13

Contested Resources and South-South Inequalities: What Sino-Brazilian Trade Means for the “Low-Carbon” Bioeconomy

Fabrizio Rodríguez

13.1 Introduction: Bioeconomy and South-South Inequalities

Shifts in energy consumption away from the early industrializing centres of the Global North towards the emerging economies of the Global South lead to key questions regarding the bioeconomy. To what extent are bioeconomy agendas shaping the transition away from fossil dependence in the context of South-South relations? Does the bioeconomy hold the potential to restructure the current landscape of global inequalities through the active engagement of actors from the Global South? This paper addresses these questions through a qualitative analysis of trade relations between the People’s Republic of China (from now on China) and Brazil from 2000 to 2018. The Sino-Brazilian case is interpreted as a key axis of South-South economic exchange (Hochstetler

F. Rodríguez (✉)

Institute of Sociology, Friedrich Schiller University Jena, Jena, Germany

e-mail: fabrizio.rodriguez@uni-jena.de

2013) with far-reaching yet largely unexplored implications for the bioeconomy. Brazil is a crucial source of biomass, metals and fossil resources for China, and is also responsible for 60% of the Amazon, an extremely important source of carbon storage. At the same time, China's increasing reliance on natural resource imports is having a remarkable impact on Brazilian efforts to promote low-carbon transitions, both domestically and internationally.

This chapter focuses on the Sino-Brazilian trade axis and its socio-ecological as well as political implications for the emergence of a global, low-carbon bioeconomy. It uses an analytical perspective that draws on insights from political geography (Andresen 2010; Bridge 2013) and studies on ecologically unequal exchange (Bunker 1990; Hornborg 1998; Frey et al. 2019). A cross-fertilizing approach to these perspectives highlights the socio-spatial and transnational dynamics of resource extraction while understanding commodity trade in terms of its political and economic relationship with society and nature.

Although issues of trade speak unsurprisingly to historical-materialistic analyses (Wallerstein 1979), this article also focuses on the struggles over meaning in which transitional agendas are embedded. This includes the “low-carbon” bioeconomy on the Brazilian side (Biofuture Platform 2018) and “ecological civilization” on the Chinese side (The State Council 2015). Hence, the analysis of trade flows draws the reader's attention to what Gavin Bridge has termed “the making of resources”. This refers to “the political, economic and cultural processes through which particular configurations of socionature become imagined, appropriated and commodified” (Bridge 2011b, p. 821). As the chapter engages with the material qualities of Sino-Brazilian trade, I take an interpretive stance to the analysis of trade statistics. The analysis builds on the results of my doctoral dissertation (Rodríguez 2018), and additional research conducted in Brazil and China between 2018 and 2019.

13.2 South-South Cooperation and Energy Consumption

The wording of “South-South” cooperation suggests the emergence of a new economic and political order. In this new order, solidarity and equity—not dominance and inequality—are depicted as the principles guiding higher levels of interdependence between nations and regions of the Global South. Indeed, “South-South” discourse, vividly diffused by the BRICS (Brazil, Russia, India, China and South Africa), creates a juncture of emancipatory momentum for actors seeking to transform “the (historical) structural constraints within which they are operating” (Muhr 2016, p. 632). However, this wording freezes the meaning of South-South cooperation as an inherently “good” and “empowering” project that benefits different geographies on equal terms. While China’s new prominent status in the global economy destabilizes the dominance of the West in economic globalization, China’s rise cannot be equated with the rise of the Global South as a whole (Rodríguez 2018, 2020).

China’s changing place in the world becomes evident when energy consumption is used as an indicator of economic activity. In 2000, for instance, the US still figured as the world’s largest consumer of energy, with a total energy demand of 2269 million tonnes of oil equivalent (Mtoe) from coal, gas, oil, electricity, heat and biomass.¹ This represented almost double the amount of energy consumed in China (1161 Mtoe). Between 2000 and 2009, however, the US began to give up its position as the largest single energy consumer in the world. By 2009, China’s primary energy demand had surpassed that of the US; in contrast, economic activity contracted in most Western economies because of the 2008/2009 global financial crisis. China’s energy demand continued expanding until 2014 when the country stabilized its expanding dynamics in the face of the “new normal” of lower growth rates. Interestingly, the energy consumption of the BRICS surpassed that of the early industrializing nations of the G7 (Canada, France, Germany, Italy, Japan, UK and US) during the same period.

¹Enerdata. Global Energy Statistical Yearbook 2016. See, <https://www.enerdata.net/publications/world-energy-statistics-supply-and-demand.html>. Accessed 5 June 2020.

However, as China accounts for 60% of the energy consumed by the BRICS, this acronym is far from representing a homogenous block, as illustrated in Fig. 13.1.

According to these data (Fig. 13.1), in 2018, China's energy demand was 3.4 times that of India, 4 times that of Russia, 11 times that of Brazil, and 23 times that of South Africa. In 2018, China's total energy demand was not only 1.4 times greater than that of the US, but was almost equivalent to the total energy consumed by the second and third largest energy consumers in the world (US and India, respectively). This is an important fact, given that China and India are commonly mentioned as the drivers of shifting energy geopolitics, despite the fact that the structural asymmetries between the two are considerable (Rodríguez 2018, 2020). In sum, the unqualified notion of South-South cooperation is

Fig. 13.1 Shifting dynamics in Global Energy Consumption, 1990–2018 [Mtoe] (Source Enerdata (2015, 2019); Global Energy Statistical Yearbook (2018), Accessed 1 April 2020. Author's illustration)

analytically misleading because it portrays the idea of an “equal footing” whereas, in reality, new inequalities are in fact in the making.

13.3 Going Global? Brazil Pushes for a “Low-Carbon” Bioeconomy

One of the problems of the global energy mix is its persistent reliance on carbon-intensive, non-renewable resources that are taken from the ground, combusted and carelessly emitted into the atmosphere as carbon dioxide (CO₂) (Bridge 2011a, p. 310). The project of “decarbonizing” the global economy is thus a key item in the Paris Agreement and a crucial endeavour to fight climate change. Following this rationale, the concept of the bioeconomy is part of a larger compound of concepts promising sustainable transitional pathways such as the *green* and/or *circular* economy. The bioeconomy’s particularity is its focus on biomass, bioprocesses and biotechnologies as a means of substituting (part of) the petrochemical basis of current modes of production (Birch and Tyfield 2013; Backhouse et al. 2017; Goven and Pavone 2015). International organizations such as the International Energy Agency (IEA) consider Brazil a precursor of the bioeconomy because sugarcane ethanol has become one of its main energy sources for transport over the past five decades.² This development was a response to the fourfold increase in the price of oil. In 1975, this led Brazil’s military dictatorship to launch the ethanol program *Proálcool* to reduce the country’s dependence on foreign oil and enhance energy security (Wilkinson and Herrera 2010, p. 750).

Given this trajectory, Brazilian actors from industry and government ascribe their country a leading role in the global debate on bioeconomy. While Brazil has no official strategy, the Ministry of Science, Technology and Innovation (MCTIC) emphasizes the importance of biomass and bioenergy for the development of the Brazilian bioeconomy (MCTIC 2016). The National Confederation of Industry (CNI) has also issued

²IEA Renewable Energy Market Report 2018. See, https://www.youtube.com/watch?v=_8L16vSV6tM [min 14:36]. Accessed 16 Sep 2019.

a document advocating higher levels of public investment in biotechnology and biomedicine in addition to the development of a favourable regulatory framework (Harvard Business Review 2013). Due to growing international awareness about the negative ecological consequences of fossil combustion, Brazilian policymakers and agribusinesses, collaborating partly with oil transnationals, have turned to the deployment of biomass as a *green* source of energy.³ In their view, the fight against climate change represents a new opportunity to revitalize and rescale the deployment of ethanol beyond Brazil's national borders (Lorenzen 2019, p. 8). The launching of the Biofuture Platform illustrates this recent trend. With its mission to “accelerate the transition to an advanced, low carbon, global Bioeconomy”, the Brazilian government successfully promoted the creation of a multi-stakeholder platform encompassing 20 different states at the sidelines of COP 22 in Marrakech in 2016. A key item on the Biofuture agenda is the promotion of “sustainable biomass”, which is said to provide a “low-carbon” solution to the material constraints of the fossil economy.⁴

However, critics have long pointed to the fact that land-based energy may be a cure that causes more harm than the actual disease (Houtart et al. 2010; Dietz et al. 2014; Holt-Giménez and Shattuck 2009; Oliveira et al. 2017). In this light, the term “agrofuels” has emerged in opposition to the term “biofuels” to highlight the fact that biofuel production hinges upon a land-intensive, largely exploitative system of monocultural plantations (Holt-Giménez and Shattuck 2009). At the same time, local people, and this also applies to those directly and/or indirectly affected by Brazil's sugarcane sector, face increasingly deteriorating conditions regarding access to land and employment (see Lorenzen in this volume).

Nonetheless, faced with the goal of ensuring that average temperatures do not rise by more than 1.5 degrees Celsius, Brazilian firms are reclaiming the relevance of sugarcane ethanol as a global alternative to

³Statements by an expert from the Brazilian Institute of Petroleum, Natural Gas and Biofuels (IBP) and a technical staff member of the National Sugarcane Association (UNICA) at the International Conference Rio Oil & Gas 2018. Energy to transform. Rio de Janeiro, 24–25 Sep 2018.

⁴See, <http://biofutureplatform.org/>. Accessed 3 May 2020.

fossil fuels in the transport sector (Moreno 2016). According to Biofuture, the “low-carbon” qualities of biomass stem from the assumption that the amount of CO₂ emitted through biofuel combustion is actually compensated for by the carbon sequestering function of the plants delivering the biomass itself. However, both common sense and empirical evidence speak against the carbon neutrality of agrofuels. As such, the issue is not whether agrofuels are a source of renewable energy, but whether the global upscaling of land-based energy sources holds any realistic potential of replacing the petrochemical basis of the global economy while improving its ecological balance. Empirical research suggests that the global upscaling of crop-based fuels may increase carbon emissions, particularly if market pressure “pushes” production into new agricultural frontiers or, even worse, into the Amazonian rainforests (Gibbs et al. 2008, p. 5). The use of conventional feedstock to produce bioplastics, another aspect of Biofuture’s bioeconomy concept, could have similar effects (Escobar et al. 2018, p. 11). To be clear: in Brazil, the main crop pushing deforestation in the Amazon is soy, which is mainly used by the meat industry (Trase 2018). Unfortunately, in November 2019, Jair Bolsonaro, the far-right Brazilian president, put an end to the ecological zoning of sugarcane via presidential decree. This cleared the way for sugarcane firms to expand the frontier into the Brazilian wetlands of the *Pantanal* and the Amazon (Ferrante and Fearnside 2019).

Given past and present conditions, Brazil’s push for a global bioeconomy has encountered resistance both inside and outside of its borders. In an open letter, 117 civil society organizations denounced the contradictions of the “low-carbon” narrative:

[...] the BioFuture Platform advocates transitioning the energy, transport, and industrial sectors to bioenergy and biomaterials. This ignores the science – burning biomass for energy releases as many emissions as burning coal, while the production and consumption of biofuels, bioplastic or other biomaterials reduces land available for crops, leads to deforestation and other land conversions, and releases nitrous oxide.

To mitigate the worst effects of climate change, we need governments, NGOs, academia, and the private sector to work together to reduce overconsumption of energy and [to] decarbonize the energy, transport, and

industrial sectors – not merely allow the rich to continue over-consuming whilst transitioning to another carbon-intensive resource”.⁵

As these debates show, Brazilian support of a global, “low-carbon” bioeconomy has given way to a new discursive arena in which the renewable and hence “green” qualities of biomass are constructed in opposition to the exhaustible and polluting qualities of oil. However, there is no evidence that agrofuels can deliver a substantial contribution to the problems created by fossil fuels—certainly not on a global scale. According to Kean Birch, the three main characteristics of bioenergy consist of “low energy density, biomass conversion limits, and land footprint” (Birch 2019, p. 116). Since land intensity is a problem, there are also efforts to foster new generations of “drop-in biofuels from algae and synthetic biology” (ibid.). Notwithstanding this fact, it is highly improbable that these technologies will be able to replace the energy input provided by oil. As noted by Tiziano Gomiero (2015, p. 8491), the energy density of ethanol is simply too low for energy return on investment (EROI) to make sense in the long-run. Birch makes a similar point:

[B]iomass couldn't possibly be used to power all sectors (e.g. heat, motor fuels, electricity) under existing rates and trends of global energy consumption – almost all estimates suggest that there just isn't enough solar energy being converted into biomass quickly enough, nor can biomass be extracted intensively enough, to allow that type of scenario to be sustainable. (Birch 2019, p. 115)

The global upscaling of biomass as a project to substitute the material basis for sustainable transport, as intended by the Brazilian government and sugarcane industry, is indeed a highly problematic agenda. At Biofuture, these actors contend that ethanol second-generation (E2G), which involves the use of microorganisms (such as algae), will help mitigate these problems. However, the future of Brazilian E2G remains uncertain due to sharply declining levels of public funding since the

⁵Open Letter to Biofuture. The industrialization of the Bioeconomy poses risks to the climate, the environment and people. See, <https://environmentalpaper.org/wp-content/uploads/2018/11/BioFuture-Platform-Open-Letter-final-1.pdf>. Accessed 5 June 2020.

2008/2009 global financial crisis, the enduring dominance of ethanol first-generation (E1G) stakeholders and the emergence of new varieties of sugarcane (Backhouse 2020, pp. 14–16). The differences between the advocates and critics of Biofuture are indeed struggles over the meaning and signification of agrofuels in terms of their “carbon neutrality”. Paradoxically, the Brazilian state-led oil company Petrobrás has also questioned the government’s plan to expand the use of biomass as a source of “low-carbon” energy until 2030 (Teixeira 2017). Through the *RenovaBio* policy, a set of regulations that enforce blending targets, Brazilian stakeholders from government, the sugarcane industry and agribusiness hope to revitalize the bio-based energy sector while claiming to tackle climate problems in the process (Backhouse 2020, p. 17). In contrast to the ethanol sector, Petrobrás executives have suggested that an increase in first-generation agrofuels production could hold Brazil back from achieving its 2030 climate objectives.⁶ These encompass a 43% reduction in greenhouse gas emissions, zero deforestation in the Amazon and 45% renewables in the energy mix.

13.4 Carbon-Intensive: Sino-Brazilian Trade from a Bioeconomy Perspective

The problems and contradictions of the Brazilian government’s agenda to upscale and internationalize the bioeconomy based on the explicit promotion of ethanol are further exposed by analysing Sino-Brazilian trade. If the bioeconomy is meant to promote the shift away from the deployment of fossil resources, then a much broader concept and effort to understand where to tackle this transition is required. This effort cannot only focus on the promotion of a particular resource that benefits a particular industry, such as the Brazilian sugarcane industry. Instead, a serious effort to search for an ecological balance needs to focus on the overall material base and path-dependencies linked to the fossil

⁶Petrobrás. *RenovaBio - Diretrizes Estratégicas para Biocombustíveis*. Relatório Técnico. See, http://www.mme.gov.br/documents/36224/930011/participacao_pdf_0.3717470965729722.pdf/8d3c6b05-80d7-372f-b1fa-596db8683174. Accessed 5 June 2020.

mode of production and identify ways to alter them. Besides, different understandings of sustainability and bioeconomy may prevail in different contexts.

For instance, Chinese officials view the concept of the bioeconomy as a Western idea with restricted potential to contribute to the “decarbonizing” of the national energy mix and to the “re-engineering” of the Chinese transport sector, in particular. The concept of the bioeconomy is not seen as providing a fitting solution to the challenges facing China. In domestic terms, the main driver is expected to be nuclear energy (NDRC—*National Development and Reform Commission* 2016), which is considered a clean source by the Intergovernmental Panel on Climate Change (IPCC), at least in terms of carbon emissions.⁷ Currently, biomass makes up 2% of the Chinese energy mix. An important issue is the use of organic residuals—also referred to as “biowaste” for the production of “biogas”, particularly but not only in urban areas. In this regard, the concept of the circular economy may have a higher level of relevance, whereas the bioeconomy is more likely to be developed in the fields of biochemical, biomedicine and biomaterials. The use of agrarian lands for the cultivation of energy crops is politically sensitive, since the Chinese government is likely to prioritize the use of fertile land to produce food instead of energy. Additionally, it is not practical to expect China to import South American ethanol, because the amount of fossil energy required to ship bio-based fuels across the ocean might result in a negative EROI balance.⁸

In China, a relevant concept of how to understand and, hence, tackle the current planetary crisis is the idea of “ecological civilization” (The State Council 2015). Chinese officials have begun to use this term suggesting that China may have its own way of dealing with domestic and, by extension, global ecological problems. Ecological civilization has ancient origins and reaches back 2500 years to Lao Tze. Tze depicted humans’ relationship with nature as one in which the laws of society

⁷Discussion round at the Center for International Energy Development at Xiamen University, 9 May 2019, Xiamen, China. See also World Nuclear Association: *Nuclear Power in China*. See, <https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx>. Accessed 6 Aug 2020.

⁸Ibid.

develop in harmony with the laws of the earth and heaven, whereas these move according to the major “Tao” (divine path), which in turn follows the course of nature (Pan 2016, p. 35). Recently, however, the use of the concept has changed and it is now much more pragmatically framed in terms of the Chinese Communist Party’s (CCP) policy goals for synchronizing environmental policy and economic growth (The State Council 2015). Through its emphasis on ecological civilization, the Chinese government urges Chinese companies to accelerate and intensify efforts to build an adaptive, knowledge and technology-oriented pathway towards a low-carbon milieu for the advancement of the “green industries” (Geall and Ely 2018, p. 1187). Thus, this concept has not only framed the main narrative for environmental policy within, but also, and perhaps just as decisively, outside of China.

One example is China’s Second Policy Paper on Latin America and the Caribbean (MFA—Ministry of Foreign Affairs 2016), which mentions ecological civilization as one of the main areas of cooperation without much detail. However, one thing is clear: in China, ecology has climbed up the ladder of policy priorities. Domestically, this involves a political shift away from Deng Xiaoping’s “opening up” paradigm, which was based on the then much more accepted notion of “developing first and cleaning up afterwards”. The new paradigm is a top-down (but also bottom-up) approach to “synchronizing growth and environmental protection”.⁹ This shifting reality goes hand in hand with large-scale investments in renewable energy such as wind, solar and hydropower and China’s increasingly authoritarian pathway to growth and national rejuvenation under President Xi Jinping. Internationally, China has sought to fill the leadership vacuum since the Trump government decided to pull the US out of the Paris Agreement. While this situation may change with a new administration in Washington, the Chinese government is likely to continue advancing its own ecological paradigms in different multilateral arenas, including not least the Belt and Road Initiative (BRI).

⁹Discussion round at the Center for International Energy Development at Xiamen University, 9 May 2019, Xiamen, China.

The narratives of “ecological civilization” in China (The State Council 2015) and that of the “low-carbon” bioeconomy in Brazil (Biofuture Platform 2018) reflect the construction of potentially powerful discourses of political and economic change regarding nature-society relations on a global scale. Despite different framings, these two concepts address the same problem: the perceived urgency to secure current structures of growth and wealth while simultaneously reducing the carbon footprint. In 2012, Brazil and China upgraded their diplomatic relations to the level of a “global strategic partnership”. Both countries opted for this format of South-South cooperation in the aftermath of Rio + 20. During the Rio summit, China and Brazil emphasized the importance of ensuring that their catching-up processes were not jeopardized by the environmental problems caused by the early industrialized nations.

In view of this situation, issues related to the bioeconomy have gained some relevance in Sino-Brazilian relations, mostly due to Brazilian pressure. The ten-year bilateral cooperation plan (2012–2021)¹⁰ documents a bilateral commitment to the promotion of joint research and development (R&D) programmes in key areas encompassing biotechnology, bioenergy and biomedicine. On both sides, the entities holding responsibility for the implementation of these programmes consist mainly of large actors from the agrochemical industry and governmental research institutions. In this context, the question is whether Sino-Brazilian cooperation in the bioeconomy holds the potential to enhance the ecological balance of the planet while maintaining national economic growth in motion. A look at the Sino-Brazilian trade axis shows that this relationship not only resembles a new pattern of structural inequality, but it is also deeply entrenched in the prevalent structures of the fossil economy.

Given China’s increasing reliance on external sources of agricultural products, minerals and oil on the one hand, and Brazil’s privileged endowments in these rubrics on the other, bilateral trade has expanded enormously albeit narrowly and unevenly. Consulted trade data reveal

¹⁰The plan was signed in April 2011 by the Brazilian and Chinese Governments. For the Portuguese version, see Plano Decenal de Cooperação Brasil-China 2012–2021. In E. Moreira Lima (Ed.), *Brasil e China: 40 anos de relações diplomáticas. Análises e Documentos* (pp. 405–431). Brasília: FUNAG. http://funag.gov.br/loja/index.php?route=product/product&product_id=844. Accessed 20 July 2019.

Fig. 13.2 Brazilian exports to China by commodity, 2000–2018 [Billion US\$] (Source Chatham House (2018), ‘resourcetrade.earth’, <http://resourcetrade.earth/>. Accessed 1 April 2020. Author’s illustration)

that Brazilian exports to China have expanded from US\$ 1.2 billion in 2000 to US\$ 63.4 billion in 2018. Similarly, Brazilian imports from China have gone from US\$ 1.3 billion in 2000 to US\$ 33.9 billion in 2018.¹¹ In terms of sheer weight, Brazilian exports to China have grown by a factor of 20 going from 17.7 million tonnes in 2000 to 346 in 2018. Trade data show that three commodities account for 82% of Brazilian exports to China (Fig. 13.2). In terms of value, soybeans accounted for 41%, crude oil for 22% and iron ore for 12% of total Brazilian exports to China in 2018.¹² Chinese exports to Brazil, in contrast, consist mainly of electronic merchandise, nuclear technologies, machinery and organic chemicals with significantly higher levels of value added, so that an unbalanced pattern of territorial specialization in the shifting configuration of the global economy is evident (Rodríguez 2018).

¹¹The Growth Lab at Harvard University. The Atlas of Economic Complexity. See, <http://www.atlas.cid.harvard.edu>. Accessed 2 Nov 2020.

¹²ResourceTradeEarth. See, <https://resourcetrade.earth/>. Accessed 3 June 2020.

While Brazilian trade with China has contributed to the diversification of global markets away from the US—and hence reduced North-South inequalities in the economic realm—it has also meant an increasing level of trade dependency upon the Chinese market. In 2000, for example, the US market was still the main destination for Brazilian exports. Remarkably, Sino-Brazilian trade took off between 2002 and 2008, and experienced a substantial expansion between 2009 and 2013. The expanding dynamics of Brazilian trade with China were hardly affected by the 2008/2009 global financial crisis, but trade between Brazil and the US contracted considerably. As a result, China displaced the US as Brazil's most relevant export market in 2009. Sino-Brazilian trade was further consolidated between 2011 and 2015. During this period, China attracted 18.6% of Brazilian exports, whereas the US market accounted for just 12.7%. In 2018, China concentrated an overwhelming share of 27% of all Brazilian exports while the US accounted for only 11%.¹³

However, the Sino-Brazilian trade axis is constituted by China as an increasingly wealthy and politically powerful country at the core of global energy and resource consumption, and Brazil as a semi-peripheral provider of raw materials with a rapidly deteriorating status in the global economy. Moreover, from a bioeconomy perspective, the thickening flows of raw materials travelling from Brazil to China show that this axis of South-South trade is far from being “low carbon”. In fact, the overwhelming predominance of soy, iron ore and oil as the bulk of Brazilian exports to China exposes three blind spots in the Brazilian push for a global bioeconomy agenda and questions the ecological balance of this important case of South-South trade inequality.

Soy

In Brazil, the expansive cultivation of soybeans is tightly linked to the rising consumption of protein by the emerging Chinese middle classes (Wilkinson et al. 2016) and China's decisive role in the global geopolitics of food (Oliveira 2015). This massive increase in biomass demand reinforces the large-scale system of industrial agriculture, which was established under colonial rule, further intensifying and aggravating the

¹³The Growth Lab at Harvard University. The Atlas of Economic Complexity. See, <http://www.atlas.cid.harvard.edu>. Accessed 3 June 2020.

land- and capital-intensive expansion of monocultures. The expanding cultivation of soy takes up 28 million hectares of land—three times more than sugar and eight times more than coffee (Wilkinson et al. 2016). Between 2013 and 2018, China's demand for soybeans from Brazil grew by 14%.¹⁴ In order to stay profitable, these dimensions require a great degree of mechanization and digitalization, as the case of soy cultivation demonstrates. This mode of agroindustrial production has far-reaching consequences for the entire agricultural sector in Brazil. The current monoculture model leads to the massive application of pesticides and includes the genetic altering of seeds, which is a driver of soil deterioration and vast biodiversity loss. Recent studies (Trase 2018) confirm that the expansion of soy will produce dramatic changes in land use, and that this will exacerbate deforestation rates in the Amazon while pushing CO₂ emissions to critical levels. Although the territorial and commercial dynamics of sugarcane cannot be directly equated with those of soy, there are important global trade issues that demonstrate an increasing level of market-interdependence between both commodities. As China retaliates on US tariffs by cutting its imports of US-grown soy, Brazilian farmers in the sugarcane industry may adapt their production according to the developments in the soy business (Teixeira 2018).

Iron Ore

The problematic gap between the “low-carbon” narratives of the Brazilian bioeconomy agenda and the material qualities of Sino-Brazilian trade is further exposed by the flows of iron ore travelling to China's ports. Between 2013 and 2018, these grew by 7.8%.¹⁵ Iron ore is representative of the unhindered extraction of finite resources that build the material basis for the fossil-based paradigm pertaining the American Way of Life (Backhouse et al. 2019, p. 17), and its wide-ranging effects on China's own developmental pathway: cars, urbanization, accelerated industrialization and massive consumption. Yet there is no historical precedent for the rate and scale at which imported raw materials are being processed in China. China is now responsible for more than half

¹⁴ResourceTradeEarth. See, <https://resourcetrade.earth/>. Accessed 3 June 2020.

¹⁵ResourceTradeEarth. See, <https://resourcetrade.earth/>. Accessed 3 June 2020.

of the global demand for minerals, which, in turn, leads to the creation of extractive enclaves in Brazil and elsewhere (Rodríguez 2018, 2020).

Oil

Of all problems, the untamed extraction of oil is probably the most pressing from a bioeconomy perspective. With 42% growth between 2013 and 2018, this source of fossil energy is adding huge amounts of carbon into the atmosphere. In addition, it is also delivering the material basis for the unequal consolidation of the Sino-Brazilian trade nexus. In 2006, Brazil discovered the second largest crude oil reserves in South America. Located at a depth of 7000 m and 300 km off the Atlantic shore of Brazil, these reserves named *Pré-Sal* (Schutte 2013) cannot possibly go unnoticed in debates about the transformational potential of the Brazilian bioeconomy. Petrobrás emerged as a global player in the crude oil business through enormous amounts of Chinese capital flowing to Brazil in the form of conditional loans and direct investments. In exchange, Brazil granted China guaranteed shipments of oil, hence easing China's energy needs (Alves 2013; Rodríguez 2018). As a result, the material basis of the Sino-Brazilian nexus remains hostage to the exact fossil structures that bioeconomy agendas are supposed to overcome (Backhouse et al. 2019).

13.5 Conclusion

This article engaged with the Brazilian project of building a global, low-carbon bioeconomy, its interconnections with the Chinese idea of ecological civilization and the making of South-South inequalities in the realm of trade. The analysis provides evidence of four important problems regarding the Brazilian government's agenda to stimulate and lead the global transition towards a global, low-carbon bioeconomy. First, the scope and focus of Brazil's international bioeconomy agenda are far too narrowly defined if a transition away from fossil fuels is to be achieved on a global scale. A narrow focus on the promotion of biomass to supply the future energy needs of the global transport sector fails its target because a systemic reduction in oil consumption is equally, if not much

more urgently, needed. Second, the global upscaling of agrofuels is not an environmentally viable project. The world cannot seriously expect to solve both its energy and ecological problems by fuelling the expansion of monocultures in much-needed sink areas. An effective bioeconomy agenda should not only target the transition away from oil drilling but also reconnect agricultural practices with life-sustaining and reproductive cycles. This means embracing and rethinking the principles of a balanced relationship between society and nature as set out in ancient conceptualizations of ecological civilization. The protection of primary tropical forests and the rehabilitation of cleared areas through agroforestry systems offer just two potential examples of how this abstract idea can be translated into policy and practice. However, this potential serves no cause if the untamed logics of extraction that structure the global economy remain unchallenged; this is a pending task for current bioeconomy agendas. Third, the analysis of the Sino-Brazilian agenda for South-South cooperation reveals the predominant role of national and sector-specific interests. Whereas the Chinese government seeks to satisfy its urgent domestic requirement for oil, Brazilian agribusinesses aim to expand the international market for sugar-based ethanol and soy. Instead of facilitating Brazil's transition towards the bioeconomy, Chinese resource imports from Brazil reinforce Brazil's embeddedness in the fossil structures of the global economy. Fourth, the analysis of Sino-Brazilian trade is indicative of a new pattern of global inequality, in which Brazil's geographies of resource extraction including oil, iron ore and soy provide the material basis for China's economic growth and—by extension—the stability of its regime. In conclusion, conceptualizations of a global bioeconomy should consider why and how the political economies of distant and unequally interconnected geographies prevent the implementation of a much-needed transition to a low-carbon society.

References

- Alves, A.C. (2013). Chinese Economic Statecraft: A Comparative Study of China's Oil-Backed Loans in Angola and Brazil. *Journal of Current Chinese Affairs*, 1(42), 99–130. <https://dr.ntu.edu.sg/bitstream/10356/79414/1/JCCA-2013-01-Alves-Angola.pdf%20final.pdf>. Accessed 5 Nov 2020.
- Andresen, M.A. (2010). Geographies of International Trade: Theory, Borders, and Regions. *Geography Compass*, 4, 94–105.
- Backhouse, M. (2020). The Knowledge-Based Bioeconomy in the Semi-Periphery: A Case Study on Second-Generation Ethanol in Brazil. *Working Paper 13, Bioeconomy & Inequalities*, Jena. <https://www.bioinequalities.uni-jena.de/sozbemedia/wp/workingpaper13.pdf>. Accessed 1 June 2020.
- Backhouse, M., Lorenzen, K., Lühmann, M., Puder, J., Rodríguez, F., & Tittor, A. (2017). Bioökonomie-Strategien im Vergleich: Gemeinsamkeiten, Widersprüche und Leerstellen. *Working Paper 1, Bioeconomy & Inequalities*, Jena. <https://www.bioinequalities.uni-jena.de/sozbemedia/neu/2017-09-28+workingpaper+1.pdf>. Accessed 10 June 2019.
- Backhouse, M., Rodríguez, F., & Tittor, A. (2019). From a Fossil Towards a Renewable Energy Regime in the Americas? Socio-Ecological Inequalities, Contradictions, and Challenges for a Global Bioeconomy. *Working Paper 10, Bioeconomy & Inequalities*, Jena. <https://www.bioinequalities.uni-jena.de/sozbemedia/WorkingPaper10.pdf>. Accessed 3 June 2020.
- Biofuture Platform. (2018). Creating the Biofuture: A Report on the State of the Low Carbon Bioeconomy. <http://biofutureplatform.org/resources/>. Accessed 26 Octo 2020.
- Birch, K. (2019). *Neoliberal Bio-Economies? The Co-Construction of Markets and Natures*. Cham: Springer International Publishing.
- Birch, K., & Tyfield, D. (2013). Theorizing the Bioeconomy. *Science, Technology, & Human Values*, 38, 299–327.
- Bridge, G. (2011a). Past Peak Oil: Political Economy of Energy Crises. In R. Peet, P. Robbins & M. Watts (Eds.), *Global Political Ecology* (pp. 307–324). London: Routledge.
- Bridge, G. (2011b). Resource Geographies 1. *Progress in Human Geography*, 35, 820–834.
- Bridge, G. (2013). Resource Geographies II: The Resource-State Nexus. *Progress in Human Geography*, 38(1), 1–13.
- Bunker, S.G. (1990). *Underdeveloping the Amazon. Extraction, Unequal Exchange and the Failure of the Modern State*. Chicago and London: The University of Chicago Press.

- Dietz, K., Engels, B., Pye, O., & Brunnengräber, A. (2014). *The Political Ecology of Agrofuels*. Routledge ISS Studies in Rural Livelihoods, 13. Abingdon: Routledge.
- Escobar, N., Haddad, S., Börner, J., & Britz, W. (2018). Land Use Mediated GHG Emissions and Spillovers from Increased Consumption of Bioplastics. *Environmental Research Letters*.
- Ferrante, L., & Fearnside, P. (2019). Sugarcane Threatens Amazon Forest and World Climate; Brazilian Ethanol Is Not Clean (Commentary). *Mongabay*. <https://news.mongabay.com/2019/11/sugarcane-threatens-amazon-forest-and-world-climate-brazilian-ethanol-is-not-clean-commentary/>. Accessed 3 June 2020.
- Frey, R.S., Gellert, P.K., & Dahms, H.F. (2019). *Ecologically Unequal Exchange. Environmental Injustice in Comparative and Historical Perspective*. Cham: Palgrave Macmillan.
- Geall, S., & Ely, A. (2018). Narratives and Pathways Towards an Ecological Civilization in Contemporary China. *The China Quarterly*, 236, 1175–1196.
- Gibbs, H.K., Johnston, M., Foley, J.A., Holloway, T., Monfreda, C., Ramankutty, N., et al. (2008). Carbon Payback Times for Crop-Based Biofuel Expansion in the Tropics: The Effects of Changing Yield and Technology. *Environmental Research Letters*, 3, 1–10.
- Gomiero, T. (2015). Are Biofuels an Effective and Viable Energy Strategy for Industrialized Societies? A Reasoned Overview of Potentials and Limits. *Sustainability*, 7, 8491–8521.
- Goven, J., & Pavone, V. (2015). The Bioeconomy as Political Project: A Polanyian Analysis. *Science, Technology & Human Values*, 40, 302–337.
- Harvard Business Review (2013). Bioeconomy. An Agenda for Brazil. http://arquivos.portaldaindustria.com.br/app/conteudo_24/2013/10/18/411/20131018135824537392u.pdf. Accessed 26 Oct 2020.
- Hochstetler, K. (2013). South-South Trade and the Environment. A Brazilian Case Study. *Global Environmental Politics*, 13(1), 30–48.
- Holt-Giménez, E., & Shattuck, A. (2009). The Agrofuels Transition. *Bulletin of Science, Technology & Society*, 29, 180–188.
- Hornborg, A. (1998). Towards an Ecological Theory of Unequal Exchange: Articulating World System Theory and Ecological Economics. *Ecological Economics*, 25(1), 127–136.
- Houtart, F., Bawtree, V., Bello, W.F., Bukassa, B.L., Geuens, G., & Mpozi, B.B. (2010). *Agrofuels: Big Profits, Ruined Lives and Ecological Destruction* (Transnational Institute Series). London: Pluto Press.

- Lorenzen, K. (2019). *Sugarcane Industry Expansion and Changing Land and Labor Relations in Brazil. The Case of Mato Grosso do Sul 2000–2016*. Working Paper 9, Bioeconomy & Inequalities, Jena. <https://www.bioinequalities.uni-jena.de/sozbeimedia/WorkingPaper9.pdf>. Accessed 20 May 2020.
- MCTIC (2016). *Estratégia Nacional de Ciência, Tecnologia e Inovação 2016–2022*. Ministério da Ciência, Tecnologia, Inovações e Comunicações. Brasília. http://www.finep.gov.br/images/a-finep/Politica/16_03_2018_Estrategia_Nacional_de_Ciencia_Tecnologia_e_Inovacao_2016_2022.pdf. Accessed 20 May 2020.
- MFA (2016). China's Policy Paper on Latin America and the Caribbean. http://www.fmprc.gov.cn/mfa_eng/wjdt_665385/2649_665393/t1418254.shtml. Accessed 19 Sep 2019.
- Moreno, C. (2016). *Landscaping a Biofuture in Latin America*. Berlin: FDCL.
- Muhr, T. (2016). Beyond 'BRICS': Ten Theses on South-South Cooperation in the Twenty-First Century. *Third World Quarterly*, 37, 630–648.
- NDRC (2016). The 13th Five-Year Plan for Economic and Social Development of The People's Republic of China (2016–2020). https://en.ndrc.gov.cn/policyrelease_8233/201612/P020191101482242850325.pdf. Accessed 6 Aug 2020.
- Oliveira, G. de L.T. (2015). The Geopolitics of Brazilian Soybeans. *The Journal of Peasant Studies*, 43, 348–372.
- Oliveira, G. de L.T., McKay, B., & Plank, C. (2017). How Biofuel Policies Backfire: Misguided Goals, Inefficient Mechanisms, and Political-Ecological Blind Spots. *Energy Policy*, 108, 765–775.
- Pan, J. (2016). *China's Environmental Governing and Ecological Civilization*. Berlin, Heidelberg: Springer.
- Rodríguez, F. (2018). *Oil, Minerals and Power: The Political Economy of China's Quest for Resources in Brazil and Peru*. Doctoral Thesis. University of Freiburg.
- Rodríguez, F. (2020). Endstation China? Die globalen Stoffströme auf ihrem Weg durch die „Werkstatt der Welt“. *PROKLA. Zeitschrift für kritische Sozialwissenschaft*, 198, 89–108.
- Schutte, G.R. (2013). Brazil: New Developmentalism and the Management of Offshore Oil Wealth. *ERLACS*, 95, 49–70.
- Teixeira, M. (2017, April 19). Petrobras Opposes Brazil Plan to Boost Biofuels After Selloff. *Reuters*. <http://www.reuters.com/article/us-petrobras-climatech-ange-idUSKBN17K2MG>. Accessed 12 Oct 2020.
- Teixeira, M. (2018, Aug 14). Brazil's Farmers Dump Sugar for Soy as Trade War Boosts Chinese Demand. *Reuters*. <https://www.reuters.com/article/us->

brazil-grains-sugar/brazils-farmers-dump-sugar-for-soy-as-trade-war-boosts-chinese-demand-idUSKBN1KZ0B5. Accessed 29 May 2019.

The State Council. (2015). Central Document No. 12: Opinions of the Central Committee of the Communist Party of China and the State Council on Further Promoting the Development of Ecological Civilization. http://www.gov.cn/xinwen/2015-05/05/content_2857363.htm. Accessed 6 Aug 2020.

Trase. (2018). Trase Yearbook 2018: Sustainability in Forest-Risk Supply Chains: Spotlight on Brazilian Soy. <https://yearbook2018.trase.earth/>. Accessed 20 May 2020.

Wallerstein, I.M. (1979). *The Capitalist World-Economy: Essays*. Cambridge, New York: Cambridge University Press.

Wilkinson, J., & Herrera, S. (2010). Biofuels in Brazil: Debates and Impacts. *The Journal of Peasant Studies*, 37, 749–768.

Wilkinson, J., Wesz Junior, V.J., & Lopane, A.R.M. (2016). Brazil and China: The Agribusiness Connection in the Southern Cone Context. *Third World Thematics: A TWQ Journal*, 1, 726–745.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.