

Chapter Title: INTRODUCTION: WRITING A GLOBAL ENVIRONMENTAL HISTORY OF SOYBEAN FARMING DURING THE GREAT ACCELERATION

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Book Title: The Age of the Soybean

Book Subtitle: An Environmental History of Soy During the Great Acceleration

Book Editor(s): Claiton Marcio da Silva, Claudio de Majo

Published by: White Horse Press. (2022)

Stable URL: <https://www.jstor.org/stable/j.ctv309h1fx.6>

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INTRODUCTION: WRITING A GLOBAL ENVIRONMENTAL HISTORY OF SOYBEAN FARMING DURING THE GREAT ACCELERATION

Claudio de Majo and Claiton Marcio da Silva

The soybean is far more than just a versatile crop whose derivatives serve the protein needs of a meatless diet. One of the world's most important commodities, soy represents the embodiment of mechanised industrial agriculture and is one of the main actors behind the socioeconomic, political, and ecological transformations of industrial farming in several world regions. Snowballing soybean expansion has mobilised different social actors, with scientific research and the free market playing a decisive role in the grain's nutritional and industrial ubiquity. Extending this argument, we could say that we live in a world dependent not only on fossil fuels but also on soy. At the core of this dependency lies the combination of the market and scientific research that has allowed soy to increase productivity, adapt to less fertile soils and be used in a wide range of products: from oils and animal feed to mattresses and cars. Soybeans have been adapted to areas previously unthinkable, such as the cold regions of Russia and Great Britain and the North American state of North Dakota. The advances obtained by this combination of scientific research and market might in future mitigate the effects of harmful activities linked to soy. For example, it could potentially increase its contribution to global protein demand, balancing the impacts of the global livestock industry.

Following this line of thought, the problem is not soybeans themselves, but the high social and environmental price paid for the rapid expansion of the crop in the last sixty years – a 1,200 per cent total production increase since 1961.¹ This expansion has been at the expense of territories previously

1 See H. Ritchie and M. Roser, 'Soy', *Our World in Data*. Available at <https://ourworldindata.org/soy> (Accessed 29 June 2022).

THE AGE OF THE SOYBEAN: 5–15 doi: 10.3197/63800040695086.intro

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dedicated to polyculture or cereals, and it continues apace, advancing over savannah and forest ecosystems. As recently as 2019, Eliseu Guarani-Kaiowá, a Brazilian indigenous leader, declared that ‘our blood irrigates the soya consumed in Europe’,² directly linking the expansion of soybean monocultures to the eviction and murder of indigenous peoples and other traditional populations. Currently, soy is the world’s third most important commodity in production and export, totalling 350 million tonnes harvested annually (250 million of which are almost equally shared by Brazil and the United States, the world’s leading producers). Although soy is an essential asset in the diets of vegans and vegetarians, less than twenty per cent of global production is destined to direct human consumption (mainly cooking oil, milk, and tofu). The remaining amount primarily serves as animal feed, fuelling the global livestock industry (about 77 per cent) and, to a lesser extent, for other industrial purposes (e.g., biofuels, lubricants, etc.).³

Considering the dramatic changes brought by soy expansion, this book discusses the global history of this expansion from an environmental perspective, through various theoretical-methodological lenses. The main chronological focus is a judgement call: the post-World War II epoch – what John McNeill and Peter Engelke have defined as the Great Acceleration.⁴ In several world regions, this process has proved indissolubly linked to the rise of mechanised industrial agriculture with socio-economic, political and ecological consequences. Due to their versatility and resilience, soybeans have played an essential role in regional dietary regimes and rotational agricultural techniques. Since the 1950s, soybean farming has become one of the most valuable agricultural commodities on the global market.⁵ As a result, several countries have heavily invested in biotechnologies to convert soybeans into cash crops. In particular, with the crop’s adaptation to tropical climates since

2 R. Belincanta, ‘“Nosso sangue irriga a soja consumida na Europa”, denuncia comitiva indígena em Roma’, *RFI* 21 Oct. 2019: <https://www.rfi.fr/br/brasil/20191021-nosso-sangue-irriga-soja-consumida-na-europa-denuncia-comitiva-indigena-em-roma> (Accessed 29 June 2022).

3 Ritchie and Roser, ‘Soy’.

4 On the Great Acceleration, see J. R. McNeill and P. Engelke, *The Great Acceleration. An Environmental History of the Anthropocene since 1945* (Cambridge, MA: Belknap Press of Harvard University Press, 2014). On the role of soybean during the Great Acceleration, see C.M. da Silva and C. de Majo, ‘Genealogy of the Soyacene: The tropical bonanza of soyabean farming during the Great Acceleration’, *International Review of Environmental History* 7 (2) (2021): 65–96.

5 On the historical appreciation of soybean’s qualities see I. Prodöhl, ‘Versatile and cheap: A global history of soy in the first half of the twentieth century’, *Journal of Global History* 8 (3) (2013): 461–82. On the role of soy as an international commodity, see e E. Langthaler, ‘The soy paradox: The Western nutrition transition revisited 1950–2010’, *Global Environment* 11 (1) (2018): 79–104.

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the 1970s, several countries of the Global South (especially Latin American ones) have specialised in expanding monocultural production. As a result, soy has rapidly replaced cereal fields, orchards and other spaces typically used for family agriculture and small-scale production in only a few decades. Moreover, soybean cultivation occurs at various scales; it is easier to find large farms in the top ten producing countries – Brazil, the United States, Argentina, China, India, Paraguay, Canada, Russia, Ukraine and Bolivia.⁶ However, the advance of large soybean farms is also discernible in smaller producers such as Mexico, Mozambique, and Colombia. In these countries, the conjunction between favourable market prices and soybean's versatility and resilience has led local farmers to replace crops such as lentils, corn and vines, as well as animal breeding. The conjunction of these factors has turned Global South countries with extensive agricultural frontiers and the United States into the planet's ideal territories for soy production. Together, Argentina, Bolivia, Brazil, Paraguay, Uruguay, India, and Mexico produce more than half of global soya yields. Brazil and Argentina yield almost 160 million metric tons (MMT) combined. The other half is primarily occupied by the United States and China, among the world's top five producers.⁷

Controversially, soybean monocultures producing cash crop commodities have brought both positive and negative economic and socio-environmental consequences. On the one hand, soy commodities have brought economic prosperity to several peripheral territories, generating crucial sources of wealth for countries that have invested in social programmes, such as Brazil and Bolivia. The high dollar price against local currencies has encouraged the export of primary products such as soy and beef since the early 2000s. For economists and politicians, this investment choice towards agriculture and cattle ranching has relieved the effects of the 2008/2009 world economic crisis, generating revenues that are then invested in heating the domestic market. Revenues from the soybean sector, and from agribusiness in general, have also been used to sustain income transfer programmes and social policies in leading producing countries such as Brazil and Argentina.

On the other hand, the proliferation of soybean monocultures has generated controversial effects for society and ecology. As soy has swelled the

6 The Science Agriculture, *Top 10 Biggest Soybean Producers in the World*: <https://scienceagri.com/top-10-biggest-soybean-producers-in-the-world/> (Accessed 29 June 2022).

7 For further information, see J. Karunga, '10 countries with largest soybean production', *World Atlas* (30 August 2018): www.worldatlas.com/articles/world-leaders-in-soya-soybean-production-by-country.html (Accessed 29 June 2022).

pockets of big landowners, the rise of agricultural monopolies has determined the forced eviction of landless populations and the dismantlement of their traditional lifestyle. Since its approval in Latin America during the 1990s, GM soy has overwhelmingly dominated the agricultural sector, increasing farmers' dependence on seed-producing multinational agribusinesses and affecting the biodiversity of entire bioregions. Although countries like India have maintained their cultivation from non-transgenic seeds, other activities leading to socio-environmental damage are generated by large-scale cultivation, such as use of pesticides or high consumption of water resources. While the dramatic consequences illustrated above are relatively well-known among environmental organisations and policymakers, they are only part of a complex global network that links western markets with powerful geo-economic entities such as China and the European Union, while at the same time side-lining traditional and alternative forms of production.

Over recent years, the rapidly changing global and environmental dynamics characterising soybean farming have prompted scholarly attention. From East to West, soy as a research topic has mobilised researchers of various trends and approaches. In recent years, essential monographs on the subject have been published, such as Christine DuBois' *The Story of Soy* (Reaktion Books, 2018), which addresses the transformation of the soy crops from their first domestication efforts in the Far East to their ubiquitous presence on the global food-chain in the present. Equally important, in *Rethinking Revolutions: Soybean, Choupals and the Changing Countryside in Central India* (Oxford University Press, 2016), Richa Kumar addresses, from extensive ethnographic and documentary research, the changes brought about by the advance of soybean in Central India. On Latin America, Matilda Baraibar Norberg's *The Political Economy of Agrarian Change in Latin America* (Palgrave Macmillan, 2020) addressed the cases of Argentina, Uruguay and Paraguay, demonstrating the different actors that came together in the composition of the food chain connecting Latin America's Southern Cone to the global market, mainly for beef and soybeans. More specifically referring to Argentina, Pablo Lapegna's *Soybeans and Power: Genetically Modified Crops, Environmental Politics, and Social Movements in Argentina* (Oxford University Press, 2016) and Amalia Leguizamón's *Seeds of Power: Environmental Injustice and Genetically Modified Soybeans in Argentina* (Duke University Press, 2020) address the contestable rise of GM soy crops, a springboard for the introduction of GMOs all over Latin America.

While several recent publications have successfully unveiled the key

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historical drivers of the rise of soybean in the global food chain, the environmental impacts of this transition are an ongoing process that will continue permeating our society for years to come. The growing dependency of global markets' on the numerous soybean varieties yielded at different latitudes will undoubtedly determine the continuation of such international exploits. This volume is thus timely in tackling the challenge of exploring the biological and environmental transformations determined by the rise of soy in global food chains. Recent research efforts have begun to outline the first sets of thematic guidelines and potential historical narratives linked to the rise of this leguminous crop on the world stage. In attempting to move beyond the one-sided term *Soylandia*, these studies have proposed concepts such as *Sojización* and *Soyacene* to convey the complex political and techno-scientific entanglements and power relations brought by soybean's planetary expansion.⁸ Yet, this comprehensive analytical framework still lacks the empirical corpus to assess the multiple economic, social, technological and environmental facets. The present book addresses this significant gap, proposing a wide-ranging global environmental history of soybean farming, mainly centred upon the Great Acceleration.

Building on the growing corpus mentioned above, this book represents the first attempt to address these challenges, proposing one of the most significant efforts to date at an environmental history of soybeans. Its pages gather a wide range of researchers of various nationalities, addressing broad regions and the dispersion, increased demand for, production and consumption of soy, with attendant socio-environmental effects. In unpacking the multi-scalar histories of soy farming, emphasising impacts on ecology and society, the research team that collaborated on this project includes environmental, social and economic historians, STS scholars, anthropologists, public health and policy managers and geneticists. Such a wide range of expertise has significantly enriched the traditional historical approaches with ethnographic and scientific contents.

As a result, the chapters in this book cover a wide geographical range, examining soybean histories in countries including Japan, China, India, Zimbabwe, Brazil, Argentina, Uruguay, Paraguay, Germany, the Nether-

8 On *Sojización*, see Matilda Baraibar Norberg, *The Political Economy of Agrarian Change in Latin America: Argentina, Paraguay and Uruguay* (Cham: Palgrave Macmillan, 2020). On the *soyacene*, see C.M. da Silva and C. de Majo, 'Towards the Soyacene: Narratives for an environmental history of soy in Latin America's Southern Cone', *Historia Ambiental Latinoamericana y Caribeña (HALAC)* 11 (1) (2021): 329–56.

lands and the United States; and simultaneously addressing both national and transnational or world/global histories. The volume is divided into five parts, addressing different moments of soy production and its environmental impacts. Through this vast selection of empirical and methodological content, the contributors strive to add historiographical nuance to previous scholarly efforts while at the same time hoping to inspire related research agendas.

Part I provides three comprehensive historical overviews of soybean cultivation before the Great Acceleration, mainly focused on Asia and the Americas. While chronologically situated outside our intended framework, these are necessary to help readers situate early soybean farming experiences in time and space and understand the multiple environmental challenges. Despite it being virtually impossible to retrace the complex genealogy of soy in the limited space of a few book chapters, the nuanced analyses featured in this volume allow us to partly solve what is perhaps the most complex task for any historian – namely what Marc Bloch would define as the ‘myth of origins’. In the first chapter, Samira Peruchi Moretto, Eunice Sueli Nodari and Rubens Nodari trace a general overview of soybean’s biogenetic characteristics, contributing to its worldwide success. Drawing from complex bio-genetic notions, they speculate on the origins of soy and the possible factors that allowed this resilient legume to adapt to different geographical and climatic contexts. Such an ambitious reconstruction is continued in the second chapter, where Brian Lander and Thomas DuBois propose a *longue durée* case study on soybean farming and its multiple nutritional uses in China, allegedly the cradle of soy domestication and the first region of the world where it became a staple crop. Intriguingly, most of the agricultural and environmental challenges brought by the expansion of soybean farming in the Chinese context will return in other geographical and historical contexts. The third chapter, authored by Rhuan Targino Zaleski Trindade, closes the circle, interlinking early soybean farming experiences in southern Brazil with Polish farmers who migrated overseas between the late nineteenth and early twentieth centuries. The adoption of this Asian crop among Polish communities, led by intellectual Ceslau Biezanko, constituted one of the first steps towards the rise of the crop in South America, today the world’s primary production hub.

Part II discusses the economic dynamics that led to the global expansion of soybean during the Great Acceleration, emphasising global food chains. In the fourth chapter, Ernst Langthaler sets the tone of this discussion, looking at the process of agro-food globalisation witnessed by an essential

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crop commodity such as soy since the mid-twentieth century. Drawing from a vast set of empirical data, the author outlines the different phases that characterised soybean commodity networks from the 1950s to the present and their relations with dramatic global socioeconomic and environmental transformations. Similarly, in the fifth chapter, Matilda Baraibar Norberg looks at the main economic drivers that led to the progressive marketisation of soybean in Latin America – what several scholars from Spanish-speaking countries have defined as *sojización*. Using Karl Polanyi's seminal book, *The Great Transformation*, as a litmus test, the author explores the multiple historical market shifts and continuity that propelled *sojización*. While Baraibar Norberg primarily focuses on national market dynamics in Hispanic countries, the sixth chapter, authored by Cassiano de Brito Rocha, Kárta de Jesus Boaventura, Giovanni de Araujo Boggione and Sandro Dutra e Silva, looks at the dynamics of soy commodification in Brazil. In particular, it focuses on the economic region of Matopiba, the country's last soybean frontier belonging to the Cerrado savanna bioregion. Drawing from empirical sources and remote sensing detections, the chapter analyses land utilisation patterns linked to the soybean frontier expansion over the last fifty years and its projected future growth.

The following three sections complement the global reach of the previous one, delving into localised histories and experiences linked to the acceleration of soybean farming since the mid-twentieth century. The third part provides a fine selection of the different ecological milieus affected by the rising age of soybeans. In Chapter Seven, Eduardo Relly and Claudio de Majo explore the unknown igneous geographies of soybean in several bio-regions of Latin America. Although fire played a crucial role in developing millennial coevolutionary human-nature interactions in many of these territories, it also became one of the main tools propelling the tropicalisation of soybean farming. The result was an indissoluble relationship between the rise of soybean monocultures and fire-based forest clearing and destruction. While fire contributed to the unfolding of the age of soybeans, water supplies were progressively affected by the same phenomenon. As shown by the eighth chapter, authored by Larissa de Lima Trindade, John Hoornbeek, Mutlaq Albugmi, Joshua Filla and Rodrigo Fortunato de Oliveira, the massive growth of soybean has provoked dramatic water contamination issues both in Brazil and the US. Drawing from a large corpus of scientific literature, the authors also explicitly link the risks of water contamination with adverse health effects on the rise. The section closes with chapter nine, where Enrique

Antonio Meija discusses the impact of intensive soybean farming on the soil nitrogen cycle of the Argentinean Pampas. Adopting an original theoretical framework, the chapter looks at the often-unaccounted dynamics of ecological exchanges permeating the global nitrogen trade and their hidden socioeconomic costs.

Just as natural milieus have historically borne the mark of intensive soybean farming, this leguminous crop has dramatically reshaped nutritional habits and technologies. Part IV addresses these transformations in several world regions throughout the last decades. In Chapter Ten, Anna Zeide illustrates the multiple uses of soybeans in Northern America from the 1950s, often unrecognised in contemporary scholarship. As the author demonstrates, the incredible versatility of soy allowed it to become a mainstay of American diets, utilised as a core of different food production processes and animal nutrition. Meanwhile, countercultural movements also increasingly adopted soy as a meat and dairy substitute. While soy entered American diets through the back door, the eleventh chapter demonstrates how scientific soybean imaginaries influenced public opinion and production choices in the European continent. By focusing on the example of Germany, Janina Priebe brings to light scientific visions and socio-technical imaginaries linked to soy throughout the twentieth century. As the author demonstrates, these imaginaries provided the breeding ground to transform soy into an age-defining commodity, inaugurating a trend whose social, economic and environmental developments would accelerate from the 1950s onwards. Moving to the southern hemisphere, Jo Klanovicz's chapter provides a fascinating example of the biotechnological innovations that allowed the subtropical regions of southern Brazil and Paraguay to become world-producing leaders. However, as Klanovicz demonstrates, such leadership comes with a price, as local soybean agrolandscapes entail radical shifts in labour, land, capital and technology relations. The immediate consequence of this revolutionary set of transformations is perhaps best reflected in present debates opposing advocates of genetically modified soybean breeds and defenders of organic farming. However, such discussions do not belong just to the southern hemisphere. As the chapter authored by Erik van der Vleuten and Evelien de Hoop demonstrates, sustainability debates have permeated public discourse over the last five decades in the Netherlands. Drawing from a vast array of studies, the authors argue for the historiographic need to incorporate discussions addressing the relationship between soybean consumption at a

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regional level (both for human diet and animal feeding) and the different sustainability narratives that arose simultaneously.

The fifth and final part of the volume delves into the regional environmental histories of soybean farming over three continents. The fourteenth chapter, authored by Richa Kumar, looks at the ambivalent effects of soybean farming in the central Indian region of Malwa in the state of Madhya Pradesh, the nation's production core where soybeans are already a consolidated cash crop. Adopting a mixed historiographic and ethnographic approach, Kumar demonstrates the increasingly pervasive role of soybean monocultures in the Indian domestic commodity market and their localised socio-environmental downsides, shedding light on a context that conventional narratives have often omitted. Similar issues are also indirectly raised by Vimbai Kwashirai in his chapter on Zimbabwe. As the author notes, so far, soybean farming experiences in Zimbabwe uniquely depart from other experiences. The adoption of soybean as a subsistence rather than a cash crop has broadly benefited local farmers, improved their daily diets and significantly ameliorated crop rotation regimes, especially for nutrient-demanding staple crops such as maize. However, as Kwashirai notes, such an eminently positive experience is also justified by the relatively slow uptake of soybean crops over the last century. This scenario leaves the potential consequences of soybean marketisation still unclear. Much more tangible are the socio-environmental implications of soybean farming in the Buenos Aires Pampean region, as described by José Muzlera. Through a mixed methodology adopting historical records and structured interviews, the chapter describes the socio-environmental impacts of the dominant agribusiness model. Looking at its specific effects on local economic activities and land tenure patterns, Muzlera draws a nuanced picture of this productive paradigm's dynamics and how it affects individual and collective wellbeing.

Although each one deals with the history of soybean farming in its own unique way, the chapters together convey a comprehensive historical picture of the social, environmental and economic implications of the rise of soy on the world stage. Nonetheless, further scholarly endeavours could, of course, potentially enrich the literature on the topic, adding depth and nuance to the themes tackled here. Possible future research lines would tackle the relationship between the growth of soybean farming and another global behemoth: the livestock industry. While the multiple interrelations between these two industrial sectors are relatively well-known, systematic historical

reconstructions, both locally and globally, have only been partly undertaken.⁹ Another potentially engrossing point would concern the changing energy inputs fuelling the soybean farming industry (e.g., oil, gas, coal) and the proportional outputs generated by the production of biofuels. These two research trajectories could potentially converge in studies linking soybean industrial products and patterns of land grabbing and environmental contamination at a local level.

Overall, this volume lays vital foundations for understanding and tackling global soy cultivation issues. Its contributions offer a historically-grounded analysis of some of the most distinctive historical transitions that have made soybean one of the world's major commodities and of the socio-environmental consequences of such expansion. Besides stimulating further scholarship and new research lines, as indicated above, this volume aspires to provide intellectual grounding for more nuanced discussions about the challenging future of commodity markets and modern agriculture, two sectors where soy has played – and will undoubtedly continue to play – a significant role.

ACKNOWLEDGEMENTS

We would like to acknowledge the institutions that supported this project, which originated from a research project linked to the Environmental History Laboratory of the Federal University of the Southern Frontier (UFFS) and funded by the Brazilian National Council for Scientific Research (CNPq). In 2019, we had the opportunity to gather part of the group during the 3rd World Congress of Environmental History in Florianópolis (Brazil). Gradually, new collaborators joined the project, contributing to our volume with new chapters and resources. Therefore, besides the UFFS, this book includes researchers from the Federal University of Santa Catarina (UFSC), the State University of the Midwest of Paraná (Unicentro), the State University of Goiás (UEG), and the Evangelical University of Goiás (Unievangélica), all in Brazil. Other institutions include the Rachel Carson Center for Environment and Society of the Ludwig-Maximilians University of Munich and

9 For a historical perspective on Uruguay, Argentina, and Paraguay, see Baraibar Norberg, *The Political Economy of Agrarian Change in Latin America*. For a discussion of this relation today in Brazil, see Rebecca Lima Albuquerque Maranhão et al., 'The spatiotemporal dynamics of soybean and cattle production in Brazil', *Sustainability* **11** (7) (2019): 2150; and Raoni Rajão et al., 'The rotten apples of Brazil's agribusiness', *Science* **369** (6501) (2020): 246–48.

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the Friedrich Schiller University of Jena in Germany, the Johannes Kepler University of Linz in Austria, the University of Basel in Switzerland, the Eindhoven University of Technology and Vrije Universiteit of Amsterdam in the Netherlands, Stockholm University and Umeå University in Sweden, Kent State University, Virginia Tech and Brown University in the USA, Beijing Normal University in China, the Indian Institute of Technology in Delhi, India, and the National University of Quilmes in Argentina. We also thank the Federal University of the Southern Frontier (UFFS), CNPq and the Research and Innovation Support Foundation of Santa Catarina State (FAPESC), the Johannes Kepler University of Linz, the Eindhoven University of Technology, Stockholm University, Umeå University, Virginia Tech and Brown University in the USA for their financial support to the open-access publication of this volume. All the contributors to the volume worked with commitment, participating in a dynamic international team of scholars from all over the world. Finally, we thank Sarah Johnson and James Rice at The White Horse Press for believing in our project and making it possible, lending their dedication and professionalism to the cause.

