

From the Anthropocene to the Soyacene

Writing Planetary History through a Commodity Lens

Abstract: This essay addresses a twofold aim: On the one hand, it outlines a research agenda for planetary commodity history, arguing that a commodity lens enables the theoretical claims of planetary history to be put into historiographical practice. In this regard, historians should strive to trace the planetary footprint of a commodity's more-than-human actor network comprising the deepening and widening of commodity chains and their flexible combinations across multiple times and spaces. Soy serves as a key commodity of agro-food globalization in the long twentieth century. Against this backdrop, the universalist notion of the Anthropocene might be specified by the concepts of the Capitalocene or Soyacene. On the other hand, this essay presents a case study of planetary commodity history with a focus on the Brazilian state of Mato Grosso in the Anthropocene since the sixteenth century in general, and in the Soyacene since the late twentieth century in particular. It outlines the widening of soy's planetary footprint with regard to deforestation and global warming, as well as its deepening in terms of herbicide contamination and planetary health. Mato Grosso as a soy hotspot not only reveals the socio-natural dynamics of commodity frontiers but also highlights the transregional incorporation of this region into nation-state and global market dynamics via hierarchical commodity chains and other types of asymmetrical connections. Moreover, this case study provides evidence for a regionally grounded periodization of the Anthropocene.

Zusammenfassung: Dieser Essay verfolgt eine zweifache Zielsetzung: Zum einen entwirft er eine Forschungsagenda für eine planetare Warengeschichte. Dabei wird argumentiert, dass eine warenzentrierte Perspektive es ermöglicht, die theoretischen Prämissen der planetaren Geschichte in historiographische Praxis zu überführen. In diesem Zusammenhang sollten Historiker*innen den planetaren Fußabdruck des mehr-als-menschlichen Akteursnetzwerks einer Ware nachzeichnen – unter Berücksichtigung der Vertiefung und Ausweitung von Warenketten sowie ihrer flexiblen Kombinationen in verschiedenen Zeiten und Räumen. Soja fungiert dabei als Leitware der Globalisierung von Landwirtschaft und Ernährung im „langen zwanzigsten Jahrhundert“. Vor diesem Hintergrund lässt sich der universalistische Begriff des Anthropozäns zu dem des Kapitalozäns oder gar des Sojazäns präzisieren. Zum anderen präsentiert der Essay eine Fallstudie planetarer Warengeschichte am Beispiel des brasilianischen Bundesstaates Mato Grosso im Anthropozän seit dem sechzehnten Jahrhundert im Allgemeinen bzw. im Sojazän seit dem späten zwanzigsten Jahrhundert im Besonderen. Dabei wird untersucht, wie sich der planetare Fußabdruck von Soja in Bezug auf Entwaldung und globale Erwärmung ausweitet und im Zusammenhang mit Herbizidbelastung und der planetaren Gesundheit vertieft. Als Soja-Hotspot offenbart Mato Grosso nicht nur die sozio-ökologischen Dynamiken von Warenfronten, sondern verdeutlicht auch die transregionale Einbindung dieser Region in

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nationalstaatliche und globale Marktdynamiken über hierarchische Warenketten und andere Formen asymmetrischer Verflechtungen. Nicht zuletzt liefert diese Fallstudie Belege für eine regional verankerte Periodisierung des Anthropozäns.

Keywords: Anthropocene, soy, Brazil, Mato Grosso, deforestation, contamination

The “shock of the Anthropocene” poses fundamental challenges for history, potentially initiating a planetary turn of historical thought. It questions the constitutive difference between human and natural history, which has legitimized their existence as separate disciplines since the onset of modern scientific thought.¹ According to the foundational myth, the term ‘Anthropocene’ was spontaneously invented by chemist Paul Crutzen at a conference in 2000. It soon entered the domains of the social sciences and humanities in general and of history in particular. While environmental historians such as John McNeill have picked up the concept in their empirical work,² Dipesh Chakrabarty’s interventions have been decisive in fuelling the theoretical debate.³ Accordingly, whereas conventional history rests on the modern dichotomy of humanity and the rest of nature, the history of the Anthropocene as a new epoch of the Earth system – with the human species representing a planetary force – must reintegrate these two domains.⁴

However, the planetary turn seems trapped in the fragmentation between theoretical claims and empirical research. This essay aims to bridge this gap based on the conviction that theory is a tool for historiographical practice rather than a means in itself. It argues that a commodity lens can help to reduce the overwhelming complexity of the planetary turn and operationalize its theoretical claims in empirical research. Moreover, it guides well-grounded stories that add complexity to simplistic notions of grand narratives of the Anthropocene. Soy – meaning the domesticated soybean (*Glycine max*) and its ramified product tree – is employed as a lens for doing planetary commodity history. A regional case study on the Brazilian state of Mato Grosso illustrates how this research agenda might be operationalized.⁵

Planetary commodity history: A research agenda

Bridging theoretical reasoning and empirical research

The debate on the history of the Anthropocene has recently gained comprehensive theoretical reasoning. Most importantly, Chakrabarty’s *Four Theses* propose overcoming “global”

1 Christophe Bonneuil/Jean-Baptiste Fressoz, *The Shock of the Anthropocene: The Earth, History, and Us*, London/New York 2016.

2 John McNeill/Peter Engelke, *The Great Acceleration: An Environmental History of the Anthropocene since 1945*, Cambridge 2016.

3 Helmuth Trischler, *The Anthropocene: A Challenge for the History of Science, Technology, and the Environment*, in: *NTM Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin* 24/3 (2016), 309–335.

4 Dipesh Chakrabarty, *The Climate of History: Four Theses*, in: *Critical Inquiry* 35 (2009), 197–222; Dipesh Chakrabarty, *The Climate of History in a Planetary Age*, Chicago 2021.

5 The first, theoretical part of this essay is an edited version of Ernst Langthaler, *Writing Planetary History Through a Commodity Lens*, in: Anna-Lena Eick/Achim Landwehr/Tom Vanassche (eds.), *Geschichte/n schreiben im Anthropozän*, Göttingen 2026, 105–121. The second, empirical part is based on original research.

with “planetary” historical thinking. The first thesis is the most fundamental, arguing that “anthropogenic explanations of climate change spell the collapse of the humanist distinction between natural history and human history.”⁶ The second thesis claims that “the idea of the Anthropocene, the new geological epoch when humans exist as a geological force, severely qualifies humanist histories of modernity/globalization.”⁷ It criticizes the hegemonic paradigm of global history, emphasizing the transformation of the human-made world through capitalist globalization since the onset of colonialism around 1500. This negative definition is complemented by the positive one of the third thesis, which states that “the geological hypothesis regarding the Anthropocene requires us to put global histories of capital in conversation with the species history of humans.”⁸ These two definitions are synthesized by the fourth thesis, which concludes that “the crosshatching of species history and the history of capital is a process of probing the limits of historical understanding.”⁹ In sum, Chakrabarty argues that a post-anthropocentric history must overcome the anthropocentric dichotomy between the human sphere and the rest of nature, re-integrating these two domains within a planetary perspective of the Earth system that includes the human species as a geological force. Rather than further developing dominant paradigms, this manifesto calls for a paradigm shift in historical thinking: the fusion of human and natural history into planetary history. It remains open how to translate this “well-nigh impossible” theoretical claim into historiographical practice, however.¹⁰

Beyond the discipline of history, the interdisciplinary field of Earth system science (ESS) stresses historical arguments in data-based analyses of interactions between planetary spheres (atmosphere, hydrosphere, lithosphere, etc.), including the impact of human societies.¹¹ These approaches mainly relate to the periodization of the Anthropocene: Did this latest geological epoch begin with the European colonization of the “New World” around 1500, the massive burning of fossil fuels during the British Industrial Revolution around 1800, or the use of nuclear energy in the Global North around 1950? A widely acknowledged turning point is the so-called Great Acceleration beginning around 1950, which suggests a human-driven transformation of the Earth system. Accordingly, shifts in socioeconomic trends (population size, petroleum use, fertilizer application, etc.) as well as socioecological trends (surface temperature, carbon dioxide concentration, biodiversity loss, etc.) during the mid-twentieth century indicate a human-driven deviation of the Earth system from Holocene variability. Although a seminal paper identifies factors such as the US-led economic order and the breakthrough of fossil-based technologies,¹² most accounts in ESS build their historical arguments on simplistic descriptions of causally interlinked trends rather than on complex explanations of planetary transformations. A telling example of the integration of social sciences and humanities into ESS and their simultaneous subordination to natural-science hegemony is

6 Chakrabarty, *Four Theses*, 201.

7 *Ibid.*, 207.

8 *Ibid.*, 212.

9 *Ibid.*, 220.

10 Julia Adeney Thomas/Mark Williams/Jan Zalasiewicz, *The Anthropocene: A Multidisciplinary Approach*, Cambridge 2020, 130–134.

11 Thomas/Williams/Zalasiewicz, *Anthropocene*.

12 Will Steffen et al., *The Anthropocene: Conceptual and Historical Perspectives*, in: *Philosophical Transactions. Series A: Mathematical, Physical, and Engineering Sciences* 369/1938 (2011), 842–867, 849–852.

the latest model of the Earth system, which extends the former model to include the “anthroposphere” (energy systems, knowledge, science and technology, political economy, etc.).¹³

It seems that the planetary turn in history has got stuck halfway, so to speak: On the one hand, theoretical reasoning by historians is often detached from data-based research on Earth system trends. On the other hand, data-rich empirical analyses by ESS often lack comprehensive explanations of historical dynamics in the human sphere and its interactions with non-human spheres. Planetary history therefore faces the challenge of bridging the gap between theoretical reasoning and empirical research, as well as the one between the natural sciences and the social sciences and humanities. Within multi- and interdisciplinary collaborations, planetary history would assume the role of answering why-questions with fully-fledged explanations linking structural forces and (non-)human forms of agency within the Earth system.¹⁴

Planetarizing the historical and historicizing the planetary

Taking the planetary turn seriously means considering the Earth system as a whole, including the human species. According to actor-network theory (ANT), the Earth system and its elements are conceived as non-human actors – or “actants” – related to human actors within more-than-human networks.¹⁵ One does not need to be invested in ANT to recognize more-than-human relationships as historical research topics.¹⁶ Planetary history regards not only animals, plants, and inanimate things but also the entire Earth and its parts as actors with agency. Accordingly, the Earth as a differentiated, dynamic, and contingent geopower (“planetary multiplicity”) as well as human responses to planetary challenges and opportunities (“Earthly multitudes”) come into focus.¹⁷ History consequently extends its scope from anthropocentric notions of the global and sustainable to post-anthropocentric notions of the planetary and habitable.¹⁸ History in a planetary sense would replace the modern dichotomy of culture and nature (the former as active subject, the latter as passive object) with the co-evolution (and eventually co-transformation) of human and non-human – in effect, *hybrid* – actors within the Earth system.¹⁹ The notion of Earth system agency in history does not eclipse (non-)intentional forms of human agency, but instead complements them in complex ways.²⁰

13 Will Steffen et al., The Emergence and Evolution of Earth System Science, in: Nature Reviews Earth & Environment 1/1 (2020), 54–63.

14 Sandra Maß, Zukünftige Vergangenheiten: Geschichte schreiben im Anthropozän, Göttingen 2024, 176.

15 Bruno Latour, Reassembling the Social: An Introduction to Actor-Network-Theory, Oxford 2007.

16 Maß, Vergangenheiten, 113.

17 Nigel Clark/Bronislaw Szerszynski, Planetary Social Thought: The Anthropocene Challenge to the Social Sciences, Cambridge 2021, 8–9.

18 Chakrabarty, Four Theses, 213.

19 Christophe Bonneuil, Der Historiker und der Planet: Planetaritätsregimes an der Schnittstelle von Welt-Ökologien, ökologischen Reflexivitäten und Geo-Mächten, in: Frank Adloff/Sighard Neckel (eds.), Gesellschaftstheorie im Anthropozän, Frankfurt am Main/New York 2023, 55–92, 75.

20 Zoltán Boldizsár Simon/Julia Adeney Thomas, Earth System Science, Anthropocene Historiography, and Three Forms of Human Agency, in: Isis 113/2 (2022), 396–406.

A planetary understanding of history, as outlined before, is only one side of the coin; the other side is the critique of the Anthropocene concept for reintroducing the universalist figure of the *anthropos*, which social sciences and humanities have already dismissed, to highlight human particularities. Accordingly, conceiving humans as an undifferentiated whole – as a species among others – levels out the multiple differences between social groups with regard to class, gender, race, age, religion, and other social contrasts, as well as between the world regions of the Global North and South.²¹ This argument is particularly relevant to the debate on the periodization of the Anthropocene and the associated driving forces and responsibilities. Critical scholars argue that not the human species as a whole but only particular social formations – European colonialism in the “New World” from 1500 onwards, fossil-fuel powered industrialization in the Global North beginning in 1800, and capitalist and socialist economic growth in the Global West (and East) from 1950 – have become planetary forces. Consequently, they propose alternative terms to characterize the Anthropocene: Plantationocene, Capitalocene, Technocene, and Chthulucene, to mention only a few.²² These approaches call for historicization of the planetary – i.e., for identifying, describing, and explaining evolutionary and transformative changes of the Earth system through human action, differentiated by multiple social contrasts (class, gender, race, etc.) and in interaction with more-than-human dynamics.

Historians dealing with the planetary turn face a set of more or less challenging options. Simply relabelling conventional historical approaches, such as environmental history, as “planetary” would miss the point. The opposite strategy, replacing history as we know it with a form of historically informed natural science, would throw the baby out with the bathwater. I therefore argue for a dual strategy of engaging with planetary history that extends the global to the planetary without abandoning it. On the one hand, history should reflexively extend its scope to the more-than-human domains of the Earth system (*planetaryizing the historical*), and on the other should critically apply its differentiated toolkit to Anthropocene narratives (*historicizing the planetary*). In short, ESS challenges history, but history also challenges ESS.²³ While most representatives of the former strategy prefer the universalist Anthropocene term, most followers of the latter reject it in favour of more specific terms emphasizing socioecological inequalities. An integrative approach is Jason Moore’s “world-ecology,” which overcomes the dichotomy of society and nature while avoiding the universalist notion of the *anthropos* by highlighting particular social formations. Accordingly, the limitless exploitation of cheap labour and nature by capital and power groups is key to the transgression of planetary boundaries in the Capitalocene.²⁴

21 Andreas Malm/Alf Hornborg, The Geology of Mankind? A Critique of the Anthropocene Narrative, in: The Anthropocene Review 1/1 (2014), 62–69.

22 Donna Haraway, Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin, in: Environmental Humanities 6 (2015), 159–165.

23 Simon/Thomas, Earth System Science, 400.

24 Jason W. Moore, Capitalism in the Web of Life: Ecology and the Accumulation of Capital, London/New York 2015; Jason W. Moore (ed.), Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism, Oakland, CA 2016.

Accounting for the multiplicity of time, space, and agency

The dual strategy of planetarizing the historical and historicizing the planetary involves at least three conceptual challenges to historical research: the multiplicity of time, space, and agency. The *multiplicity of time* emerges from intersections of planetary timescales measured in thousands, millions, and billions of years with human timescales measured in years, decades, and centuries. Chakrabarty criticizes the tendency of social sciences and humanities dealing with the Anthropocene to eclipse the geological time of Earth history in favour of the human-centred time of global history.²⁵ However, what initially appears contradictory turns out to be complementary from multi-temporal approaches, new and old.²⁶ Reinhart Koselleck builds a semantic bridge between geology and history with the notion of overlapping “sediments of time.”²⁷ More systematically, Fernand Braudel’s model of multiple layers of time – short-term events, medium-term conjunctures, and long-term structures (*longue durée*) – offers a key to meeting the multi-temporal challenge. Accordingly, a multi-temporal perspective can be achieved by connecting these layers of time through up and down movements: “One could move from the short term to the somewhat less short term and finally to very long time (if this exists, it must be the time of the sages).”²⁸ This “very long time” – the “time of the sages” – approximates what Anthropocene scholars conceive as geological time. The Braudelian approach of oscillating between human and planetary timescales, thereby reconstructing their interactions transversally – or, more precisely, explaining how they both enable and limit each other – emphasizes the multiplicity of time. This undertaking is all the more obvious as planetary and global history converge in the Anthropocene, as the Great Acceleration around 1950 reveals. It remains to be seen whether the academic and public debate on the Anthropocene will lead to a rearrangement of preceding “regimes of historicity” – premodern, modern, and presentist – or to a different, planetary one.²⁹

The *multiplicity of space* emerges from connections, both human and non-human, that link locations of more-than-human encounters across long, even transcontinental distances. Similar to the transversal linkages between layers of time, layers of space – from the global to the local – are also transversally linked. The term “teleconnection” has been transferred from climatology to history to grasp interactions between distant places in the Earth system. There are indications that more-than-human teleconnections have increased in number and strength in the Anthropocene: from transcontinental transfers of animals, plants, and diseases during the European expansion to the “New World” to the recent increase in local adverse weather conditions, droughts, and floods due to the global climate crisis.³⁰ As a more system-

25 Dipesh Chakrabarty, Anthropocene Time, in: History and Theory 57/1 (2018), 5–32.

26 Achim Landwehr, Zeiten haben: Klimakrise und Endlichkeit, Frankfurt am Main/New York 2025.

27 Reinhart Koselleck, Sediments of Time: On Possible Histories, Stanford, CA 2018, 3–9; Achim Saupe, Zeitschichten: Anmerkungen zur Historisierung und Dynamisierung einer Zeitfigur, in: Achim Saupe (ed.), Zeitschichten und Pluritemporalität in der Geschichtskultur, Göttingen 2026, 21–68.

28 Fernand Braudel, History and the Social Sciences: The Longue Durée, in: Review (Fernand Braudel Center) 32/2 (2009), 171–203, 198 (originally published in 1958).

29 François Hartog, Regimes of Historicity: Presentism and Experiences of Time, New York 2017; Bonneuil, Historiker.

30 John McNeill, The Environment and the World Economy since 1500, in: Tirthankar Roy/Giorgio Riello (eds.), Global Economic History, London 2024, 187–205, 195–201; McNeill/Engelke, Great Acceleration.

atic multi-spatiality, Moore's world-ecology extends human-centred world-systems analysis as pioneered by Immanuel Wallerstein – the bundle of unequal connections between core, semi-periphery, and periphery – further in a more-than-human direction.³¹

The *multiplicity of agency* emerges from interactions between human and non-human actors, differentiated by the degrees, types, and logics of agency, within more-than-human networks. Human history deals with individual and collective agency that also affects parts of the environment: people burn down forests, cultivate fields, build dams, and so on. Vice versa, the non-human agency of the environment may affect people through impacts such as floods, landslides, or diseases.³² Agency must not be confused with intentionality, however: Even human activity is not necessarily intentional, as the sociology of the habitus reveals.³³ Conversely, non-human activity is not necessarily non-intentional, as human-animal studies on mammals argue.³⁴ In an ANT-inspired sense, agency is the ability of human and non-human actors embedded in hybrid networks to affect somebody or something else more or less strongly, regardless of the degree of intentionality.³⁵ This extended notion of agency does not level out differences between actors; on the contrary, as social sciences and humanities highlight internal differences within humanity, they can also differentiate externally between humans and (animate and inanimate) non-humans.³⁶ With the gradual transition from the Holocene to the Anthropocene, new forms of agency emerge: the human agency to change the course of the Earth system (e.g., by tapping sources and closing sinks of greenhouse gases) as well as the planetary agency to change the course of – and even extinguish – the human species (e.g., through adverse weather caused by accelerated climate warming). One of the challenges of planetary history lies in understanding the complex relationship between multiple forms of human and non-human agency.³⁷

Adopting a commodity lens

To operationalize the multiplicity of time, space, and agency with more or less limited resources, historians need a clear research focus such as the commodity perspective. Commodity history has recently established itself as a historical subdiscipline with multi- and interdisciplinary links.³⁸ The chosen commodity provides a lens through which abstractions such as the Anthropocene can be investigated more concretely. The ANT-inspired leitmotif of the commodity perspective says: “follow the thing.”³⁹ Foundational in this regard was the

31 Moore, *Capitalism*.

32 Thomas/Williams/Zalasiewicz, *Anthropocene*, 125–134.

33 Loïc Wacquant, *A Concise Genealogy and Anatomy of Habitus*, in: Thomas Medvetz/Jeffrey J. Sallaz (eds.), *The Oxford Handbook of Pierre Bourdieu*, Oxford 2018, 528–536.

34 Chris Pearson, *History and Animal Agencies*, in: Linda Kalof (ed.), *The Oxford Handbook of Animal Studies*, Oxford 2017, 240–257.

35 Latour, *Reassembling*.

36 Alf Hornborg, *Artifacts Have Consequences, Not Agency: Toward a Critical Theory of Global Environmental History*, in: *European Journal of Social Theory* 20/1 (2017), 95–110.

37 Simon/Thomas, *Earth System Science*.

38 Jonathan Curry-Machado/Jean Stubbs, *Introduction: Researching Commodity History*, in: Jonathan Curry-Machado et al. (eds.), *The Oxford Handbook of Commodity History*, New York 2024, 1–18.

39 Ian Cook, *Follow the Thing: Papaya*, in: *Antipode* 36/ 4 (2004), 642–664.

notion of commodity chains as institutionalized linkages of sites of production, distribution, and consumption across empires and nation-states within the capitalist world-system. Other approaches – most importantly, global commodity chains and global value chains – shift away from this long-term world-historical perspective towards more short-term industry-centred analyses. The scholarship on global production networks emphasizes the multi-spatiality of globalization – that is, the embeddedness of global relations in national, regional, and local contexts.⁴⁰ The critique that chain approaches overemphasize the urban centres (compared to the rural peripheries) as well as political and economic aspects (compared to socioecological ones) gave rise to the concept of commodity frontiers.⁴¹ Commodity frontiers are contested zones where new sources of labour and nature are incorporated as “fictitious commodities” into the capitalist accumulation of value. They can be regarded as regional sites functioning as teleconnections within transregional commodity chains. Commodity frontier dynamics comprise phases of expansion and contraction, connected to “double movements” of marketization and socioecological protection in the capitalist world-system.⁴² Since the commodity perspective has been widely adopted in global history, there is no reason to assume that it does not work for planetary history as well. However, its anthropocentric legacy needs to be overcome by way of a post-anthropocentric extension that takes into account the agency of commodities as planetary forces.

Soy provides a promising commodity lens for a planetary history of the long twentieth century for several reasons: First, the soybean has developed from an East-Asian food crop in the late nineteenth century to the biggest cash crop of global agro-food capitalism in the early twenty-first century, extracted mainly in South and North America.⁴³ Second, as a plant with versatile properties, soy is a subject with significant agency that defines the possibilities and limits of its use. Simultaneously, it is an object of techno-scientific manipulation – from conventional breeding to genetic engineering – due to the agency of actors such as plant researchers, commercial breeders, and biotech firms.⁴⁴ Third, due to its quantitative and qualitative significance, the more-than-human network around soy has become a planetary force, driving global warming, species extinction, and agrochemical contamination on a massive scale.⁴⁵ Soy has thus become a marker of the human-reconfigured biosphere, as has been argued for the broiler chicken.⁴⁶ Fourth, soy plays a paradoxical role in the Great Acceleration:

40 Jennifer Bair, *Global Commodity Chains: Genealogy and Review*, in: Jennifer Bair (ed.), *Frontiers of Commodity Chain Research*, Stanford, CA 2009, 1–34; Ernst Langthaler/Elke Schüßler, *Commodity Studies with Polanyi: Disembedding and Re-embedding Labour and Land in Contemporary Capitalism*, in: *Österreichische Zeitschrift für Soziologie* 44/2 (2019), 209–223; Bernd-Stefan Grewe, *Global Commodities and Commodity Chains*, in: Tirthankar Roy/Giorgio Riello (eds.), *Global Economic History*, London 2024, 271–285.

41 Jason W. Moore, *Sugar and the Expansion of the Early Modern World-Economy. Commodity Frontiers, Ecological Transformation, and Industrialization*, in: *Review (Fernand Braudel Center)* 23/3 (2000), 409–433; Ulbe Bosma/Eric Vanhaute, *Commodity Frontiers: Linking Global Capitalism and Local Resilience*, in: Jonathan Curry-Machado et al. (eds.), *The Oxford Handbook of Commodity History*, New York 2024, 85–101.

42 Langthaler/Schüler, *Commodity Studies*.

43 Ernst Langthaler, *Soy*, in: Jeannie Whayne (ed.), *The Oxford Handbook of Agricultural History*, New York 2024, 304–324.

44 Christine M. Du Bois, *The Story of Soy*, London 2018.

45 Matilda Baraibar Norberg/Lisa Deutsch, *The Soybean Through World History: Lessons for Sustainable Agro-food Systems*, Oxon/New York 2023.

46 Carys E. Bennett et al., *The Broiler Chicken as a Signal of a Human Reconfigured Biosphere*, in: *Royal Society Open Science* 5/12 (2018), 180325.

On the one hand, as an animal feed for the agro-industrial livestock complex, it is part of the mainstream; on the other hand, as a human food for vegetarian diets, it is allied with alternative and counter-movements.⁴⁷ As proposed by Claiton M. da Silva and Claudio de Majo, we can conceive the Anthropocene – or, more precisely, the Capitalocene – as a *Soyacene*.⁴⁸

Following soy through time and space emphasizes the multiplicity of time, space, and agency in planetary history. Regarding the multiplicity of time, soy highlights the intersection of short-, medium, and long-term rhythms ranging from the annual growth cycle of the bean plant through decades- and centuries-long periods of soy expansions to *longue durée* phenomena such as soy-driven ecological change.⁴⁹ With regard to the multiplicity of space, soy accentuates teleconnections between regional sites of its production and consumption through transregional trade networks and their institutional arrangements.⁵⁰ In terms of the multiplicity of agency, soy underlines interactions with human actors such as nation-states, capitalist enterprises, and social movements as well as with non-human actors ranging from allies such as hybrid corn to opponents such as herbicide-resistant “super-weeds.” This perspective even reveals the multiplicity of soy itself – for instance, its paradoxical role as both protagonist and antagonist of the Western nutrition transition to meat-based diets and the associated expansion of the agro-industrial livestock complex.⁵¹

Tracing a commodity's planetary footprint

The socio-natural footprint of a commodity network indicates the direction, speed, and drivers of planetary change. Anthropocene scholars have developed different socioecological benchmarks including the ecological footprint, the 24 trends indicating the Great Acceleration, and the nine planetary boundaries, to mention but the most important.⁵² Since all of these benchmarks build on calculations, they have strengths as well as weaknesses: On the one hand, quantitative indicators provide numeric information from big data about aspects covering long time spans and large spaces; on the other hand, qualitative information – pejoratively referred to as “anecdotal evidence” – is often sidelined or ignored.⁵³ To include the full account available from historical sources, research needs to combine quantitative and qualitative information on the socio-natural footprint of the commodity network under investigation as an indicator of planetary change. A commodity's footprint thus goes beyond a single indicator expressed by numbers, comprising a complex mosaic of quantitative and qualitative

47 Ernst Langthaler, The Soy Paradox: The Western Nutrition Transition Revisited, 1950–2010, in: *Global Environment* 11 (2018), 79–104.

48 Claiton M. da Silva/Claudio de Majo, Towards the Soyacene: Narratives for an Environmental History of Soy in Latin America's Southern Cone, in: *Historia Ambiental, Latinoamericana y Caribeña (HALAC)* 11/1 (2021), 329–356.

49 Baraibar Norberg/Deutsch, Soybean.

50 Ernst Langthaler, Great Accelerations: Soy and its Global Trade Network, 1950–2020, in: Claiton M. da Silva/Claudio de Majo (eds.), *The Age of the Soybean: An Environmental History of Soy during the Great Acceleration*, Winwick 2022, 65–90.

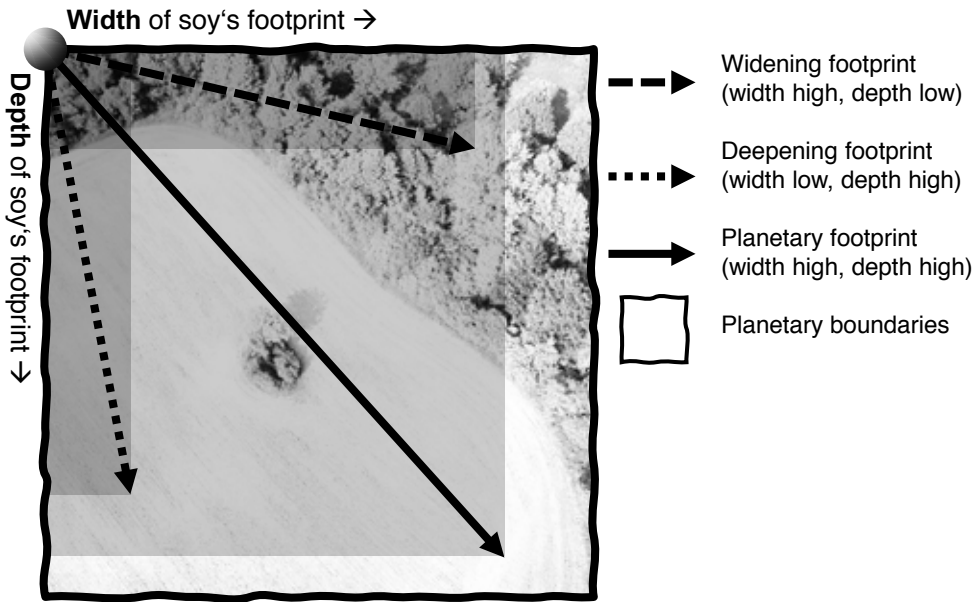
51 Langthaler, Soy Paradox.

52 Erle C. Ellis, *Anthropocene: A Very Short Introduction*, New York 2018, 103–127.

53 Sean Cubitt, Data/Anecdote, in: John Parham (ed.), *The Cambridge Companion to Literature and the Anthropocene*, Cambridge 2021, 54–68.

pieces of evidence on the socio-natural dynamics of its entire network. The adequate form of representation is more than a table or diagram – it is the text of a story. A telling example of the content and form of a commodity’s footprint is the “ecological hoofprint” of global meatification.⁵⁴

Figure 1: Widening and deepening of a soy’s planetary footprint



Source: Design by the author.

The planetary footprint (i.e., the aggregate impact on the Earth system) of a commodity network results from the dynamics of commodity chains and commodity frontiers. Commodity chains act as teleconnections linking sites of frontier expansion (or contraction) within the domains of production and consumption. Power- and capital-driven commodity frontiers can expand *externally* through extensive incorporation of new spaces (*widening*, e.g., conversion of native grasslands into crop monocultures), *internally* through more intensive incorporation of already occupied spaces (*deepening*, e.g., adoption of high-productive technologies), or *flexibly* through combinations of both modes (Figure 1). The conditions and consequences of capital accumulation through frontier expansion, including disruptions of society and nature, are often contested and need to be regulated according to the interests and values of key actors (nation-states, big business, social movements, etc.). From these encounters, a stable regime institutionalizing commodity frontier expansion for a certain period can emerge – before eventually destabilizing again due to external and internal dynamics and transforming into a different regime.⁵⁵ In the case of soy, three agro-food regimes have suc-

⁵⁴ Tony Weis, *The Ecological Hoofprint: The Global Burden of Industrial Livestock*, London 2013.

⁵⁵ Ernst Langthaler/Maximilian Martsch/Gabriel Tober, *Conceptualizing Historical Commodity Studies: The Case of Soy*, in: Juan Carmona-Zabala (ed.), *Commodities in History: Theoretical Reflections and Empirical*

ceeded one another since the onset of globalization in the 1870s: the imperial, developmental, and corporate regimes.⁵⁶

Transferring the above considerations to the case of soy, the history of the Soyacene explores the contested widening and deepening of soy's planetary footprint in the framework of global agro-food regimes, crises, and transitions since around 1870. The widening of the footprint refers to changes such as the expansion of the soy growing area in Asia and the Americas starting in the early twentieth century, and recently also in Europe and Africa. The deepening of the footprint refers to changes such as the application of the biotechnological package around transgenic soy since the 1990s. How widening and deepening combine in flexible ways becomes evident in South American "soylandia," where the transgenic biotechnology is enabling soy's more-than-human network to expand into near-natural biomes – mainly savannah and rainforest – previously less suited for profitable extraction and marketization.⁵⁷ Oscillating between zooming out to the widening and zooming in to the deepening of commodity webs, researchers can trace soy's planetary footprint through time and space.

Deconstructing grand narratives and reconstructing grounded stories

Planetary history – like every form of history – is not only about critical research but also about storytelling. Within the Anthropocene discourse, four grand narratives associated with regimes of historicity about humans' relation to their planet from the past to the future determine academic and public thinking. The dominant *naturalist* narrative claims that the human species has inadvertently altered the Earth system at a geological scale in the past. However, Earth system scientists have made *anthropos* aware of the danger and now provide policymakers with the necessary knowledge and technology to lead humanity towards a sustainable future. The *post-nature* narrative overcomes the division of society and nature by claiming that nature is socially constructed. In contrast to classical modernity in the past, this reflexive-modern spirit might lead humanity to refashion nature technologically and institutionally for a brighter future. The *eco-catastrophist* narrative conceives the past as an unsustainable path transgressing planetary boundaries and pushing the Earth system to irreversible tipping points. If civil society fails to adopt a more participatory politics, a post-growth economy, and a sustainable lifestyle, human life on the planet will be extinguished in the near future. Finally, the *eco-Marxist* narrative argues that capitalism has failed to reproduce labour and nature in the past due to over-exploitation: The elites in the core countries of the world-system have accumulated profit and power through unequal economic and ecological exchange with the peripheries, where the associated social and ecological costs have undermined (non-)human habitability. Avoiding the further transgression of planetary boundaries in the Capitalocene thus requires a radical break with the capitalist growth imperative in favour of a future eco-socialist order.⁵⁸ These grand narratives occupy positions in a discursive field structured by

Case Studies, Rethymno 2023, 25–60.

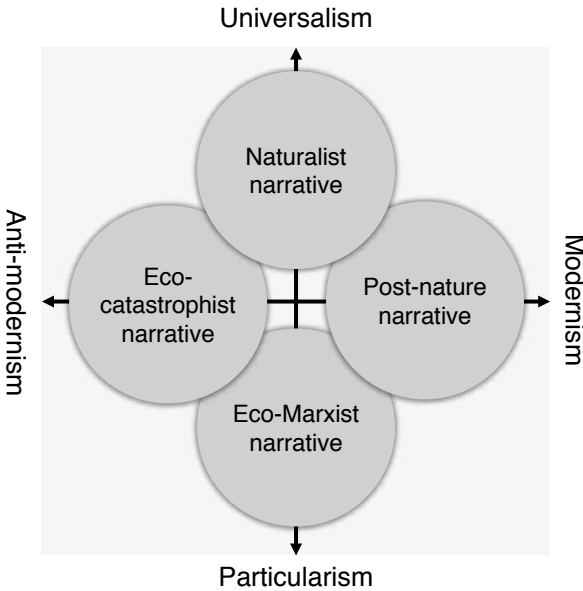
56 Philip McMichael, *Food Regimes and Agrarian Questions*, Halifax 2013.

57 Langthaler, Soy.

58 Christophe Bonneuil, *The Geological Turn: Narratives of the Anthropocene*, in: Clive Hamilton/Christophe Bonneuil/François Gemenne (eds.), *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*, London/New York 2015, 17–31.

two dimensions (Figure 2): universalism (naturalist narrative) versus particularism (eco-Marxist narrative), and anti-modernism (eco-catastrophist narrative) versus modernism (post-nature narrative).

Figure 2: Grand narratives of the Anthropocene



Source: Design by the author.

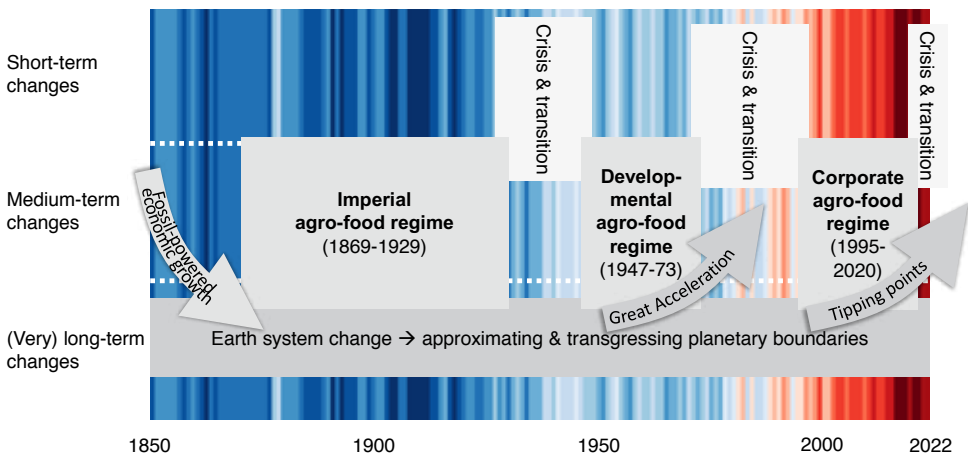
Rather than uncritically adopting or hyper-critically rejecting these grand narratives, planetary history can use them critically as a reflexive framework for creating pluralist stories. It might take from the naturalist narrative the insight that the relation of the human species to the Earth has changed fundamentally in the Anthropocene. However, it can draw on the eco-Marxist narrative to overcome the undifferentiated notion of the *anthropos* by highlighting societal differences such as class, gender, and race as well as unequal political, economic, and ecological structures. Moreover, it acknowledges hybrid assemblages of society and nature as argued by the post-nature narrative. Finally, it takes ecological footprints, planetary boundaries, and tipping points of the Earth system as described by the eco-catastrophist narrative into account.⁵⁹

The deconstruction of these grand narratives is no end in itself, but rather a means to an end – the reconstruction of evidence-grounded stories. Besides space and agency, historical accounts emphasize time in general and periodization in particular. Most grand narratives tend to construct history as a unilinear pathway from one state to another, ranging between stories of failure (e.g., the eco-catastrophist narrative) and success (e.g., the post-nature narrative). Historical evidence often contradicts such simplifications and calls for more complex storytelling. The story of the Soyacene includes periods of path dependencies, when an agro-

⁵⁹ Bonneuil, Geological Turn.

food regime organizes the expansion of commodity chains and their frontiers according to institutionalized rules of the game, as well as periods of path openness, when a hegemonic regime descends into crisis due to external and internal pressure, alter- and counter-hegemonic alternatives arise from niches, and the old regime transforms into a new one. The succession of periods of path dependency and openness shapes the periodization of the Soyacene into the imperial (1869–1929), developmental (1947–1973), and corporate agro-food regimes (1995–2020), each followed by a period of crisis and transition.⁶⁰ These medium-term cycles of regime formation, crisis, and transition interact with other layers of time: The top layer includes short-term events such as military conflicts, economic turbulence, and technological shifts; the bottom layer comprises long-term changes in the Earth system that affect the medium-term (e.g., global warming) and short-term layers (e.g., weather-related disasters) in the Great Acceleration, when planetary boundaries are transgressed and systemic tipping points are approximated. This multi-temporal model provides a heuristic framework for a non-linear, evidence-grounded, and commodity-focused planetary history (Figure 3).

Figure 3: Multi-temporal framework of the history of the Soyacene



The background shows “climate stripes” depicting annual deviations from the average global surface temperature from 1961 to 2010, with blue colours indicating cooler years and red colours indicating warmer years.

Source: <https://www.reading.ac.uk/planet/climate-resources/climate-stripes> (31 March 2026).

Design by the author.

Planetarizing historical thought

This essay argues that the seemingly impossible project of planetary history could become possible through a commodity lens, as illustrated with the case of soy. But to what extent does such a programme involve a “process of probing the limits of historical understanding,”⁶¹

⁶⁰ Langthaler, Soy.

⁶¹ Chakrabarty, Four Theses, 220.

as Chakrabarty argues? On the one hand, planetary history goes beyond conventional (i.e., anthropocentric) history. On the other hand, a post-anthropocentric history oriented towards the Earth system, including the human species, is not entirely different from preceding forms of history. For instance, it shares with them the “historical method” comprising heuristics, criticism, and interpretation that lives up to history’s scientific aspirations.⁶² We can conceive the planetary turn as another extension of history’s scope in a long series since the mid-twentieth century: the “social science turn” of the 1960s and 1970s, which focused on society in a comprehensive sense and its class structure; the “cultural turn” of the 1980s and 1990s emphasizing everyday practices of men and women, semiotic and discourse analysis, and the meta-historical reflection of historiography as literature; and the “global turn” of the 2000s and 2010s that highlighted international comparisons and transnational connections, to mention the most important.⁶³

Accordingly, the current “planetary turn” is yet another paradigmatic shift that turns attention to the non-human domains of the Earth system as an integral part of a more-than-human history. It goes beyond environmental history, which still – at least rhetorically – stresses the dichotomy of society and nature (i.e., society’s “environment”). After having socialized, culturalized, and globalized the discipline, history is now moving towards *planetaryizing*. Writing planetary history is a challenging endeavour, but it obsolesces neither the modern historiographical legacy in general nor global history in particular. Planetary history might even become a radicalized form of global history that both concentrates on and de-centres the human impact on the Earth system. The planetary turn does not necessarily require a profoundly shattering revolution or a re-invention of history; a horizon-broadening reform of historical thought to include the more-than-human may suffice.

The research agenda of planetary commodity history outlined above can be summed up in seven theses:

1. The planetary turn in history has not yet bridged the gap between theoretical reasoning and empirical research.
2. Planetary history should adopt the dual strategy of planetaryizing the historical and historicizing the planetary.
3. Planetary history must account for the multiplicity of time, space, and agency.
4. The overwhelming complexity of planetary history can be reduced to a manageable degree through a commodity lens.
5. A commodity network’s planetary footprint results from the widening and deepening of its frontiers and can be traced by zooming in and out.
6. Planetary commodity history should deconstruct grand narratives and reconstruct evidence-grounded stories.
7. Since the planetary turn continues the series of history’s paradigmatic shifts, it leads to a reform rather than a revolution of historical thought.

⁶² Jörn Rüsen, *Evidence and Meaning: A Theory of Historical Studies*, New York/Oxford 2017, 125–144.

⁶³ Georg G. Iggers/Q. Edward Wang/Supriya Mukherjee, *A Global History of Modern Historiography*, London/New York 2017, 204–263, 310–345.

Planetary commodity history: The case of Mato Grosso

Sediments of time

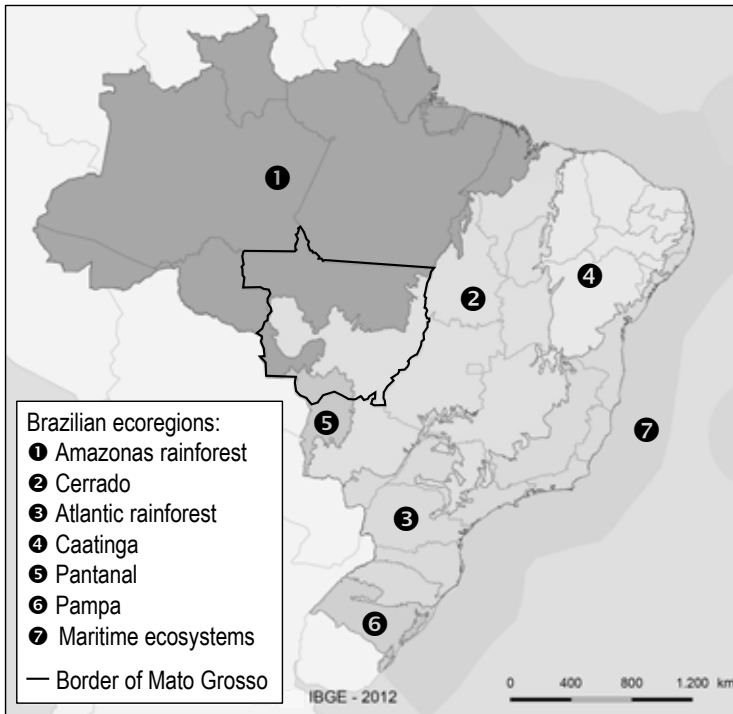
As argued above, planetary commodity history combines zooming out to the level of a commodity network as well as zooming in on its individual nodes. The following section addresses soy's commodity web and its planetary footprint from the perspective of nodes (or commodity frontiers) rather than arrows (or commodity chains).⁶⁴ The Brazilian state of Mato Grosso has been chosen as a focus region of planetary dynamics at soy frontiers for two reasons: First, Mato Grosso has emerged as a hotspot of soy expansion in Brazil, the world's leading soy powerhouse with shares of 36 per cent of total production and 44 per cent of total exports in 2024.⁶⁵ Second, the state is located at the intersection of the two Brazilian ecoregions ("biomes") most important for soy expansion: the savannah (Cerrado) and the Amazon rainforest (Figure 4). To fully understand Mato Grosso's socio-natural transformation as a soy frontier, we should also consider the region's colonial legacies. Accordingly, four overlapping sediments of time have been identified: The first extends from the sixteenth to the early twentieth centuries, when Mato Grosso was represented by white colonizers as a "wilderness" on the fringes of the Anthropocene triggered by the European conquest of the "New World" after 1500 as well as the fossil fuel-powered industrialization of the West after 1800 (*colonial Anthropocene*); the second lasts from the 1930s to the 1980s, when authoritarian regimes opened the remote region to state-led capitalist modernization (*authoritarian Capitalocene*); the third extends from the 1980s to the 2000s, when soy fields expanded rapidly into the savannah and rainforest biomes (*unleashed Soyacene*); and the fourth emerges since the 2000s, when contradictory effects of the socio-natural crisis triggered public-private management of the ongoing soy expansion (*organized Soyacene*).

Colonial Anthropocene (16th–20th centuries): From around 1500, the Amazonian Basin played an ambivalent dual role in the European expansion to the "New World": On the one hand, the tropical rainforest with its diverse communities of indigenous peoples, animals, and plants appeared to the colonial gaze as an isolated "wilderness." On the other hand, the Amazon River and its branching tributaries opened up routes of expansion for European "civilization." In the sixteenth century, political control and economic exploitation of the new colony were initially limited to the narrow strip of land along the Atlantic coast. It was only when land reserves and forced labour became scarce, and the greed for precious stones and metals grew, that the extraction front advanced from the "civilized" coast into the "wild" interior. The Portuguese invaders repelled the claims of the rival colonial powers – Spain, England, France, and the Netherlands – and established a province in the seventeenth century that encompassed large parts of the Amazonian Basin. It was primarily diamond and gold prospectors who sought to realize their dreams of wealth in Mato Grosso. Economic and religious penetration was followed by bureaucratic integration from the eighteenth century onwards: Mato Grosso became a captaincy in 1748, a province in 1822, and a state in 1889. After Brazil declared its independence from Portugal in 1822, the young nation-state sought to assert its territorial integrity amid internal uprisings and external attacks. In the national

64 For an analysis of soy's global commodity chains since the 1950s see Langthaler, *Great Accelerations*.

65 Source: FAOSTAT, <https://www.fao.org/faostat/en/#home> (9 March 2026). Calculation by the author.

Figure 4: Location of Mato Grosso in the Brazilian ecoregions



Source: Design by the author.

context, Mato Grosso was a geopolitically vulnerable border region on the sidelines of the rubber and coffee extraction booms, which integrated other parts of the country into global commodity markets at the turn from the nineteenth to the twentieth century. Soybeans were already acclimatized in Brazil around 1900, but only in the South. While fossil fuel-powered economic growth – that is, the Anthropocene in the form of the Capitalocene – had already been unleashed in the industrial centres of the capitalist world-system, Mato Grosso remained a resource-rich but barely accessible periphery within the periphery.⁶⁶

Authoritarian Capitalocene (1930s–1980s): After the commodities boom had broken down during the Great Depression, the Amazonian Basin became a target region for capitalist development by the interventionist nation-state. In 1938, the authoritarian Vargas regime launched the “March to the West” – a state-led development program which initiated expert assessments, road construction projects, land purchases, and investment incentives. In 1964, the military leadership responded to escalating social tensions with a coup supported by the United States. Through a “conservative modernization” under bureaucratic-technocratic auspices, the military regime sought to contain class conflicts without altering the politi-

66 Antonio Augusto Rosotto Ioris, *Frontier Making in the Amazon: Economic, Political and Socioecological Conversion*, Cham 2020, 31–35.

cal and economic balance of power.⁶⁷ According to the logic of the developmental agro-food regime, the state launched a large-scale colonization program to integrate the Brazilian Midwest, including Mato Grosso, both geopolitically and geoeconomically. While public colonization – often accompanied by chaos, corruption, and failure – primarily attracted settlers from impoverished regions, affluent families from the South responded more eagerly to private projects.⁶⁸ The state-led colonization offensive included the construction of high-ways connecting Mato Grosso to the country's administrative and economic centres.⁶⁹ The colonization and infrastructure projects of Brazilian high modernism radically reshaped the state's socio-natural landscape: Settlements and road projects displaced the indigenous population from their ancestral living spaces and converted the species-rich vegetation of the savannah and rainforest into cattle pastures and crop monocultures. From 1960 to 1988, 57 per cent of the savannah and 12 per cent of the rainforest in Mato Grosso were cleared.⁷⁰ The accelerated expansion of the agricultural frontier created a niche for a stable network around soy consisting of three elements: first, new methods of mineral fertilization to make the nutrient-poor and acidic soils fertile for crop production; second, new plant varieties that could tolerate poor soils, longer days, and the tropical climate of the savannah region; and third, new styles of farming that combined technological enthusiasm, market orientation, and pioneering spirit. This assemblage received institutional and financial support from the agricultural research agency EMBRAPA, which established a soybean centre, as well as from PRODECER, a Japanese-Brazilian development program for the savannah region, in the 1970s.⁷¹

Unleashed Soyacene (1980s–2000s): The coalition between the two newcomers from the South – adapted plant varieties and white settler families – unleashed an unprecedented expansion of the soy frontier in Mato Grosso from the 1980s onwards (Figure 5). This more-than-human power couple conquered the region so forcefully that the resident indigenous and smallholder population pejoratively labelled them “grasshoppers.”⁷² The immigrant soy farmers established a politically well-connected and economically prosperous class with common features – large holdings, cutting-edge technology, and innovative spirit – and a shared pioneer identity. Their entrepreneurial style of farming differed both from peasant farming (due to strict market orientation) and capitalist farming (due to strong cooperative

67 Ioris, *Frontier Making*, 35–38, 52–54; Gerd Kohlhepp, *The Brazilian Amazonia in Change II: Five Decades of Exploitation, Deforestation and Attempts at Sustainable Development*, Bielefeld 2025, 227–228.

68 Lisa Rausch, *Convergent Agrarian Frontiers in the Settlement of Mato Grosso, Brazil*, in: *Historical Geography* 42 (2014), 276–297, 280–285; Wendy Jepson/Christian Brannstrom/Anthony Filippi, *Access Regimes and Regional Land Change in the Brazilian Cerrado, 1972–2002*, in: *Annals of the Association of American Geographers* 100/1 (2019), 87–111.

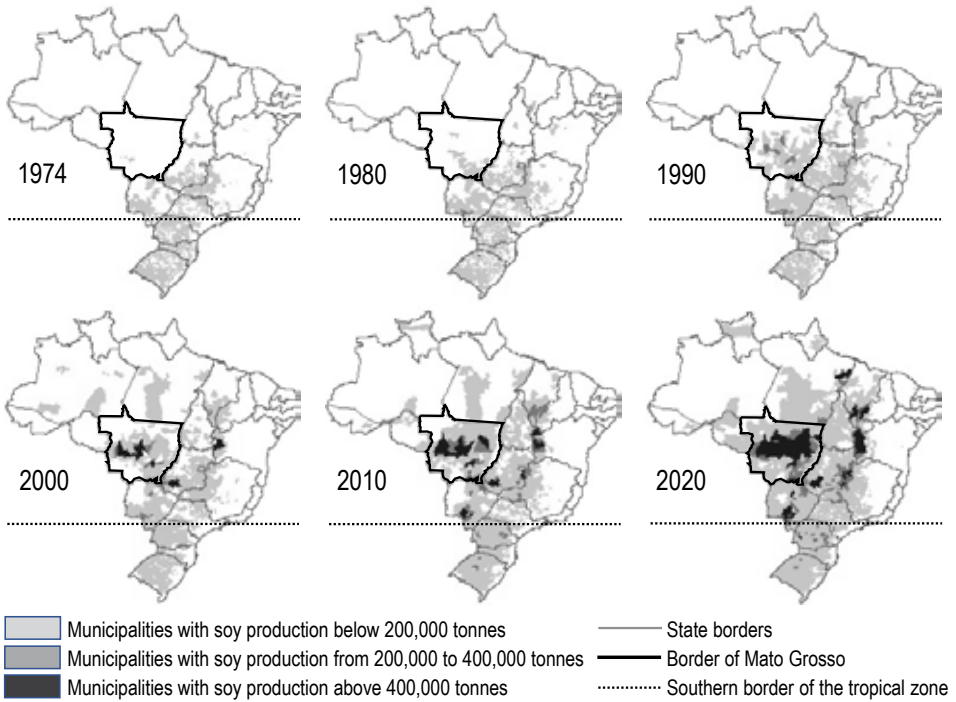
69 Kohlhepp, *Amazonia*, 249–250.

70 Freg J. Stokes et al., *Tropical Deforestation and Indigenous Resistance over the Longue Durée in South America*, in: *Journal of Global History* 20/2 (2025), 121–142; Philip M. Fearnside, *Deforestation in Brazilian Amazonia*, in: George M. Woodwell (ed.), *The Earth in Transition*, Cambridge 1990, 211–238.

71 Claiton Márcio da Silva, *Between Fenix and Ceres: The Great Acceleration and the Agricultural Frontier in the Brazilian Cerrado*, in: *Varia Historia* 34 (2018), 409–444; Cassiano Brito Rocha/Claudio de Majo/Sandro Dutra e Silva, *A Geo-historical Analysis of Expanding Soybean Frontiers in the Brazilian Cerrado*, in: *HALAC* 12/2 (2022), 217–252.

72 Da Silva, *Fenix*, 426.

Figure 5: Soy expansion in Brazil, 1974–2020



Source: Fábio Pitta/Maria Luisa Mendonça, *Industrial Soy Expansion in Brazil: Financialization, Deforestation, and Dispossession in the Birthplace of Waters*, n.p. 2022, 18. Design by the author.

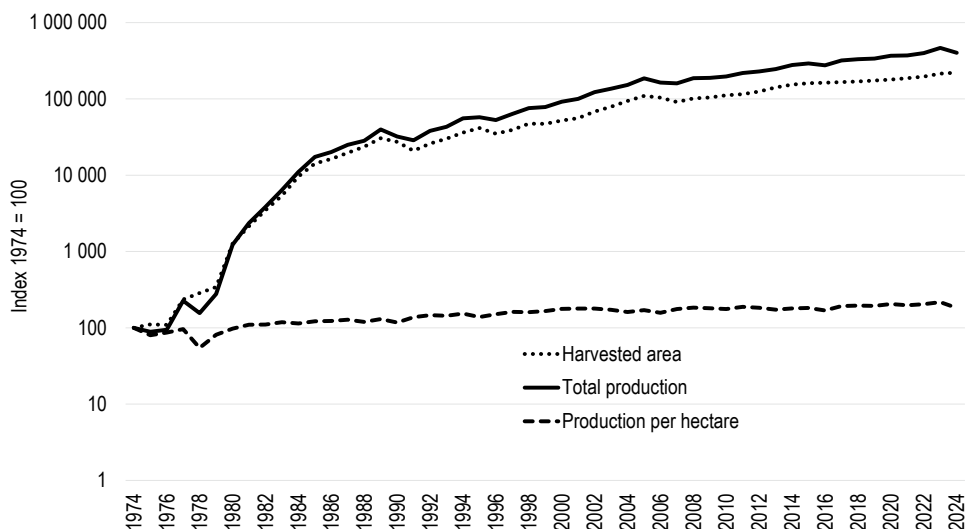
attitudes).⁷³ Mato Grosso experienced two soy booms (Figure 6): the first in the 1980s, with a 32-fold growth of production from a low level, and the second from the mid-1990s to the mid-2000s, with a 3.5-fold increase from a much higher base. Both were mainly due to the enlargement of the harvested area. The stagnation between these booms reflected the shaky transition from state-protected to market-oriented development after the shift from military dictatorship to liberal democracy in 1985. Due to its neoliberal agenda, the government began during the 1990s to improve the transport infrastructure and open the national market to transnational agribusiness companies (“ABCDs”), which gained control over the commodity chain as creditors, processors, and traders. This politico-economic constellation derived its legitimacy from hegemonic media discourses that attributed technological, administrative, and managerial efficiency to the soy business. Growing demand from the European Union and China as well as the liberalized framework of the World Trade Organization in the corporate agro-food regime fuelled Mato Grosso’s export-oriented soy expansion.⁷⁴ While agribusiness firms and growth-oriented farmers accumulated profits, indigenous and smallholder

73 Herbert S. Klein/Francisco Vidal Luna, *Feeding the World: Brazil’s Transformation into a Modern Agricultural Economy*, Cambridge 2019, 263–264; Kohlhepp, *Amazonia*, 230–237; Ioris, *Frontier Making*, 57.

74 Klein/Luna, *Feeding the World*, 247–248; Ioris, *Frontier Making*, 56.

communities as well as near-natural biomes were displaced at a large scale by the expanding soy monoculture.⁷⁵ Whereas the first boom was confined to the savannah region, the second boom also encroached on the rainforest along the newly paved highways. However, soy acted as an indirect rather than a direct driver of deforestation: Initially, lucrative soy fields displaced less profitable cattle pastures from the savannah into the rainforest; a few years later, they eventually followed them again.⁷⁶

Figure 6: Soy expansion in Mato Grosso, 1974–2024



Source: IBGE, SIDRA, Tab. 1612, <https://sidra.ibge.gov.br/Tabela/1612> (22 March 2026). Calculation by the author.

Organized Soyacene (2000s–2020s): At the turn of the millennium, Mato Grosso consisted of a patchwork of “modernized” and neglected places and regions: On the one hand were affluent neighbourhoods, thriving soy and cattle farms, and designated nature and indigenous reserves; on the other were urban slums, struggling family farms, and devastated rainforest and savannah areas.⁷⁷ The period of left-wing governments starting with the Lula da Silva administration in 2003 was characterized by ambivalence: On the one hand, the socio-natural destabilization through commodity frontier expansions continued. On the other hand, state, corporate, and civil society engaged in restabilization through ‘sustainable’ governance. Besides the tightening of the Forest Code in 2012, combined with monitoring and enforcement

75 Philip M. Fearnside, Soybean Cultivation as a Threat to the Environment in Brazil, in: *Environmental Conservation* 28 (2001), 23–38.

76 Elizabeth Barona et al., The Role of Pasture and Soybean in Deforestation of the Brazilian Amazon, in: *Environmental Research Letters* 5/2 (2010), 24002.

77 Ioris, *Frontier Making*, 57–61; Mariano Turzi, The Political Economy of Agricultural Booms: Managing Soybean Production in Argentina, Brazil, and Paraguay, Cham 2017, 83–100; Martin Coy/Frank Zirkel/Tobias Töpfer, Peripher und doch global vernetzt: Das brasilianische Agrobusiness und seine Folgen für räumliche Prozesse und Arbeitswelten, in: *WSI-Mitteilungen* 72/1 (2019), 31–38.

measures, the Soy Moratorium of 2006 and the associated Roundtable on Responsible Soy, negotiated by agribusiness firms, state agencies, and environmentalist NGOs, aimed to contain soy-driven rainforest loss due to consumer concerns.⁷⁸ This case of “ecological modernization” promoting the market-induced decoupling of soy expansion and rainforest loss delivered mixed results: During the first years, deforestation rates declined and expansion shifted to the savannah biome. From the 2010s onwards, deforestation increased again and expansion shifted back to the rainforest biome, peaking during the right-wing Bolsonaro administration, albeit on a smaller scale than in the early 2000s. Simultaneously, a third soy boom, starting in the late 2000s and combining extensive and intensive growth, more than doubled production from an already high level.⁷⁹ However, the application of the biotechnological package of herbicide-resistant transgenic seeds and the herbicide glyphosate from the mid-2000s onwards failed to achieve the promised yield increases.⁸⁰ Capitalist farming styles by speculative financial investors from other Brazilian states and foreign countries competed with the entrepreneurial farming styles of regional soy farmers.⁸¹ However, the largest profits were made by transnational trading and processing companies, which exploited an increasing share of Mato Grosso’s soy acreage (2004: 69 per cent, 2020: 83 per cent) as ‘ghost acres’ used by overseas countries, among which Western Europe slowly gave way to East and Southeast Asia.⁸²

Widening soy’s planetary footprint: The example of deforestation

Among the varieties of the widening of soy frontiers, and thus soy’s planetary footprint, the deforestation in the Amazonian Basin stands out with regard to destabilization of the Earth system: “Of the nine processes identified as critical for Earth system stability, five with the most critical status, namely climate change, biosphere integrity, land system change, freshwater change, and biogeochemical flows, are significantly influenced by the Amazonian Basin, particularly at regional to continental scales.”⁸³ The strength of corporate-driven soybean expansion, exacerbated by the weakness of national environmental policies under neoliberal governments, decimated large swaths of rainforest and savannah vegetation in Mato Grosso. Of the forests existing in 1970, excluding the extremely species-rich bush and grassland areas, 2.7 million hectares, or 5 per cent, had already been cleared by 1978. During the first soy boom lasting

78 Damien Arvor et al., Combining Socioeconomic Development with Environmental Governance in the Brazilian Amazon: The Mato Grosso Agricultural Frontier at a Tipping Point, in: *Environment, Development and Sustainability* 20/1 (2018), 1–22, 11–16.

79 Carlos A. Silva/Mendelson Lima, Soy Moratorium in Mato Grosso: Deforestation Undermines the Agreement, in: *Land Use Policy* 71 (2018), 540–542.

80 Cleiva Schaurich Mativi et al., The Use of Glyphosate and RR Soybean Productivity in Brazil from 2009 to 2018, in: *Revista Ibero Americana de Ciências Ambientais* 13/11 (2022), 129–138.

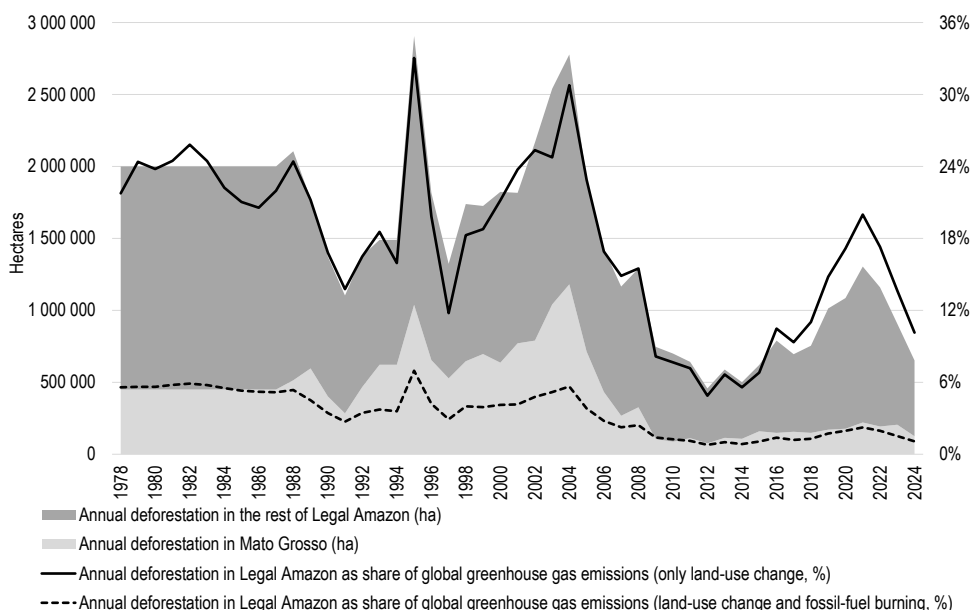
81 Mateo Mier y Terán Giménez Cacho, Soybean Agri-food Systems Dynamics and the Diversity of Farming Styles on the Agricultural Frontier in Mato Grosso, Brazil, in: *The Journal of Peasant Studies* 43/2 (2015), 419–441; Andrew L. Ofstehage, Financialization of Work, Value, and Social Organization Among Transnational Soy Farmers in the Brazilian Cerrado, in: *Economic Anthropology* 5/2 (2018), 274–285.

82 Source: TRASE, <https://trase.earth/> (22 March 2023). Calculation by the author.

83 Marco A. Franco et al., How Climate Change and Deforestation Interact in the Transformation of the Amazon Rainforest, in: *Nature Communications* 16 (2025), 7944, 2.

until 1988, an average of 0.45 million hectares of forest, or 23 per cent of the total deforested area in the Legal Amazon, fell victim to clearing fires and chainsaws each year.⁸⁴ After a decline in the late 1980s and early 1990s, deforestation gained momentum once again during the second soy boom. Annual deforestation reached a first peak in 1995 at 1.04 million hectares and a second peak in 2004 at 1.18 million hectares. During this decade, Mato Grosso's share of deforestation in the Amazonian region skyrocketed from 35 to 43 per cent (Figure 7).

Figure 7: Deforestation and greenhouse gas emissions in Mato Grosso and the rest of the Legal Amazon, 1978–2024



Source: Fearnside, Greenhouse Gases (deforestation 1978–1988 and greenhouse gas emissions 1990 in the Legal Amazon); Instituto Nacional de Pesquisas Espaciais (INPE), Terra Brasilis, PRODES, https://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/rates (21 February 2026, deforestation since 1988 in the Legal Amazon); Global Carbon Project, Global Carbon Budget 2025, <https://globalcarbonbudget.org/download/2341/?tmstv=1762815901> (21 February 2026, global greenhouse gas emissions since 1978). Calculation by the author.

The obligatory and voluntary measures for forest protection under the “post-neoliberal” left-wing governments significantly loosened the coupling of the third soy boom with deforestation. In 2010, the annual area cleared fell below the 100,000-hectare threshold for the first time since recording began. Deforestation later accelerated again and exceeded the 200,000-hectare mark in 2021 during Brazil’s right-wing intermezzo, but remained well below the levels seen up until the mid-2000s. Between 2001 and 2016, 6 per cent of the deforestation in the Amazon rainforest and 17 per cent in the Cerrado were attributable to soy expansion.

84 Philip M. Fearnside, Greenhouse Gases from Deforestation in Brazilian Amazonia: Net Committed Emissions, in: *Climatic Change* 35/3 (1997), 321–360, 324–326.

Not included in these figures are the pastures on deforested land before 2001, which soy conquered, nor the newly established pastures that eventually became soy fields after 2016. In the rainforest biome, which was protected by the reformed Forest Code and the Soy Moratorium, deforestation declined more sharply than in the less protected savannah biome. As overall deforestation increased once again, the focus shifted back in the opposite direction.⁸⁵

Soy-driven deforestation is not a phenomenon limited to the territory of Mato Grosso and the rest of the Legal Amazon, but it had – and continues to have – a planetary impact. In addition to the displacement of indigenous communities and the loss of animal and plant species, many of which were endemic, the greenhouse gas effect caused by deforestation is particularly significant. Based on a detailed calculation for 1990, greenhouse gas emissions from the Legal Amazon since the 1970s have had a significant impact on the global climate balance up to the mid-2000s. The share of Amazonian deforestation in global land use-related greenhouse gas emissions into the atmosphere fluctuated between 21 and 26 per cent during the first soy boom in the 1980s, peaking at 33 per cent in 1995 and 31 per cent in 2004 during the second soy boom; for Mato Grosso alone, the range was 5 to 7 per cent, with peak values of 12 and 13 per cent. Measured against global anthropogenic greenhouse gases in total, including emissions due to land use change and fossil fuel burning, the Legal Amazon accounted for 3 to 7 per cent and Mato Grosso alone for 1 to 2 per cent in this period. During the third soy boom, when losses of rainforest became a matter of international concern, its climate-related impact had already considerably declined. However, most of the deforestation-related carbon dioxide and other greenhouse gases since 1970 (Legal Amazon: 79 per cent, Mato Grosso: 82 per cent) had already been emitted into the atmosphere in the three and a half decades until 2004, and will remain there for centuries and millennia.⁸⁶ Soy-driven deforestation in the Amazonian Basin affected not only the regional climate by raising surface temperatures and reducing rainfall.⁸⁷ It has also been a significant driver of the planetary climate crisis – and, thus, of the Anthropocene.

Deepening soy's planetary footprint: The example of contamination

Whereas the widening of soy's planetary footprint, as indicated by deforestation-driven greenhouse gas emissions, peaked in the early Soyacene (until the mid-2000s), its deepening – as exemplified by herbicide contamination – was most prevalent in the late Soyacene (from the mid-2000s onwards). The third soy boom not only displaced species-rich grasslands,

85 Xiao-Peng Song et al., Massive Soybean Expansion in South America Since 2000 and Implications for Conservation, in: *Nature Sustainability* 4 (2021), 784–792; Erasmus K. H. J. zu Ermgassen et al., Using Supply Chain Data to Monitor Zero Deforestation Commitments: An Assessment of Progress in the Brazilian Soy Sector, in: *Environmental Research Letters* 15/3 (2020), 35003; R. D. Garrett et al., Intensification in Agriculture-Forest Frontiers: Land Use Responses to Development and Conservation Policies in Brazil, in: *Global Environmental Change* 53 (2018), 233–243; C. A. Silva/Mendelson Lima, Soy Moratorium in Mato Grosso: Deforestation Undermines the Agreement, in: *Land Use Policy* 71 (2018), 540–542.

86 Source: Fearnside, Greenhouse Gases. Accordingly, the clearing of one square kilometre of Amazon rainforest caused 71,388 tonnes of greenhouse gas emissions (CO₂-equivalent) in 1990. Calculation by the author.

87 Rafaela Flach et al., Conserving the Cerrado and Amazon Biomes of Brazil Protects the Soy Economy from Damaging Warming, in: *World Development* 146 (2021), 105582.

shrublands, and forests, but also led to a socio-natural shift on the fields, where transgenic soy varieties replaced conventional ones. The U.S. biotech company Monsanto, which had been marketing the broad-spectrum herbicide glyphosate under the brand name “Roundup” since the 1970s, developed the “Roundup Ready” soybean variety, whose genetically engineered bacterial DNA confers glyphosate resistance, in the 1990s. The biotechnological package consisting of herbicide-resistant seeds and a matching herbicide promised a patent-protected solution to a major problem in commercial soybean cultivation: the labour- and capital-intensive weed control required during the early, slow growth phase of the plants. In addition to the economic arguments of simplification and cost reduction, product marketing also brought ecological arguments to the fore: protection against soil erosion through no-till cultivation and the reduction of herbicide use through increased efficiency. In short, transgenic soy embodied the logic of “ecological modernization.” Following Monsanto’s international market launch in 1996, a political controversy erupted in Brazil, with a coalition of technology corporations, government agencies, farmer lobbies, agricultural research institutions, and the mass media pushing through the legalization of transgenic soy – which was already being grown illegally in the southern areas of the country – temporarily in 2003 and permanently in 2005 despite strong resistance from civil society movements.⁸⁸

The ambivalence surrounding “green genetic engineering” soon became apparent in the soybean fields of Mato Grosso. Following the approval of the new technology, the share of transgenic soybean varieties in the total acreage surged from 31 per cent in 2005/06 to 83 per cent in 2012/13 and peaked at 97 per cent in 2021/22.⁸⁹ At the same time, herbicide use exploded, with a significant turning point emerging in the early 2010s: The initially rising proportion of glyphosate use stabilized near the 50 per cent mark and eventually began to decline. Behind this lay a more-than-human dynamic beyond farmers’ control: The excessive use of glyphosate in soy fields over several years created selective pressure for glyphosate-resistant “super-weeds,” which farmers combated by using increasingly more and stronger herbicides such as the defoliant 2,4-D used by the U.S. Army during the Vietnam War (Figure 8).⁹⁰ The anticipated increases in land productivity to reduce deforestation pressure also failed to materialize.⁹¹ Contrary to the promised simplification and cost reduction, transgenic soy cultivation became increasingly complicated and expensive. The fact that most soy farmers – with the few exceptions within non-transgenic supply chains – nevertheless clung to this contradictory technology illustrates the strong path dependence of the “transgenic treadmill.” The increasing contamination of air, soils, and water in Mato Grosso’s soy-growing regions has sparked numerous protests by adversely affected civil society groups in recent years. They criticize not only the scientifically proven increase of diseases among the rural population but also the deliberate use of herbicides as a weapon by soy farmers to drive

88 Renata Motta, *Global Capitalism and the Nation State in the Struggles over GM Crops in Brazil*, in: *Journal of Agrarian Change* 16/4 (2016), 720–727.

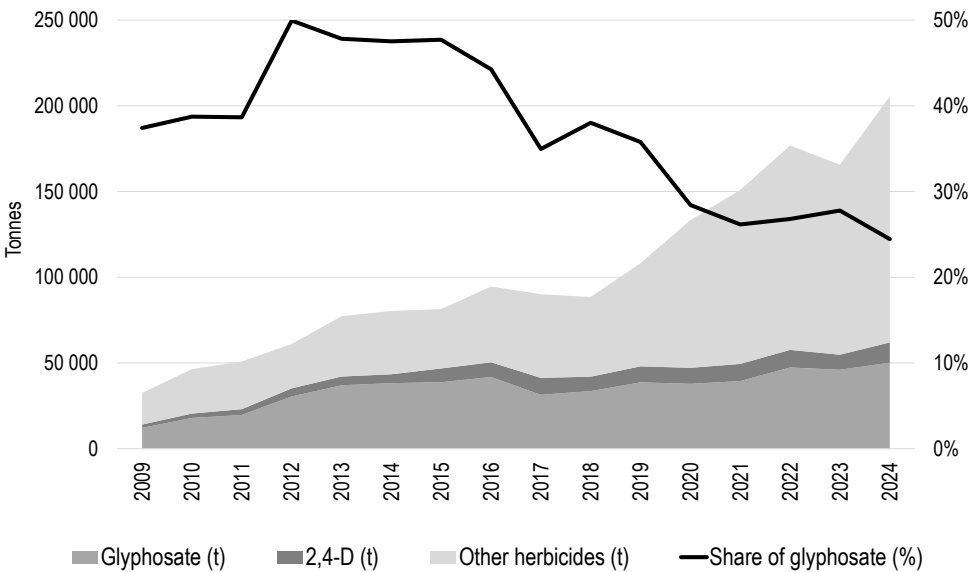
89 Source: Soja Livre Institute, <https://sojalivre.com.br/> (22 March 2026). Calculation by the author.

90 Sergio de Oliveira Procópio et al., *Impacts of Weed Resistance to Glyphosate on Herbicide Commercialization in Brazil*, in: *Agriculture* 14 (2024), 2315; Vicente Eduardo Soares de Almeida et al., *Use of Genetically Modified Crops and Pesticides in Brazil: Growing Hazards*, in: *Ciencia & Saude Coletiva* 22/10 (2017), 3333–3339.

91 Sergio de Oliveira Procópio et al., *Impacts of Weed Resistance; Vicente Eduardo Soares de Almeida et al., Use of Genetically Modified Crops; Mativi, Use of Glyphosate.*

out small-scale farmers and indigenous residents living nearby.⁹² The ecological-modernist utopia of soy-related biotechnology has turned into a socio-natural dystopia of planetary health – not only in Mato Grosso, but also in other regions within the global countryside.⁹³

Figure 8: Herbicide application in Mato Grosso, 2009–2024



Source: IBAMA, Relatórios de comercialização de agrotóxicos, <https://www.gov.br/ibama/pt-br/assuntos/quimicos-e-biologicos/agrotoxicos/relatorios-de-comercializacao-de-agrotoxicos> (22 March 2026). Calculation by the author.

Conclusion

This essay addresses a twofold aim: On the one hand, it outlines a research agenda for planetary commodity history. It argues that a commodity lens enables the theoretical claims of planetary history to be put into historiographical practice. In this regard, historians should trace the planetary footprint of a commodity’s more-than-human actor network, which comprises the deepening and widening of commodity chains and their flexible combinations, through multiple times and spaces. Soy serves as a key commodity of agro-food globalization in the long twentieth century. Against this backdrop, the universalist notion of the Anthropocene

92 Global Atlas of Environmental Justice, Pesticide Poisoning Linked to Agribusiness in Mato Grosso, Brazil, <https://ejatlas.org/print/soy-expansion-and-pesticide-contamination-in-sorriso-mato-grosso-brazil> (20 March 2026).

93 Federico Maggi et al., The Global Environmental Hazard of Glyphosate Use, in: *Science of the Total Environment* 717 (2020), 137167.

might be specified as a Capitalocene or even Soyacene. On the other hand, this essay presents a case study of planetary commodity history with a focus on the Brazilian state of Mato Grosso in the Anthropocene since the sixteenth century in general, and in the Soyacene since the late twentieth century in particular. It outlines the widening of soy's planetary footprint in terms of deforestation and global warming as well as its deepening with regard to herbicide contamination and planetary health. Mato Grosso as a soy hotspot reveals not only the socio-natural dynamics of commodity frontiers but also the transregional incorporation of this area into nation-state and global market dynamics via hierarchical commodity chains and other asymmetrical connections. Moreover, this case study provides empirical evidence for a periodization of the Anthropocene, one of the theoretical key challenges: colonial Anthropocene (16th–20th centuries), authoritarian Capitalocene (1930s–1980s), unleashed Soyacene (1980s–2000s), and organized Soyacene (since the 2000s). This periodization does not claim universal validity; rather, it is grounded in the particular regional trajectory of Mato Grosso. In comparison with further case studies in other regions, this bottom-up approach might offer a more convincing solution to the periodization problem than the prevailing top-down approach in Anthropocene history.