforts to foster industrialization, which were later replaced by the widespread promotion and adoption of service-based economies (Mullings 2004). For centuries, Caribbean societies were founded on an agrarian-based economy producing (to some extent for domestic, but most notably) for export markets (Rhiney 2016), a trend that persisted up to the 1950s, thus dominating labor relations and land use patterns throughout the region. Starting in the mid-1950s, however, the economic significance of the agriculture sector in the Caribbean began to decline due in large part to efforts in promoting industrialization as a means for regional development. These efforts followed two distinct lines of thought: while some argued for import substitution strategies, others contended for a model called industrialization-by-invitation, the latter gaining more acceptance at that time. On the ground, these economic policies led to the intensification of non-agricultural activities, such as mining bauxite and drilling for oil, manufacturing (notably apparel export), and tourism. This development pattern further intensified in subsequent decades. While today, there exists domestic agricultural production with some export of agricultural products, as well as mineral exports, Caribbean economies are dominated by service-based economies: tourism, business process outsourcing (BPO), special economic zones (SEZ), and offshore financial services (Pantin and Attzs 2009).

In the way of discussing the three axes of land use taken up in this chapter, agriculture, urbanization, and services, this chapter aims to highlight the effects discourses, strategies, and practices have on human-environment entanglements across the Caribbean. The three axes below foreground what Leichenko and O'Brien (2008) call "double exposure," the drivers and effects of environmental change in-

tertwined with economic globalization, which merges at the intersection of capital, labor, and territory in the concept of the Plantationocene. The cross-cutting theme of the three axes is thus the plantation's racially biased extractive mode of labor organization, notably putting black and brown bodies in vulnerable positions (Yusoff 2018) and establishing systemic sufferation. Systemic sufferation "is experienced as the lived spatialization of endemic poverty […], and the inequalities and adversities that cause it. As such, it produces scalar repercussions that represent a protracted state of crisis that is not just a crisis of the state, which it is, but also a multiplication of everyday crises experienced with such regularity that their discreteness becomes indiscernible from the normative functioning of society" (Lewis 2020: 49). Thus, the formation of human-environment relations through socioeconomic practices and environmental conditions materializes in distinct discursive and corporeal Caribbean landscapes.

Axis I: Agriculture

Caribbean economies were founded on agriculture and have been an integral part of the global economy from as early as the sixteenth century (Best 1968; Klak 1998; Levitt 1991; Momsen 1998). For centuries, Caribbean economies have been geared towards supplying primary agricultural commodities such as sugar and bananas to metropolitan markets in Europe. Alongside the region's painful legacies of genocide, chattel slavery, and indentureship, the immense wealth generated from Caribbean plantation economies powered industrial revolutions in Western Europe and the wider North Atlantic (Mintz 1986).

Since the 1950s, agriculture's status (the sugar industry in particular) in the Caribbean has waned significantly as regional governments have sought to diversify their economies in light of changes in the international economy (Levitt 1991). During the interwar years and immediately after World War II, it became increasingly evident that agriculture alone could not satisfy the region's need for achieving economic growth, employment generation, and overall improvement of living standards for its growing population (Farrell 1980; Potter et al. 2004). Added to this were the structural challenges that were handed down over the centuries from the region's colonial past. Land was unevenly distributed and skewed primarily towards export-oriented plantation agriculture. As Beckford (1972) pointed out in his seminal book, *Persistent Poverty*, the establishment of plantation economies meant that the majority of foods were produced to satisfy demands in Europe's expanding metropolitan markets while cheap food products (like salted cod) were imported to sustain the local population. As a result, the best agricultural lands have traditionally been devoted to plantation agriculture, while domestic agriculture was confined to small fragmented and marginal lands (Mintz 1985).

The 1950s and 1960s represented a milestone period in Caribbean history. The post-war era not only saw growing calls for independence but went alongside a concerted effort to set the region on a new development trajectory based more on industry and services. Post-war development policy in the Caribbean was thus characterized by a deliberate attempt to shift away from agriculture towards industries that were to be fueled by foreign capital and technology. Lewis (1950; 1954) proposed a dual sector development model that became known as the "industrialization-by-invitation" model. The model recommended economic policies to stimulate industrialization through the facilitation of direct foreign investment, which was based on the rationale that agricultural production could not sustain Caribbean development. Lewis rejected import substitution strategies arguing that the region's domestic markets were too small to support such an approach. He also contended that the lack of local capital and knowledge presupposed the out-sourcing of investment and expertise (Blomström 1984; Figueroa 1996; Lewis 1950; Lewis, 1954; Lewis, 1955; Rose 2002).

This thinking dominated regional development policy up to the 1960s (Girvan 2005). There was an increasing shift away from agricultural exports towards non-agricultural activities such as bauxite, light manufacturing, and tourism (Bernal 1982; Girvan 1971; Girvan and Jefferson 1971; Jefferson 1972; Levitt 1991). Development was to be achieved by shifting the surplus labor from "backward" underperforming agricultural sub-sectors to more competitive manufacturing industrial activities. While Lewis did not recommend abandoning agriculture (Figueroa 1993; Figueroa, 1996; Rose 2002), he was critical of its economic competitiveness. Traditional agriculture was plagued by low productivity, low-income generation, and considerable underemployment. Aside from it being a supplier of surplus labor to the more modern industrialized sector, Lewis theorized that growth in other industries would, over time, create increased demand for agricultural products thus providing an impetus for furthering and modernizing agricultural development in the islands.

The Lewis-inspired policies of the 1950s and 1960s did not however transform Caribbean economies as anticipated. Factors such as the region's small size and limited natural resource base played a part in this. So did regional governments' failure to precisely follow the model's prescribed strategies (Conway 1998; Farrell 1980; Figueroa 1993). In reality, there was little attention to the promotion of manufactured exports and the forging of linkages between the different industries. This was exacerbated by the general neglect of agriculture (particularly domestic agriculture) in development policies across the region (Rose 2002; Timms 2008). In larger islands such as Jamaica, this went alongside rural depopulation, with people seeking salaried jobs in urban centers including resort towns.

Market protectionism and achieving self-sufficiency were emphasized during the 1970s, which was partly linked to different regional governments' engagement and experimentation with social democracy. In countries like Grenada and Ja-

maica, there were interests in land redistribution and increasing state-led support to smallholder farmers. This was, however, short-lived as the 1980s represented a period of intense market liberalization, increased privatization, and state retrenchment in the Caribbean. Caribbean economies were confronted with severe economic pressures arising from inflated oil and food prices, stagnant or declining economic growth rates, and widening national debt burdens (Timms 2008). As a result, more and more Caribbean states entered negotiations with the International Monetary Fund (IMF) and World Bank in an attempt to secure loans to help resuscitate their ailing economies. These loans came with rigid conditionalities that prescribed the application of neoliberal economic policies. This saw a reduction in state expenditures, removal of subsidies, and the progressive liberalization of domestic markets (Deere 1990; Klak 1998; Weis 2004), with agriculture (particularly support for domestic agriculture) being one of the hardest hits.

The impact of structural adjustment on agriculture in the Caribbean was substantial as the decline in government spending and trade tariffs meant reduced support for local smallholder farmers and increased competition from food imports (Timms 2008; Weis 2004). Research across the region demonstrates the extent to which the imposition of neoliberal development policies impacted the productive capacity of regional states (Ahmed 2004; Barker and Beckford 2008; Clegg 2004; Handa and King 2003; Mullings 2004; Timms 2006; Wiley 1998).

Since the 1980s, the deprioritization of the regional agriculture sector has continued. Progressive market liberalization and free trade policies have had a twofold impact on Caribbean agriculture. Commencing since the late 1970s, regional governments have come under increasing pressure to liberalize their domestic markets to facilitate more and more food imports. The removal of state support to local farmers and the liberalization of the food import regime have led to massive food importation – mostly highly subsidized processed foods from North America. For instance, Weis (2004) has shown how the liberalization of the Jamaican economy in the 1990s has threatened the viability of the island's agriculture sector and resulted in a flooding of cheap food imports in local markets. Later, progressive neoliberalism under the disguise of free trade policies handed down by the World Trade Organization (WTO) led to the removal of the region's preferential market access to Europe and a general lowering of world commodity prices. These have severely affected regional agricultural exports, particularly banana and sugar (Ahmed 2004; Blythman 2005; Clegg 2004; Momsen 2008).

Apart from the significant influx of food imports, Caribbean economies have had to contend with contracting world commodity markets and declining terms of trade for their few traditional exports. Caribbean vulnerability to globalization in general and to changes in the global trading environment was exposed by the WTO rulings on the European Union's banana regime and its associated impact on the small economies of the Windward Islands. This has led to the phasing out of prefer-

ential European market access for Commonwealth Caribbean banana producers in response to the WTO-imposed sanction in 2002 emerging from the dispute largely between the EU and several Latin American countries, who were supported by the United States acting on behalf of its banana companies. This resulted in banana production declining from rates as high as 92 percent of total exports in Dominica and 87 percent in St. Lucia in 1991 to 24 percent and 48 percent in 1999 respectively (Ahmed 2004; Bernal 2000).

Trade liberalization policies have thus had a profound impact on Caribbean agriculture. Throughout the Eastern Caribbean, former plantation lands have been converted to tourism attractions or being targeted for prime housing development schemes. Most Caribbean countries (probably with the exception of Guyana and Cuba) continue to be net importers of foods, with ever increasing food import bills. These problems are being compounded by a persistent decline in regional food production and exports, as well as by low levels of investments, limited transfer of technology, and a worsening labor crisis as more and more young people choose jobs outside of agriculture. Climate induced changes such as rising sea levels and shifting rainfall patterns, will likely compound the situation. Scientific studies are already showing that the amount of land suitable for agricultural production will likely decrease across the Caribbean in coming decades under a warmer and drier regional climate (Rhiney et al. 2018).

In sum, agricultural landscapes have experienced significant changes since the 1950s. Agriculture is no more the mainstay for Caribbean economies. This has given way to tourism and other service industries. The multiple overlapping crises of the sector are traceable back to the plantation system, highlighted by the decline of the sugar and banana industries without an adequate sustainable replacement. Recent shifts in population have gone alongside rapid urbanization and a concomitant decline in agricultural lands. Increasing amounts of agricultural lands are being converted to other land use activities such as housing, tourism, and manufacturing. The effects of anthropogenic climate change, notably shifting precipitation patterns and likely increasing number of major hurricanes, renders agricultural activity more and more difficult. And while agriculture remains an important source of livelihood for many rural households, the future sustainability of this important industry is very uncertain, which poses serious negative food security implications for the Caribbean.

Axis II: Urbanization

While agriculture has been the dominant factor shaping land use in the Caribbean since the sixteenth century, urban centers were, from the beginning, a pillar of the colonial plantation system. Scholars like Robert Potter have proposed models that conceptualize how the plantation system shaped urban development and land use

from the colonial era onwards (see, for example, the plantopolis model in Potter 1995). Otherwise, isolated plantations were connected in each colony through a single or small number of port towns that served primarily as administrative centers for trade and political control. Indeed, from the onset of European colonialism, Caribbean towns were set up to serve as ports, and administrative centers within a largely mercantilist system that facilitated the export of raw materials from colonies to metropolitan markets in Europe. These towns also served as retail outlets for imported goods from Europe but were never locations for manufacturing activities. As Clarke points out, these towns "were pre-industrial by predilection and proscription" (1974: 224). This also meant that these towns did not experience the same level of expansion that took place across western European centers in the eighteenth and nineteenth centuries, linked in large part to the industrial revolution.

Instead, the establishment of a plantation economy in the Caribbean relegated these colonies primarily as sites of extraction and agriculture, with limited urban growth. This meant that the majority of the population in these colonies lived outside of the urban centers, which served almost exclusively as sites for administering trade, agricultural exports, services, and various commercial activities. And while emancipation saw the emergence of free villages in the nineteenth century, urban growth and form experienced very little change. The rapid expansion of Caribbean cities only began in the 1950s driven by massive rural-to-urban migratory flows, a period that also coincided with many Caribbean territories becoming independent nation states and the growth of service industries. These flows towards urban areas were also fueled by the diminishing role of agriculture (as aforementioned) as well as by the representation of the move to the city as a way of social mobility and participation in modernity (Chamoiseau 1992). In the insular Caribbean, this resulted in a distinctive spatial polarization in terms of politics and economy alongside spatial concentration of population within one city, developed prior to the rural hinterland under strictly strategic military and economic aspects, playing a dominant role, framed as hypercephalism (*macrocéphalie*) or urban primacy in the literature.

According to Potter et al. (2004: 290), the total population of the Caribbean living in urban areas grew from 7.7 million (representing 38.2 percent of the total population) to 28.8 million (64.6 percent) from 1960 to 2000. Today, the Caribbean is a highly urbanized region with a distinct set of settlement structures and labor organization patterns. On average, almost 70 percent of the population in Caribbean territories is living in urban areas. Some territories even reach urbanization rates of over 90 percent (Dodman, McGregor, and Barker 2009: 366; Klaufus and Jaffe 2015: 64; Marc and Saffache 2011: 435). The large extent of urbanization produces a range of environmental and health issues for the population (Jaffe 2016). For instance, Martinique's capital Fort-de-France, saw its population grow from 60,000 inhabitants in 1954 to 100,000 in 1969. Today, 76,500 people live within the city limits (*commune*), as well as 152,000 in the wider area (*agglomération*) (INSEE 2021;

Martouzet 2001). The urban sprawl has manifested in the growth of urbanized areas in the city from 156 hectares (385 acres) in 1945 to 1,897 hectares (4,688 acres) in 2015 (Ville de Fort-de-France 2022: 60). Without substantial industrialization, the arriving new urban dwellers formed an increasingly large group of inhabitants who rely on precarious and insecure, often part-time, and disorganized low-paid labor. On most of the Lesser Antilles like Martinique, the migrating rural population settled in the peripheral, not yet urbanized, areas surrounding the city center: along the coast, rivers, and on steep hills. These areas are especially exposed to natural hazards such as flooding and landslides (Bohle 2018; Saffache 2000). On the Greater Antilles, where the capitals tend to be larger in terms of number of inhabitants, the incoming rural population often moves to inner city tenement housing, before eventually moving either to middle-income areas or informal settlements (Clarke 1974: 228; Potter et al. 2004: 304).

Alongside other social and economic factors (which can be found in urban areas all around the world), climate change notably poses enormous challenges for Caribbean cities, since these cities are located along the coast and are thus especially exposed to the threats associated with rising sea levels. All over the Caribbean, adaptation strategies designed especially for urban areas are set up to address various challenges related to coastal protection, resilient housing, and sustainable transport, to name a few areas (Rhiney 2015; Robinson and Butchart 2022).

Caribbean urban structure is also characterized by social-spatial fragmentation and residential segregation in very confined spaces. In the modern era, town centers adjacent to the colonial port with their old colonial commercial, administrative, and residential remnants have either become rundown areas characterized by low social status but still play an essential role for the local economy or have been transformed in rather cliché-ridden representations of a Caribbean city for touristic purposes. The most prominent example in point for the first case is downtown Kingston (Jamaica), where low-income households dominate and where the extensive *Coronation Market* is vital for the city's marginalized population in terms of food supply and small-scale economic activities. Some of the neighborhoods in Kingston's inner city have been shaped by long standing gang warfare and violence to an extent that today one may find stretches of vacant areas in central locations rendered uninhabitable (Gray 2004; Howard 2005; Jaffe 2015).

In cities like Kingston, the central business district has been moved from downtown to other areas. In this case, New Kingston has been built north of the inner city, where companies set up offices for white-collar workers in high-rise buildings. Also, middle- and high-income households have left the inner city and moved to suburban areas. While the tendency of middle- and upper-class movement to the suburbs – often accompanied by the establishment of U.S. style shopping malls or plazas alongside the roads leading from the city center to the suburbs – hints at a concentric pattern of land use alongside socioeconomic factors, the parallel settlement of

urban poor all over the urban area leads to a clutter of middle- to high-income areas located in close proximity to informal settlements and even peri-urban communities. This urban fragmentation in very confined spaces means that while e.g., low-income and high-income households are clearly spatially separated and form discrete communities, they are nevertheless located in close proximity. This leads to two sets of relations between different social classes. On the one hand, different housing areas are functionally interconnected, especially in terms of low-income areas providing a steady supply of low-paid labor for wealthier areas. On the other hand, lives of those living in different areas may be fully disconnected and their "transnational linkages are perhaps stronger than intra-urban ones" (Jaffe, de Bruijne, and Schalkwijk 2008: 9).

Due to the lack of housing, which goes back to the neoliberal approach "no housing policy as housing policy" which was outlined by Potter et al. (2004: 252) for the Eastern Caribbean, the poor migrants from the provinces organize themselves. Thus, makeshift squatter settlements emerge on the edges of cities. Where they are not displaced by the private sector or the state, they become entrenched over the years (Potter et al. 2004). This illustrates how the lack of prospects in the rural provinces leads to migration processes that result in renewed land use through urbanization and sprawl.

A recent urbanization process localized in Haiti is, on the one hand, very particular due to its genesis. On the other hand, it can be considered as an example of non-sustainable land use as a consequence of decades of centralization and extensive exploitation of the hinterlands and their people. In the aftermath of the earthquake on January 12, 2010, more than 1.5 million people were left homeless and more than 250,000 lost their life. Soon after the earthquake a decision was made that permanently changed the spatial organization of the country (Balandier 2015). Under intense pressure, a committee made up of the Haitian government, the international community, various NGOs, and the U.S. military decided to set up a tent camp about 18 kilometers from the gates of Port-au-Prince. This was followed by two presidential decrees in February and March 2010, which declared the surrounding area of approximately 33 square kilometers as an area of public utility (Petter et al. 2020). Who exactly made this first decision of placing the camp is difficult to reconstruct today and to a certain extent irrelevant. The fact is that in the mentioned area and beyond today stands one of the largest cities of the country. Called Canaan, the place is not formally recognized as a city but is home to more than 200,000 people (Sherwood, Smits, and Konotchick 2018: 226). Situated on an alluvial fan on the slope of the Chaine des Matheux mountain range and on the tectonic Matheux-Neiba fold, the settlement has neither a necessary sewage system nor permanent access to electricity. Surveys from Habitat for Humanity also found that basic earthquake-resistant construction techniques had not been followed for a majority of the buildings (Kersaint 2023).

In a close examination of the process of urbanization, it becomes apparent that this city is emblematic and the materialization of decades of exploitative land use. The Haitian ecological crisis is fueled by largely foreign agro-industries all over the country. The extensive monoculture cultivation of crops has a long tradition in the Caribbean islands. From sugar cane during colonial times to sisal and rubber during the twentieth century. Anthropogenic land use has not only exploited the land and the people who had to cultivate it. The profits generated were generally transferred elsewhere. These agro- and montane-industrial ventures usually acted ruthlessly regarding socially grown structures and the fertility of the soils.

In addition to the ecological crisis in large parts of the country produced by land use, this also led to a lack of social perspectives, whereby the former often reinforced the latter (Joos 2021). This is because the peasant communities that originally worked in social alliances, such as the *lakou*, could no longer exist due to the degradation of the soil after the foreign companies left. This devaluation of the structures in the provinces, together with the centralization that had already begun during the U.S. occupation (1915–1934), led to massive rural exodus since the beginning of the twentieth century, which intensified during François Duvalier's government, became extreme under Jean-Claude Duvalier, and has continued ever since (Anglade 1982; Godard et al. 2015). Thus, a continuity in the Plantationocene is evident in the axis of urbanization. The focus of spatial development – driven primarily by external actors – was not the production of living space for the people, but the further exploitation of the soil and the use of the land.

While special trade zones for the composing industry and the cultivation of cash crops are spatially organized, housing in Haiti functions as for other parts in the Caribbean according to the principle "let the poor provide for themselves" (Potter 2016: 252). Thus, since 1950, an extreme housing deficit has emerged in the Port-au-Prince metropolitan area, the magnitude of which was highlighted by the 2010 earthquake. Concerning the issue of housing in Haiti, the Port-au-Prince metropolitan area acted like a pressure cooker. The earthquake was the valve through which the pressure could escape, and Canaan the area that absorbed it. Thus, the entire area was urbanized within a few years, while the government turned a blind eye to the ongoing processes of influx. Following this principle, housing for at least 200,000 people was created in Haiti within ten years. However, this was accompanied by high risks for the population.

Canaan today not only represents the decades-long anthropogenic ecological crisis in the Haitian provinces, but the agglomeration itself produces new risks for the environment and the population living there. Due to the tectonic risk and the lack of control to comply with the *Comité interministériel d'Aménagement du Territoire* construction standards, an earthquake triggered by activities of the Matheux-Neiba fold could have dramatic consequences. Already now, parts of the agglomeration are repeatedly inundated by strong floods accompanied by transported debris. Even

more dramatic, however, is the contamination of the soil and groundwater. Due to the lack of a sewer system, in addition to hazardous substances from car repairs, for example, huge amounts of fecal bacteria enter the permeable alluvial soils using latrines (Jérôme et al. 2021).

Urban agglomerations are probably the most obvious anthropogenic overprinting of natural spaces. The removal and sealing of soils, the installation of infrastructures, the construction and transformation of space turns cities into cathedrals of the Anthropocene. It should not be forgotten that cities not only use the land on which they stand, but also exploit the urban hinterland. The use of concrete solidifies man's claim to be master over nature. At the same time, little represents the ecological crisis provoked by humanity more than this very concrete. And so, in Haiti in 2010, this very concrete led to arguably one of the largest man-made disasters in the twenty-first century. However, it did not cause a rethinking in relation to land use and urbanization, much more it dramatized the urban situation, as the example of Canaan shows.

Axis III: Services

Service-based economic activities, most notably tourism, business process outsorcing (BPO), and offshore financial services, play a crucial role in today's Caribbean. Nevertheless, from a land use perspective, there are significant differences within this sector. For instance, the offshore financial services take place in a deterritorialized manner: that means that while offshore financial services are an important source of income for some Caribbean governments, only few people in the Caribbean work in this sector and there are very few material traces of these economic activities in the region. Therefore, for an analysis of land use patterns, these activities are neglectable. The same holds true for a major employer in the Caribbean, the BPO industry, which primarily consists of data processing and call center services. In this case, a large amount of Caribbean workforce is involved, but the industry's labor is scattered and does not require larger areas of land. In its most extreme form, the lottery scams (Lewis 2020), labor is mostly detached from space as it is condensed to an individual or a small group and some smartphones or laptops. Tourism, however, is the sector which considerably transformed Caribbean landscapes. Tourism needs lots of land space and infrastructure and leads to massive resource consumption and environmental degradation.

The tourism industry in the Caribbean is based entirely "on (the idea of) unspoiled natural landscapes and an image of the region as paradise" (Jaffe 2009: 317). These notions are widely challenged in critique of contemporary mass tourism practices as neocolonial and neoliberal consumption and commodification of the Caribbean (Cruse and Marques 2013; Sheller 2003; Walcott 1993). From a solely economic standpoint, the tourism sector is of utmost economic importance for the

Caribbean. In the early 1960s, the steam shipping liner service (originally established for the banana export) eventually declined due to the rise of jet planes and the comparatively inexpensive air fares. In the beginning of the 1970s, the modern cruise ship industry began to form, and the former liners became the first operating modern cruise ships. Today, the Caribbean represents the main market for cruising with an estimate of 40 percent (Rodrigue and Notteboom 2013) of worldwide cruise passengers.

It is rather challenging to determine the exact numbers for tourism's contribution to the region's economies due to the issues surrounding data collection in the Caribbean. Nevertheless, the sheer number of visitors in context of the size of the Caribbean territories makes it clear that tourism is a major economic sector. In 2014, the 29 Caribbean Tourism Organization's member territories reported 22 million tourist arrivals plus 24.5 million cruise ship passenger arrivals that year (CTO 2015). The tourist's expenditures are an important factor in many of these territories and generate large double-digit shares of Caribbean territories' GDP. In the same vein, tourism accounts for a large share of employment (Pantin and Attz 2009).

Cruise ship tourism has some interesting insights into land use, as territorial detachment is a characteristic of cruise ships. The ships, as "mobile chunks of multinational capital," sail under so-called flags of convenience allowing them to avoid strict "labor, environmental, health, and safety laws" (Wood 2004: 160) and to minimize fiscal burden. Today's cruising is characterized by the fact that the cruise ships themselves are more important for their customers than the destinations of the cruise. In the extreme case, there is no connection to the region, neither onboard (supplies and employees are predominantly sourced from other regions) nor ashore (interchangeability of ports of call, or even avoidance of contact between tourists and residents by establishing private sites). It is often emphasized that stay-over tourists are better for local economies than cruise ship passengers, as the latter just spend a few hours ashore and do not need, for instance, accommodation and food. For example, data from 2000 shows that "[w]hile cruise tourists constituted about 42 percent of all tourists to the Caribbean […], they accounted for only 12 percent of expenditures" (Wood 2004: 159). Although these are not the latest figures, the ratio has probably not changed dramatically. Nevertheless, cruise ship terminals and related infrastructure like casinos and duty-free shops have been established all over the Caribbean. Even more so, since 1977, cruise lines have established private sites for their customers. Currently, cruise lines operate nine sites in the region, mostly referred to as "private islands." These enclosed sites are just as much detached from their respective territories as the cruise ships themselves. In many Caribbean locations, cruise ship tourism has led to major landscape transformation, contamination of land and water, air pollution, and the like. Cruise ship tourism thus represents another form of commodification and externalization (Lessenich 2016) of land and resources where profits and revenues are transferred

in other world regions while environmental impact is located and suffered in the Caribbean.

The Mexican federal state of Quintana Roo is another illustrative example for extensive land use on the grounds of mass tourism (Bohle 2021). Due to its geographic conditions and lack of exploitable resources, the region did not have many plantations in the colonial era, notable exceptions being *chicle* and *copra* plantations. For centuries, the densely wooded karst landscape at the eastern coast of Yucatán, was Mexico's outermost periphery, sparsely populated by indigenous peoples. Until the beginning of the twentieth century, the region was thus conceptualized as a peripheral hinterland and "empty" space. Only over the course of the twentieth century, the Mexican state started efforts to develop the region as part of the nation-state.

Since early in the 1950s, there have been more and more concerted efforts to populate the region by the Mexican government with the aim to establish *Nuevos Centros de Población Ejidal*. Parallel to this, in 1968, the Mexican central bank Banxico established a program to foster the development of the region as a tourist destination. The area's population grew immensely, from 27,000 in 1950 to 50,200 in 1960 to 1,857,985 in 2020. Today, most of the inhabitants (90 percent) are living in urban areas along the coast. Almost half of Quintana Roo's population (911,503) is living in the *Municipio* Benito Juárez, in other words, in and nearby Cancún (Boggio Vázquez 2008; INEGI 2020; Mendoza Ramírez 2004).

The well-known city of Cancún is the result of planning processes by the Mexican government, Banxico and later the *Fondo Nacional de Fomento al Turismo* (FONATUR). The overarching goal of these planning efforts was "to transform remote tropical lagoons and mangroves into an elite 'sea, sun, and sand' resort destination. […] To accomplish this mission, and to successfully attract the necessary capital, FONATUR turned 12,700 hectares of *ejidos* (communal lands) committed to the project into a city with two spatially enclosed and functionally segregated areas with differential access routes and infrastructure provision" (Córdoba Azcárate, Baptista, and Dominguez Rubio 2014: 100). Since the 1990s, the Cancún-model of tourism development was expanded under the plan of Ecological Land Zoning along the coast to the south to reorganize the entire coastline (Manuel-Navarrete 2012). The regional development is based solely on the region's commodification for mass tourism. In this way, the entire Caribbean coast of Quintana Roo was transformed into an urbanized touristic landscape within decades. In 2019, Quintana Roo counted 17,125,344 stay-over tourist arrivals and roughly 9,000,000 cruise passenger arrivals (SEDETUR 2022). The Cancún model was discursively framed as kick-off for the region's development with estimated positive effects for other economic sectors like agriculture and small industry, especially for the rural indigenous population. Though, in their analysis, Torres and Momsen argue that these positive effects did not take place and they conclude that the Cancún model "generated profit for the government, transnational corporations, and entrepreneurial elites, it has failed

to achieve backward linkages that may have improved conditions for the region's impoverished rural population" (Torres and Momsen 2005: 259).

The service sector, especially the tourism sector, reveals the competing perspectives on the region in a concise manner. While the tourism industry sells imaginations of an untouched nature, the reality is characterized by technically and energetically demanding large-scale projects. The tourism sector shows a clear continuity of colonial services. This is because the wants and needs of North Atlantic clients dictate the conditions and tasks of local workers. Especially when it comes to sex work, the control over the Caribbean bodies and thus the colonial continuity becomes particularly clear. Furthermore, as has been shown, tourism's profits do not end up in the hands of the local population to a larger extent. Thus, the service sector appears to be the anthropogenic driver of the ecological crises, starting with infrastructure, the CO_2 intensive transport of tourists by ship or plane, and the import of food and consumer goods. As it is the case with Caribbean cities, due to its coastal location, mass tourism infrastructure is highly vulnerable to climate-induced sea-level rise and growing intensity of hurricanes.

Conclusion

Land use in the Caribbean since the 1950s is marked by a series of continuities going back to the plantation system, as well as major shifts in a globalizing world. The socioecological consequences of the extremely extractive mode of land use in the Caribbean mount to multiple crises. The discussed examples highlight the main patterns regarding agriculture, urbanization, and services. It has become clear that these are in many ways intertwined. At the same time, there is a wide range of diverse and distinct processes which remind us of the great regional diversity in the Caribbean. In general, the shift from plantation-based agriculture to mining, composite industries, and tourism in the second half of the twentieth century occurred in the context of a more and more liberalized world economy. These economic changes had different manifestations and traits in the various Caribbean islands but have common features. The variations were largely shaped by different (neo-)colonial policies, the specific decolonization processes, divergent interests, and undertakings of the United States of America and resulting political regimen. Therefore, this chapter argues that the Caribbean should not be understood as a regional unit, but that the specific individual cases should always be examined. The overarching similarity is that the adjustments were not oriented to the needs of the peoples but primarily to those of foreign political and economic powers. For this reason, land use in the Caribbean was not designed for sustainability, but for short-term profits, without considering the consequences for the local population and its environment.

The commodification of land for export-oriented crop production, mining, and the tourism industry was accompanied by internal and external migration, and an overall undermining of social structures. The triggered rural exodus processes led to the transformation from rural to urban societies, which was often not accompanied by an improvement in living conditions, despite the hopes associated with it. So, while rural habitat was destroyed, no adequate urban habitat was created. Which lead to seemingly uncontrolled urban sprawl accompanied by the production of risk to people and the environment. With the migration to the cities, the former peasants became precarious workers as *petit commercants* on the streets or low-paid jobbers in the service sector. Moreover, land use was usually accompanied by massive environmental degradation. In particular, the monocultural cultivation of cash crops and the coal and steel industry left behind nutrient-poor soils. The extensive soil surface sealing alongside the coasts for the development of tourist centers, as well as the excavation of landing channels for the ever-larger cruise ships, led to the degradation of coastal areas and marine biotopes.

Nevertheless, uncertainty and risk are not new or unknown aspects of life in the region (Rohland 2021). Rather, the (dis)continuities point to the need to think about the Anthropocene in flux. The Anthropocene as an analytical concept has its limits, and the authors, therefore, suggest the integration of the Plantationocene into the debate to highlight where the drivers of land use are located: in the plantation system and the global capitalist system. The overarching extractive mode of organizing life and death (in human-human, as well as in human-environment relations), which "is predicated on the presumed absorbent qualities of black and brown bodies to take up the body burdens of exposure to toxicities and to buffer the violence of the earth" (Yusoff 2018), represents an unsustainable and unjust way of land use in the Caribbean. Land use in the Caribbean is thus – due to the outlined conditions of the Plantationocene – very much prone to disasters and driver of ongoing and overlapping crises. Extreme events like the hurricanes Irma and Maria reveal the closely intertwined effects of land use in the Caribbean. Thinking through the Caribbean about land use thus makes it clear that it allows to highlight the relevance of (environmental) justice within Anthropocene debates. For instance, in post-disaster reconstruction efforts after hurricanes, the biopolitical discourses and practices of different actors become evident (Bohle 2018; Bohle 2021; Bonilla 2020; Grove 2013; Grove 2014; Moulton and Machado 2019; Rhiney 2019; Sheller 2018). It seems crucial to resist the urge to just "bounce back" and continue the current mode of land use in the Caribbean, but rather to pause in order to think about how land use should be organized, in other words, to think about desirable Caribbean futures.

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Appendix

Biographical Notes

Narciso Barrera Bassols is a Mexican geographer and anthropologist dedicated to the study of Indigenous/peasant ontologies, epistemologies, and practices on nature for more than four decades. He holds a Ph.D. in Environmental Sciences from Ghent University, Belgium and the International Institute of Geoinformatics Sciences and Earth Observation, the Netherlands. He has been a National Researcher at SNI-CONAHCYT since 2005 and has a Level III rating. Currently, he is a full-time professor at the Faculty of Natural Sciences in the Environmental Geography program at the Autonomous University of Querétaro. His lines of research are Ecogeography, Environmental History, Rural Landscapes, Socio-Environmental Conflicts, Political Agroecology, Biocultural Diversity, Ethnoecology, Ethnogeography, and Ethnoedaphology. He has conducted fieldwork with Mesoamerican, Andean, Andalusian, and southern African peoples. He has published more than 150 international and national articles, books, and book chapters. He is an advisor to Indigenous and peasant organizations in Mexico and is a visiting professor at universities in Colombia, Brazil, Argentina, and Spain. Founder of the Thematic Network of Biocultural Heritage of CONAHCYT in his country. He has coordinated the International Diploma in Agroecology for Sustainability from 2015 to date. He currently coordinates the Political Agroecology Working Group of the Latin American Council of Social Sciences (CLACSO).

Gerónimo Barrera de la Torre is a postdoctoral researcher at Brown University, under the Emerging Voices Fellowship program of the American Council of Learned Societies. He conducted his doctoral studies at the University of Texas at Austin in the Latin American Studies program (LLILAS-Benson). His topics of interests are Indigenous/campesino, critical and political geographies, political ecology, critical cartography, and collaborative methodologies, particularly social mapping and documentary video. He has worked with Indigenous Chatina and peasant communities in Oaxaca, Mexico, exploring local knowledge and history, and the effects of forest conservation on communal lands, forest commodification, and social differences among communities in the same region. He has recently published a book chap-

ter on "Social Cartography in Latin America" (Routledge, 2023), and co-published the article "Guarding the colonial woodlands: a genealogy of discourses on forest conservation in Bourbon's eighteenth-century New Spain (Mexico)" (Journal of Historical Geography, 2022). Finally, he will co-author the book *Society Despite the State. Reimagining Geographies of Order* (2024) with Pluto Press.

Johannes Bohle is a geographer and works as an urban planner focusing on bicycle transportation planning in the Stuttgart metropolitan area. Previously, he taught geography and geography education at *Europa-Universität Flensburg*. His dissertation was completed at Bielefeld University's Center for InterAmerican Studies and examined the governmentality of hurricane riskscapes in the Caribbean. For seven years, he was member of the Socare (Society of Caribbean Research) executive board. His research in the Caribbean is based on extensive fieldwork in Martinique, Dominica, Jamaica, Florida, and Quintana Roo. It led to publications on human-environment relations ("Caribbean Entanglements," 2015), the spatial dimension and biopolitics of extreme events ("Hurricane-Riskscapes and Governmentality," 2018), and climate change adaptation ("Sustainable Urban Planning?", 2018). Currently, he is co-editing the book "Politics of Education in the Caribbean and its Diasporas."

Juan Manuel Cerdá holds a Ph.D. from the National University of Quilmes (UNQ), a Master's degree in Contemporary European and Latin American History from Torcuato Di Tella University, and a Specialist degree in Statistics Applied to Social Sciences from the Center for Statistics and Information of FLACSO-IDES. Currently, he is an Independent Researcher at CONICET and a research professor at UNQ. His research areas focus on socio-environmental inequalities in Argentina, particularly in relation to the wine sector and its sustainability from a historical perspective.

Rafael Chambouleyron has been Professor at the *Universidade Federal do Pará*, Brazil, since 1996. He obtained his PhD from the University of Cambridge, in 2005. He studies the history of colonial Amazonia, focusing on its territorial occupation, Indigenous and African labor, and economic dynamics. In 2023, he edited a book on the production, trade, and circulation of Amazonian spices, entitled *As drogas do sertão e a Amazônia colonial portuguesa* (Centro de História da Universidade de Lisboa, 2023).

Nicolás Cuvi is a biologist who holds a Master's in Scientific Communication and a Ph.D. in History of Sciences from the Autonomous University of Barcelona. Since 2010, he has been a tenured research professor at the Latin American Faculty of Social Sciences (FLACSO Ecuador). He currently coordinates the Ph.D. in History of the Andes, and researches the history of environmental sciences and environmental history in the Andes and the Amazon, climate change, environmental ethics, and environmental humanities. In 2023, he jointly received the honorable mention in the

Humboldt-Caldas Medal Award, granted by the Colombian Academy of Exact, Physical, and Natural Sciences, for the article "Changes of Cinchona distribution over the past two centuries in the northern Andes" published in *Royal Society Open Science*. His latest book is *Historia ambiental y ecología urbana para Quito* (FLACSO and Abya Yala, 2022). He participated as lead author in the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. He is a member of the Ecuadorian Academy of Sciences, the Latin American and Caribbean Society for Environmental History, the Science Panel for the Amazon, and collaborates regularly with the Occupy Climate Change! project and its *Atlas of the Other Worlds*.

Leida Fernández Prieto is Senior Researcher in the Institute of History of the Spanish National Research Council (CSIC), with research interests in the history of agricultural science and knowledge, as well as Caribbean environmental history. She earned her Ph.D. in the History of Science from the University of Havana, Cuba in 2005. She was Visiting Scholar in the David Rockefeller Center for Latin America Studies (DRCLAS) at Harvard University and in the Center for Latin American and Caribbean Studies at New York University. Her publications include *Espacio de Poder, Ciencia y Agricultura en Cuba, 1878–1917* (CSIC, Editorial Universidad de Sevilla, Diputación Provincial de Sevilla, 2008) and *Cuba Agrícola: Mito y Tradición, 1878–1920* (CSIC, 2005). She is also the author of "Island of Knowledge: Science and Agriculture in the History of Latin America and Caribbean" (*Isis*, 2013); "Agriculture as Connectivity. How to Write the History of Sciences in Latin America and the Caribbean" (*Handbook of the Historiography of Latin American Studies on the Life Sciences and Medicine*, Springer Nature, 2022), and "Circulation of knowledge of Tropical Commodities" (*Handbook of Commodity History*, Oxford University Press, 2023).

Reinaldo Funes Monzote is Professor of History at the University of Havana and Coordinator of the Geo Historical Research Program at the Antonio Nunez Jimenez Foundation in Cuba. He is a member of the Academy of History of Cuba and President of the Cuban Society for the History of Science and Technology. He is the author of *From Rainforest to Cane Field. A Cuban Environmental History since 1492*, 2008, awarded with the Elinor Melville prize by the Conference on Latin American History. This is the English version of the original Spanish book titled *De bosque a sabana. Azúcar, deforestación y medioambiente en Cuba: 1492–1926*, winner of the Caribbean Thought Award in 2003 and published by Siglo XXI de México Editores in 2004. In Cuba, it was printed in a new Spanish version, receiving the Catauro Award and the Critics Award in 2009. In 2019, his book *Nuestro viaje a la Luna. La idea de la transformación de la naturaleza en Cuba durante la Guerra Fría* received the Casa de las Américas Award, Cuba, within the category of Socio-historical essay. He is co-author of *Reconstructing the Landscapes of Slavery. A Visual History of the Plantation in the Nineteenth Century Atlantic World* (The University of North Carolina Press, 2021) and coeditor of

Usos agrarios, mensura y representación en Cuba, siglo XIX (Editorial Imagen Contemporánea, 2023). His work in this volume was made possible by the support of the Davis Center Department for Historical Studies at Princeton University.

Margarita Gascón earned her Master and Ph.D. from the University of Ottawa, Canada. She is a tenured researcher of the National Council for Scientific and Technological Research (CONICET) in Argentina and teaches at the undergraduate and graduate levels in Mendoza. Her research interests are in the field of colonial Latin America and environmental history. Among her most recent publications are the afterword to *De viejas y nuevas fronteras en América y Europa* (Universidad Finis Terrae, 2022) and the chapter "Las múltiples identidades étnicas en la frontera colonial del último sur hispanoamericano," in *Critica de la Razón Indígena* (Universidad Nacional de La Plata, 2023). She is a co-editor of the book *More-than-Human Histories of Latina America and the Caribbean* (University of London Press, 2024).

Carolina Hormaza is a doctoral candidate in History at Bielefeld University, a member of the Center for InterAmerican Studies, and academic coordinator of the Volkswagen-project *Convertir la Tierra en Capital* (Turning Land into Capital). Carolina holds a B.A. in Sociology and an M.A. in Spatial Planning from the National University of Colombia. In her thesis, Carolina analyzes concepts from German geography on agrarian colonization in Latin America between 1950 and 1970. Carolina has been spokesperson for the Young Researchers Group of the German Association for Latin American Studies (ADLAF) since June 2022. Her research interests include the global history of science and its interweaving with the agrarian history of Latin America in the twentieth century. Her latest publications include the co-authored paper "Shifting perceptions or shifting attention? The local press, Venezuelan migration, and hostile perceptions in Colombia" (*Estudios sobre el Mensaje Periodístico*, 2024), the book chapter "El espacio vital y el espacio natural en los estudios sobre la Amazonia Andina colombiana del geógrafo Ernesto Guhl Nimtz." in *La Amazonía Andina en el siglo XXI: ambiente, territorio y existencias* (Editorial CLACSO-CALAS, forthcoming), and "La fotointerpretación y la geografía alemana sobre la colonización agraria en Costa Rica 1958–1968 in Allevi" in *Saberes globales y expertos locales en América Latina en el siglo XX* (Wbg Academic, forthcoming).

Pablo Ibañez Bonillo has been Researcher at CHAM – *Centro de Humanidades (Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa)* since February 2019. Principal Investigator (PI) of the coordinating institution of the MSCA Staff Exchanges project: "EDGES – Entangling Indigenous Knowledges in Universities." He holds a Ph.D. in History of America at the *Universidad Pablo de Olavide* (2016) in cross-affiliation with the University of Saint Andrews (2016). He was a Post-Doctoral Fellow at the *Universidade Federal do Pará*, Brazil (2017–2018). He was Chief Editor

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Olaf Kaltmeier is professor of Ibero-American history at Bielefeld University and director of the Maria Sibylla Merian Center for Advanced Latin American Studies in the Social Sciences and Humanities (CALAS). At Bielefeld University he was founder of the Center for InterAmerican Studies (CIAS). Since 2023 he is also director of the collaborative international VW-reseach project "Turning Land into Capital: Historical Conjunctures of (Re-)Production of Wealth in Latin America from the 19th to the 21st century". His lines of research are indigeneity, social movements, space and landscape, environmental history, state formation, inter-American studies. He has conducted research and teaching in Chile, Bolivia, Ecuador, Argentina, Mexico, Peru, and the United States. He has published more than 200 international and national articles, books, and book chapters. His latest monographies include *Resistencia Mapuche. Reflexiones en torno al poder siglos XVI a XXI* (Pehuén: Santiago de Chile 2022), *Refeudalización. Social, economic and cultural political inequality in Latin America in the early 21st century* (BiUP: Bielefeld 2018), and *National Parks from North to South. An Entangled History of Conservation and Colonization in Argentina* (WVT/UNO: Trier, New Orleans 2021).

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Évelyne Mesclier holds a Ph.D. in Geography. She is director of research at the IRD (French Institute of Research for Development) and qualified to supervise thesis research at the University of Paris 1-Panthéon-Sorbonne. She is a member of the PRODIG laboratory and was director of the IFEA (French Institute of Andean Studies) between 2016 and 2020. She is co-director of the journal *L'Espace géographique*. She has studied the transformation of rural spaces between the time of agrarian reforms and the restructuring of land ownership in the neoliberal project, on the basis of cases located mainly in Peru. She has participated in several collective projects and has coordinated international research on policies and strategies related to spaces considered as peripheral in the context of contemporary globalization. Her recent publications include the co-authored chapter "Using Scientific Modeling for Adaptation of Agriculture to Climate Change: A Political and Organizational Challenge" in *Development and Territorial Restructuring in an Era of Global Change* (Wiley – ISTE, 2022) and "Agricultures familiales et territoires dans les Suds" (IRMC-Karthala, 2022), as well as the paper "El desarrollo territorial ¿una trampa para los campesinos peruanos?" (*Eutopia. Revista de Desarrollo Económico Territorial,* 2016).

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