The Down Side of Cross-Border Integration:

The Case of Deforestation in the Brazilian Mato Grosso and Bolivian Santa Cruz Lowlands

by Anne Cristina de la Vega-Leinert and Christoph Huber

Since the 1990s, growing comprehension of the critical regulating function of tropical rain forests and awareness of their destruction have placed the Amazon at the center of international and national environmental and climate policies. The case of Brazil demonstrated that a mix of environmental (forest) laws can help to considerably slow down the high deforestation dynamics of the previous decades. This is supported by an appropriate deforestation monitoring system, a comprehensive network of protected areas and their effective management, and the enforcement of penalties in case of noncompliance (e.g., exclusion from public credits, penal sanctions). In addition, public and private-led market-oriented approaches have gained importance, such as supply-chain interventions for cattle (e.g., Terms of Adjustment of Conduct, G4 Zero-Deforestation Agreement promoted by
Greenpeace) or for soybean (e.g., Soy Moratorium), which tend to exclude producers using (newly) deforested areas from markets. Although deforestation in the Amazon dropped by around 84%, from 27,772 square kilometers in 2004 to only 4,571 square kilometers in 2012, the limits of this approach have become clear. This is partly because Brazilian environmental governance mechanisms remain extremely contested. Moreover, as highlighted by Lahsen et al. (2016), the focus on Amazonian conservation has masked the displacement of deforestation into less visible and less emblematic, but nonetheless highly diverse (both ecologically and culturally) regions such as the Cerrado. The transformation of the Amazon, therefore, cannot be seen as isolated from trends in surrounding regions, as deforestation and expansion of agriculture are shifting from the Amazon rain forest to the savannas, natural grasslands, and dry forests of Bolivia, Paraguay, Argentina (Table 1), and, more recently, Uruguay, while simultaneously conquering more remote Amazon forest areas.

The drivers and dynamics of deforestation in South America are highly complex. State policy toward land allocation and land markets strongly influence access to areas suitable for conversion, with more powerful actors controlling the consolidated agricultural frontier, and driving more marginal actors to more remote areas, who thereby open new fronts of deforestation. With increasing transnational integration, especially in the expanding soybean–livestock-based economy, so-called leakage effects of environmental policies, as well as their cross-biome and cross-border implications, need to be better understood. This article is a step in this direction. We focus on the border region between the Brazilian state of Mato Grosso and the eastern Bolivian lowlands in the department of Santa Cruz (Figures 1 and 2), where two main South American deforestation fronts converge. Both regions combine the highest soybean and livestock production of their respective countries. Indeed, large parts of Mato Grosso belong to the so-called Amazon Arc of Fire, or Arc of Deforestation. In keeping with national trends, deforestation rates in Mato Grosso did slow down compared to previous decades, although in recent years no further decline has been observed. By contrast, the department of Santa Cruz has constituted a hotspot in forest conversion since the end of the 1980s, showing few signs of reversing these trends. Here we focus on the parallel, though differing, trajectories of these two regions to explore their growing interconnection and possible implications for future patterns of deforestation.

### Agricultural Expansion and Land-Use Change Patterns in Mato Grosso

Until the mid-20th century, the federal state of Mato Grosso remained largely excluded from national economic cycles, and hence was only marginally affected by large-scale environmental changes. Mato Grosso, which comprises parts of the Amazon (53%), Cerrado (40%), and Pantanal (7%) biomes, was mainly inhabited by indigenous groups until the early 18th century, when so-called bandeirantes obtained the first large-scale properties to exploit gold finds. From the 1930s on, President Getúlio Vargas proclaimed the March

| Table 1. The Soybean and Livestock Sectors as Drivers of Deforestation and Land Conversion in South America |
|---------------------------------------------------------------|
| **Brazil** | **Argentina** | **Paraguay** | **Bolivia** |
|------------------|-------------|-------------|-------------|
| Total terrestrial surface (km²) | 8,515,767 | 2,780,400 | 406,752 | 1,098,581 |
| Forest area (km²) (2015) | 4,935,380 | 271,120 | 153,230 | 547,640 |
| in % of total land area | 59 | 9.9 | 38.6 | 50.6 |
| Change in forest area: 1990–2015 (km²) | 531,670 | 76,810 | 58,340 | 80,310 |
| in % of total 1990 forest area | 9.72 | 22.08 | 27.57 | 12.79 |
| Annual rate of change: 1990–2015 (%) | –0.4 | –1.0 | –1.3 | –0.5 |
| Proportion of Agriculture in GDP | 4.57 | 5.61 | 18.08 | 11.59 |
| Heads of cattle | 218,225,177 | 52,636,778 | 13,858,584 | 9,082,193 |
| Rank in top 10 cattle producers worldwide | 1 | 6 | not in top 10 | not in top 10 |
| Soybean production (tonnes) (2016) | 96,296,714 | 58,799,258 | 9,163,030 | 3,204,639 |
| Area under soybean cultivation (km²) (2016) | 331,536.79 | 195,046.48 | 33,700 | 13,363.99 |
| Rank in top 10 soybean producers worldwide | 2 | 3 | 6 | 9 |

---

aUN (2018) – Country profiles, http://data.un.org.
bFAO (2015) – Global Forest Resources Assessment 2015, www.fao.org/3/a-i4808e.pdf; World Bank.
cWorld Bank (2018) – Agriculture, forestry, and fishing, value added (% of GDP), https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS.
dFAO (2018) – FAOSTAT, http://www.fao.org/faostat (accessed 30 September 2018).
to the West, which, together with the foundation of the new national capital, Brasília, in 1960 and the associated development of (road) infrastructure to the interior, facilitated the integration of peripheral regions into the national economy. This was the starting point of far-reaching socioecological transformations in Mato Grosso, which accelerated during the Brazilian military administrations (1964–1985). For the federal state, the colonization of sparsely populated, but resource-rich, peripheral regions was of geostrategic importance to secure better control over national territory and increase economic value. Furthermore, the opening of new agricultural fronts offered an alternative to distributive agrarian reform and a solution to social conflicts in the traditional agricultural regions of the south and southeast, where land concentration and population pressure caused a scarcity of land. The access to “empty land” (which in reality was often inhabited by indigenous people) lured various actors into the region, including landless migrants, smallholders, capitalized farmers, ranchers, sawmill operators, laborers, miners, investors and speculators. The process of transforming Mato Grosso into one of the biggest agricultural production areas of Brazil was initiated during the 1970s and 1980s, when the federal state played a critical role through regional development strategies (e.g., POLOCENTRO) and sector-specific programs (e.g., PRODEcer) based on agricultural policies, tax incentives, subsidies, and credits designed to attract capital and modernize the agricultural sector through green-revolution approaches. Mechanized agriculture expanded in Mato Grosso thanks to the availability of large flat land areas (the plateaus—chapadões—of Mato Grosso). There, farmers from other parts of Brazil—especially from southern states, where the soy boom had started in the 1970s—could acquire large plots of land at comparatively
cheap prices. Of critical importance was the state agricultural research institute, EMBRAPA, which introduced technical innovations, such as the breeding of new crop varieties that could adjust to the tropical soil and climatic conditions in Mato Grosso. These further enticed transnational companies to introduce new cultivation techniques (e.g., no-till farming), based on the use of high levels of pesticides and genetically modified seeds, into Brazil. Meanwhile, increasing global demand and food prices favored export-oriented agribusiness, thereby turning cultivation of agricultural commodities into a lucrative business. In this respect, China has played a dominant role in global demand patterns, especially for soybean, as in the 1990s this country turned from a net exporter to a net importer, today importing about 60% of the total volume of soybeans traded globally. By integrating the global agribusiness production networks, Mato Grosso has become strongly dependent on transnational traders and agrochemical companies controlling international markets. Some Brazilian large-scale producers have, however, successfully grown into big agribusiness players and won an important market share in global production networks through the vertical integration of their activities. This new economic elite has gained strong political influence, at both regional and federal levels. The colonization and expansion of the agricultural frontier has turned Mato Grosso into Brazil’s largest production area of soybeans, corn, cotton, sunflowers, and cattle, with the agribusiness sector—including all associated industrial and distribution activities—currently accounting for 50.5% of the state’s gross domestic product (GDP). This transformation has been accompanied by strong social and environmental disruption, including soil erosion and contamination (e.g., through the use of pesticides), and has contributed to discriminatory land tenure. Huge areas have been deforested for the expansion of agriculture and cattle ranching in the Amazon biome of Mato Grosso, but also of the Cerrado, which, compared to the Amazon forests, has a low international and national profile and is not protected by comprehensive conservation policies. It is estimated that the Brazilian Cerrado has already lost more than 50% of its natural vegetation. In Mato Grosso alone more than 43,000 square kilometers of Cerrado was deforested between 2001 and 2017 (i.e., 16% of total deforestation in the Brazilian Cerrado). Although Mato Grosso has also become a leading producer of other agricultural crops at the national level, soybean clearly outperforms them in terms of area under cultivation. Furthermore, corn and cotton are usually
planted in rotation for a second harvest. This provides a significant additional source of revenue but plays a minor role in agricultural expansion strategies in the region. A sequence of temporary economic cycles is often characteristic of agricultural frontiers in Amazon regions, where mechanized agriculture takes over areas that have been previously deforested for other activities. For example, the transformation of former cattle ranches into soybean production areas is particularly noticeable in the north of Mato Grosso, in the transition zone between Cerrado and Amazon.

As soybean cultivation expands over land formerly used as pasture, cattle ranching is being displaced into more remote areas in the Amazon, thereby triggering new cycles of deforestation. Despite growing concern from environmental groups, representatives of the agribusiness have spread a discourse that portrays mechanized agriculture as sustainable (i.e., since in many areas it does not directly drive deforestation). This narrative instrumentalizes the concept of “land sparing,” which promotes the intensification of agriculture to contain the expansion of agricultural land over forested areas. Mechanized agriculture, for example, is explicitly mentioned in the national plan designed to reduce agriculture-based greenhouse gas emissions (Plano ABC), a plan subsidizing credits to farmers to encourage measures of intensification such as, for example, no-till farming or the rehabilitation of degraded pastures. Advocates of the agribusiness, furthermore, refer to the high level of compliance within the Soy Moratorium to demonstrate a decoupling of soy production from deforestation. Critics, however, interpret this as little more than a green-washing of the soy supply chain and point out that the Soy Moratorium takes neither deforestation in the Cerrado nor indirect land-use change into consideration. These aspects need to be considered in assessments of the real impact of soybean expansion on forest cover (Table 2), including their cross-border implications. This extends to Brazilian operators in the cattle and soybean sector, who pursue land concentration and deforestation in neighboring countries. The influx of Brazilian capital has been particularly strong in Bolivia since the 1990s. Thus, as early as 2006–2007, it was estimated that Brazilian farmers controlled 40.3% of the total soybean area, mainly in the surroundings of Santa Cruz de la Sierra, while Brazilian cattle ranchers accumulate 700,000 ha of land for pasture close to the border.

The Opening of a New Frontier in the Eastern Bolivian Lowlands

Looking at a satellite view of the Brazilian–Bolivian border west of Cuiabá, the sharp contrast in vegetational cover is staggering, especially around the Bolivian National Park Noel Kempff Mercado, as the forest limits literally follow the contours of this international border (Figure 2). Forests still cover approximately half of Bolivia’s land area (about 52 million hectares), of which 52 million hectares are deforested.

Table 2. Soybean Cultivation Area (1,000 ha) in Mato Grosso

|        | 1993 | 2003 | 2013 | 2014 | 2015 | 2016 | 2017 |
|--------|------|------|------|------|------|------|------|
| Brazil | 10,654 | 18,527 | 27,948 | 30,308 | 32,206 | 33,339 | 33,980 |
| Mato Grosso | 1,680 | 4,414 | 7,931 | 8,628 | 8,983 | 9,147 | 9,287 |

Source: IBGE - Produção Agrícola Municipal.
which the Amazon forest biome represents about 38%, while the Chaco and Chiquitano forests each cover 17%. Although, compared to neighboring countries, large-scale deforestation in Bolivia is relatively recent, current trends are deeply worrying because the pace of forest conversion has consistently accelerated in the last decades and because deforestation is effectively becoming legalized (see Figure 3).

Two main forest conversion patterns can be observed in the Bolivian lowlands, especially in the Department of Santa Cruz, based on detailed deforestation data for 2016–2017 (see Supplementary Material). Most deforestation occurs on private land used for large-scale cattle ranching or mechanized agriculture (about 78%), with the remaining about 22% taking place on communal land—from both local indigenous communities and Andean peasant colonies—where initial subsistence agriculture is gradually replaced by semimechanized commercial systems.

The drastic land-use changes witnessed in the Bolivian lowlands mirror trends depicted for Mato Grosso and are consistent with mechanisms of land control. Despite the Agrarian Reform of 1952, in the lowlands, land ownership remained strongly skewed toward large, private properties. To remedy this, in the late 1990s, a nationwide process of land titling was initiated that gained renewed strength during the first presidency of Evo Morales. In the lowlands, this resulted in the designation of large indigenous territories, the formal titling of indigenous communal land, and new waves of land allocation particularly to Andean colonists. Nevertheless, these achievements have not reversed historic agrarian inequalities.

In 2008, severe conflicts opposed the MAS (Movimiento al Socialismo) government and the separatist, traditional elite of the “Media Luna” lowland departments, against the backdrop of declining global prices for raw materials, and thus lower state extractive rent. To pacify the rebellious lowlands elite, an unexpected alliance was established between the agribusiness (in particular soybean sector) and the central state. The expansion of the agricultural frontier through the conversion of forest and the intensification and industrialization of the agriculture and cattle sectors have been enshrined as strategic for Bolivia in the national development strategy. This stipulates that “forests are not considered to be idle land for agriculture anymore, instead they become integral stages for the production and transformation of foodstuffs, biodiversity resources, and medicines.” In effect, the original discourse underlying the March to the East is still structuring national policy, treating forests as productive areas of critical importance to diversify the national productive matrix, reduce dependency on the oil and gas rent and to guarantee national food sovereignty through the expansion of the commercial agricultural sector. To this end, access to forested areas and their conversion are being facilitated by the progressive removal of existing regulations of forest protection.

First, under the law, formal land tenure is conditional on the provision of evidence that the land is actually being used (which allows for a status of legal possession) and the fulfillment of the so-called social and economic function of the land (i.e., through subsistence or

Figure 3. Acceleration and formalization of deforestation in Bolivia.

Source: MMAyA & ABT (2018).
commercial food production via agriculture and/or cattle ranching). By contrast, land tenure under forestry management needs to be additionally substantiated by (1) the provision of formal tenure ownership/allocation titles, and (2) the development and approval of a forest management plan, with both conditions representing important administrative and financial hurdles. Deforestation has, therefore, become the easiest way to demonstrate use and secure tenure, in particular for large-scale owners, who have the means to employ a number of strategies to evade expropriation. Second, the ongoing land allocation process is carried out centrally by the National Institute of Agrarian Reform without coordination with local authorities and often irrespective of whether land is actually inhabited, under customary use, with conservation status, or classified as land under permanent forest production. New settlements and their associated land use, therefore, constitute a pioneer front that drives the expansion of agriculture in ever more remote forested areas. Third, the agribusiness and livestock sectors are benefiting from important tax incentives to forest conversion into “productive” land. This lobby puts forward its role in the diversification of the national productive matrix, the increasing proportion of agriculture in Bolivia’s gross domestic product (currently over 11%; see Table 1), and its contribution to national food sovereignty in order to push further legal arrangements that may increase the security of land tenure. Fourth, by contrast, the forestry sector is facing a serious crisis. In the last decade, timber extraction has substantially diminished, and, with it, the profitability of timber sales on both the domestic and export markets. With stricter public control on timber trade to discourage exports, the comparatively high value of Bolivia’s currency in relation to the depreciating currencies of neighboring countries, and trends in wood consumption away from massive wood to plywood, among other factors, forestry is becoming less attractive compared to cattle ranching, arable agriculture, or illegal activities related to drug traffic in remote communities close to the Brazilian border, with all of these resulting in surging deforestation for land conversion. Fifth, Law No. 741, an explicit outcome of the recent “Sembrando Bolivia” (Sowing Bolivia) Summit of 2015, eases former restrictions on deforestation for small private properties, and land under collective tenure with the explicit goal of prioritizing food production, for example, by increasing fourfold the total surface that may be cleared. Sixth, the central government, hand in hand with its official opposition, the traditional landowner elite, pursues the development of road infrastructure within the general framework of the Initiative for the Integration of Regional Infrastructure in South America within the Inter-Oceanic Axis to facilitate the expansion of the agricultural frontier. As the governor of the department of Santa Cruz, Rubén Costas, stated in the inauguration of the new tarmac road between Santa Cruz and San Ignacio de Velasco in September 2017: “We need to be convinced and united because we are not only talking about the integration of Bolivia, but of the first central corridor which is going to connect the Pacific with the Atlantic. Bolivia will become the integrative and structuring axis of Latin America.”

Seventh, land use zoning is increasingly performed based on political and economic considerations. Although land use regulations in Santa Cruz are theoretically currently based on the departmental management plan (PLUS—Plan de Uso de Suelo), which originally determined land use categories based on environmental indicators that assessed the lands’ ecological sensitivity and suitability for agricultural use, peasant colonists are allocated forest land classified as unsuitable for agricultural use. In order to keep the land, these communities must demonstrate that they are using it. This explains why they have strongly rejected the particular regulations of forest protection applicable on common land in areas under permanent forest production. Supported by their unions, they are successfully advocating the reclassification of large expanses of land currently under permanent forest production into agricultural land in the Santa Cruz departmental management plan. This evolution continues to undermine past and present efforts to develop a solid legal framework for forest protection and conservation.

In 1965 the Isiboro Sécure National Park (1.2 million hectares) was the first protected area designated in the Bolivian lowlands. It remained a mere “paper park” because it lacked specific institutions and resources to guarantee successful conservation management. After an initial phase in protected area designation, which lasted until 1991, the Rio Earth Summit and Bolivia’s ratification of the United Nations Convention on Biological Diversity in 1992 provided the necessary momentum to establish a comprehensive framework for forest protection, based on the Forest Law (Law No. 1700). The creation of two important institutions, the National Protected Area System and Service, resulted in the designation and expansion of most current national protected areas explicitly for the conservation of forests and biodiversity. By 2013, in total, 70 protected areas had been designated in the Bolivian lowlands and Yungas, which cumulatively amount to 23.2 million hectares (i.e., 30% of the surface of the lowlands and Yungas). These comprise 18 national (covering more than 15 million hectares) and 52 subnational protected areas (covering 8.1 million hectares), with the lion’s share of these (54%) located within the Santa Cruz Department. Since 1998, however, the designation of new protected areas has primarily occurred at departmental and district levels, and considerations refocused on environmental protection (e.g., of water resources), the development of
tourism, and, more generally, attempts at containing the expansion of the agricultural frontiers. This is a daunting task against the backdrop of the explicitly extractive policy the MAS government pursues, despite fundamental advances. Indeed, 2009 had all the potential to be a turning point for forest protection. The central state enshrined Mother Earth in the new Constitution of the Plurinational State of Bolivia and enacted Framework Law No. 300 of Mother Earth and Integral Development for Living Well. “This Law defines land rights as a collective subject of public interest and establishes the collective and individual rights of indigenous nations and peoples, rural peoples, intercultural and Afro-Bolivian communities within a comprehensive development proposal for natural resource use.” It established the Plurinational Authority of Mother Earth, which introduced a non-market-based financial mechanism to support the implementation of the climate and environmental agenda at the national level. Furthermore, the new Forest and Land Inspection and Social Control Authority (ABT, Autoridad de Fiscalización y Control Social de Bosques y Tierra) was created, located in Santa Cruz de la Sierra, at the epicenter of deforestation. Forest Law remained largely unchanged since its formulation in 1996. Efforts were, nevertheless, made to improve monitoring of deforestation, increase control of the timber sector, and deter illegal forest clearing. Law No. 337, however, has contributed to legitimizing forest clearing for agricultural purposes and granted landowners who carried out deforestation illegally until 2011 amnesty, albeit conditional on payment of fines and reforestation activities.

The preceding explains why the pace of deforestation has continuously increased from the 1960s until 2017, when annual deforestation was lower than in the previous year for the first time on record. Together with the significant reduction in illegal forest clearance observed since 2012 (Figure 3), this has been hailed as an important success by the ABT, which is currently reviewing its future projection to envisage a stabilization of deforestation based on these trends. Nevertheless, in practice, the achievement is, above all, the legalization and formalization of forest clearance—a necessary step in the implementation of the official strategic goal of expanding the agricultural frontier. What had constituted a cornerstone in the development of alternative narratives of development and conservation in Latin America and inspired the world to articulate new paths toward sustainability is therefore becoming little more than rhetoric.

The East Chiquitania: Where the Two Fronts Meet

Geologically, the Chiquitania lies between the Andean piedmont to the west, the Brazilian Shield to the east, and the alluvial Chaco–Beni Plain, and at the watershed between the Amazon and Paraguay–Plata basins. The region possesses its own characteristic ecoregion, the Chiquitano Dry Forest, which comprises a range of forest communities belonging to the neotropical seasonal
dry forest complex, and connects the Amazon, Andean valleys, and altiplano ecoregions to the dry and inundated savanna habitats and dry forests of the Cerrado, Gran Pantanal, and Chaco biomes. The Chiquitano Dry Forest formerly extended into Brazil and Paraguay. In 2011, it still covered about 15 million hectares and was estimated to have high levels of ecological integrity and functionality, which led to its incorporation into the International Model Forest Network. Until the 1980s, the Chiquitano Dry Forest was largely spared, thanks to its remote location at the periphery of the main areas of forest extraction and land conversion in Brazil and Bolivia, its low population, and a growing network of protected areas, forest concessions, and indigenous territories. Since then, however, the Chiquitania has experienced some of the fastest rate of deforestation worldwide. Located between two advancing frontiers, the mechanized agricultural frontier from the west and the cattle ranching frontier from the east, it is currently the major hotspot of deforestation at national level. Satellite pictures from Chiquitos, a rural district that stretches along the road linking Santa Cruz de la Sierra to Corumbá on the Inter-Oceanic axis, illustrate the rapid pace of land conversion to establish soybean monoculture in the area between 1984 and 2000. Land use conversion follows a west-to-east and a south-to-north axis, as more remote forested areas become accessible. This is well illustrated in Table 3, which depicts important contrasts in the productive matrix in four rural districts along these axes. Indeed, to the west and south, the rural districts of Pailón and San José Chiquitos now mostly rely on (soybean) commercial agriculture and cattle ranching, while further to the north and east (Concepción and San Ignacio de Velasco) land

| Province     | Pailón          | San José de Chiquitos | Concepción       | San Ignacio de Velasco |
|--------------|-----------------|-----------------------|------------------|-----------------------|
| Total land area | 1,029,119.01  | 2,248,340.75          | 2,902,207.4      | 4,870,600.65          |
| Population   | 37,866          | 28,922                | 18,800           | 52,362                |
|   Of which Aymara / Quechua<sup>a</sup> | 1,586          | 4.2                   | 1,066            | 3.7                   |
|   Of which “foreign” language<sup>b</sup> | 14,422         | 38.1                  | 7,529            | 26                    |
| Arable land  | 326,423.84      | 31.2                  | 69,937.14        | 13.9                  |
| Of which soybean | 185,117.35    | 17.7                  | 19,631.86<sup>c</sup> | 3.9                  |
| % of total arable land | 56.7         | 28.1                  | 5.6              | 1.6                   |
| Main commercial crops<sup>d</sup> | Soybean, sorghum, sunflower, wheat, chia | Soybean, sorghum, sunflower, sesame, chia | Peanut, chia, sesame, bananas, beans | Peanut, soybean, sesame, bananas, chia |
| Pasture      | 343,817.04      | 32.9                  | 123,564.31       | 24.5                  |
| Of which cultivated | 287,667.77     | 27.5                  | 67,755.77        | 13.5                  |
| % of total pasture | 83.7          | 54.8                  | 70.3             | 41.2                  |
| # of heads of cattle | 415,153        | 145,643               | 128,420          | 397,713               |
| Forestry     | 343,207.41      | 32.8                  | 301,602.79       | 59.9                  |
| Total land under use<sup>d</sup> | 1,045,176.99  | 503,530.57            | 539,697.76       | 2,084,055.62          |

<sup>a</sup>Proxy for Andean colonist population.
<sup>b</sup>Proxy for Foreign colonists, in particular Mennonite, Japanese communities.
<sup>c</sup>Soybean, sorghum, sunflower, wheat are typically cultivated in fully mechanized, intensive systems, while peanut, sesame, chia, bananas and beans are cultivated mainly in swidden systems that can, in place, be partly mechanized.
<sup>d</sup>Includes double counting through winter and summer cultivation.

Sources: Instituto Nacional de Estadísticas: Fichas Resumen Censo de Población y Vivienda 2012, http://censosbolivia.ine.gob.bo/censofichacomunidad; Ficha Resumen Censo Nacional Agropecuario 2013, http://sica.ine.gob.bo/censofichacna/ for the four rural districts (accessed November 2018).
use focuses on extensive cattle and forestry. In San Ignacio de Velasco, which shares a border of about 500 kilometers with Brazil and was ranked first in terms of deforestation at the national level in 2017, the advancing agricultural and cattle ranching fronts meet. This rural district accumulates a rapidly growing herd of cattle on expanding pasture areas, with an embryonic commercial agricultural sector that is rapidly gaining momentum, in particular through the rapid influx of Mennonite and Andean colonies, as well as the incursion of large-scale agribusiness in the area. Although the local rural district authorities officially aim at containing new settlements and encouraging more sustainable approaches to land conversion, their rural development approach is primarily based on the gradual mechanization, intensification, and concentration of agriculture on common land. San Ignacio de Velasco is emblematic of the process of land appropriation and expansion of extractive frontiers that is currently taking place in the eastern Bolivian lowlands in blatant contradiction to the official, post-neoliberal turn once pushed by the MAS government. It has become a battlefield between a range of actors that, at different scales, all seek to increase their control on the land and natural resources of this still largely untapped area (Figure 4). Indeed, approximately half of the land area of the rural district is located in protected areas, forest concessions, and the indigenous territory of Bajo Paraguay. Despite vast land reserves, accessible agricultural land is scarce and land prices, though still low in comparison to neighboring countries, are rapidly rising. Competition between different actors to secure land is, therefore, spurring complex mechanisms, with formal land allocation and acquisition through the market constituting the tip of the iceberg.

Current Efforts Toward Transborder Integration

Recently, an official bilateral platform has been created, which brings together public authorities and representatives of the private sector (in particular cattle ranchers’ organizations) at different levels for greater integration in policy and trade between the seven rural districts of Mato Grosso (Vila Bela, Comodor, Porto Esperidiao, Pontes Lacerdad, and

![Figure 4. Key actors in San Ignacio de Velasco.](image-url)
Cáceres) and Santa Cruz (San Ignacio de Velasco and San Matías), which share a border. This reflects an effort to formalize cooperation and to establish coordinated action toward the regulation of fluxes of people and goods and a common fight against illegal activities, such as the smuggling of cattle and drugs (Table 4).

Taken collectively, these proposed measures acknowledge the reality of a porous and highly dynamic transborder region. Nevertheless, if the Bolivian partners hope to obtain important gains, it remains to be seen to what extent they can really steer and negotiate beneficial agreements with their mighty neighbor. Further, as the key actors driving these negotiations are private cattle ranch-

| Table 4. Main Axes of Transborder Integration Pursued |
|----------------------------------------------------|
| **Measures Proposed**                               |
| **Livestock sector**                                |
| Establishment of a transborder committee bringing together private cattle ranchers, their organizations and public authorities |
| Adoption of common good practice in the livestock sector |
| Coordinated action to combat cattle foot and mouth disease through vaccination campaigns |
| Transborder phyto-sanitary control points and common cattle registration and certification schemes |
| **Custom, trade and security**                       |
| Revision of the Treaty of Roboré, the official legal framework for bilateral cooperation in matters of custom and trade, to accommodate the present dynamism of the border region and ease the circulation of goods |
| Harmonization between custom systems and the creation of a bi-national chamber of commerce. |
| Creation of a transborder individual documentation system to facilitate and regulate the circulation of persons |
| Bi-national institution to intensify custom, migration and police control |
| Broader debate on the necessity to create a transborder service of intelligence to avoid the illegal circulation of persons and goods across the border |
| Transborder system of monitoring and data management on circulation of persons across the border |
| **Environment, culture, tourism and transport**       |
| Common strategy to develop transborder tourism, including transborder circuits and events |
| Exchange of experiences between participating rural districts concerning cultural tourism and natural protected areas |
| Concerted efforts towards transborder protected area management |
| Transborder tourist routes to facilitate the circulation of tourists from one country to the other |
| Connected transport networks, via the continuation and improvement of existing roads; each country being responsible for the stretch of roads within their territory |
| Reciprocal and common standards in transborder transport services |
ers of both countries, it is also unclear to what extent public authorities may want, and have the capacity, to push forward a common forest protection agenda to contain the expanding agricultural frontier.

Efforts in this direction are currently being pursued within the Zona de Integración Centro Oeste de América del Sur (ZICOSUR), which fosters economic and trade exchange with Asia and supports the diversification of the productive matrix, the modernization of the transport and communication networks, and foreign investments in the region based on the overall framework of sustainable management. Within this endeavor, a series of international conferences has been organized in recent years with the support of the International Union for the Conservation of Nature and the Biodiversity for Life Flagship Initiative of the European Union to exchange local and transborder experiences to promote best practice in territorial planning, protected area management, and sustainable land use. These conferences bring together non-governmental organizations (NGOs), subnational authorities, and conservation managers to discuss how to develop more integrated approaches in transborder regions. This is an interesting initiative, although much needs to be done toward implementation, while, certainly, more decisive efforts are required to contain and regulate transnational land use displacement processes and leakage effects of (national) forest policies.

Conclusions

The processes of opening and expanding the agricultural frontier in Mato Grosso and the Chiquitania show many similarities. In both cases, the incorporation of previously remote areas, perceived as empty, wild, and idle, became the cornerstone of national development strategies. The central/federal state played a critical role in creating the necessary conditions for the appropriation of these vast territories and the exploitation of their abundant natural resources, including:

1. A framing discourse centered on a futures narrative of progress and modernization through the conquest of new frontiers.
2. Development of transport infrastructure to facilitate access.
3. Encouragement of colonization and support of production (through land allocation/titling, innovation in farming technology, the provision of economic incentives, and agricultural extension).

During the 1980s, increasing economic liberalization led both countries to a substantial Restructuring and re-regulation of the agricultural sector, which resulted in an increasing control of the private agribusiness sector and a sharp reorientation of agricultural policy towards export-markets. Meanwhile, at the global level, a highly concentrated oilseed, cereal, and livestock sector emerged, which gained ever more strength within national boundaries. This new transnational corporative-driven model of territorial organization is controlled by the central actors of agricultural production networks (i.e., traders, agrochemical firms, and large-scale producers), which control production conditions and infrastructure developments across the South American borders. In both countries, this has been facilitated by complex formal and informal mechanisms to enable land appropriation by incoming (trans)national actors, thereby exacerbating the profound inequalities in land distribution and control (in particular via land markets, land traffic, and speculation on land). Nevertheless, there are important differences between the two national cases. The expansion of the agricultural frontier was initiated substantially earlier in Mato Grosso than in the Chiquitania, so that most of the frontier region in the Brazilian state can currently be qualified as consolidated. Indeed, even if land displacement is resulting in new cycles of deforestation on pioneer fronts of the Amazon, in Mato Grosso the peak period in deforestation has passed and the restructuring process in the region is the ongoing intensification of agricultural land use. In contrast, in Bolivia, while the region immediately surrounding Santa Cruz de la Sierra may be consolidating, the agricultural frontier in the Chiquitania is highly dynamic. Moreover, the Bolivian lowlands are prey to accelerated forest conversion stemming from multiple pressures, including (1) the national development strategy and (2) the increasing land concentration in the hands of foreign investors, farmers and cattle ranchers, a process closely associated with land conversion and use across the border in neighboring Brazil.

As pioneer frontiers expand and consolidate agricultural land use, deforestation is displaced to more remote areas and less visible biomes across international borders, such as the region between Mato Grosso and Santa Cruz, which is experiencing this process, strongly driven by the state, in alliance with the soybean–livestock sector. This is exacerbating deforestation and land conversion as west and east fronts meet. Despite existing efforts within the ZICOSUR to support coordinated action toward forest and biodiversity conservation, a transborder legal framework for forest protection and associated control and enforcement institutions have not yet been established.

Based on current deforestation rates, and despite a recent decrease in the acceleration of deforestation both in Mato Grosso and Santa Cruz, it seems difficult not to be pessimistic. In view of the ongoing perversion of the inspiring discourse that drove the foundation of the Plurinational State of Bolivia, in particular its official post-liberalism, post-capitalism turn and the enshrinement of the concepts of Mother Earth, Buen Vivir, and food sovereignty in its new constitution, we are currently witnessing the breakdown of this promising new order. The political dynamics of the changing governments in Brazil and that in place in Bolivia are also unhelpful, as they hinder the articulation and implementation of environmental policy over the long term. Forest protection under the Brazilian Forest Code has been found to depend highly on
Adaptation of global environmental change, and the science-policy interface. Christoph Huber is a PhD candidate at the Institute of Geography, University of Innsbruck, Austria, and recipient of a DOC Fellowship of the Austrian Academy of Science. In his research he focuses on the expansion strategies of the Brazilian agribusiness and their socioecological consequences.

A. Cristina de la Vega-Leinert was supported by the German Research Foundation (project grant number: VE 659/2-1). She is indebted to key informants, in particular from Tierra–Oriente, Centro de Investigación y Promoción del Cambio (CIPCA–Santa Cruz), Institute for the Development of Rural Suramérica (IPDRS), San Ignacio de Velasco Autonomous Municipal Government, Fundación para la Conservación del Bosque Chiquitano (FCCB), Asociación de Grupos Mancomunados de Trabajo MINGA, Centro de Documentación e Información Boliviana (CEDB), and all interview partners who generously gave their time and expertise. Christoph Huber is a recipient of a DOC Fellowship of the Austrian Academy of Science, and thanks the European Union for funding through the Horizon 2020 Research and Innovation Programme under the Marie Sklodowska-Curie grant agreement N° 690153.

Supplemental data for this article can be accessed on the publisher’s website.

NOTES

1. E. A. Davidson, A. C. De Araujo, P. Artaxo, J. K. Balch, I. F. Brown, M. M. C. Bustamante, M. T. Coe, R. S. Defries, M. Keller, M. Longo, J. W. Mungan, W. Schroeder, B. S. Soares-Filho, and C. M. Souza, “The Amazon Baseline,” Nature 481, no. 7381 (2012): 321–28.

2. Approximately 63% of the total area of Amazonia is located within Brazil.

3. D. Nepstad et al., “Slowdown Amazon Deforestation Through Public Policies and Interventions in Beef and Soy Supply Chains,” Science 344, no. 6188 (2014): 1118–23; C. M. Louzao, C. G. Nogueira, A. A. Azevedo, and D. McGrath, “Defending Public Interests in Private Lands: Compliance, Costs and Potential Environmental Consequences of the Brazilian Forest Code in Mato Grosso,” Philosophical Transactions of the Royal Society B 368 (2013): 1–13.

4. INPE, Monitoramento da Floresta Amazônica Brasileira por Satélite (Instituto Nacional de Pesquisas Espaciais Projeto Prodes, 2018), http://www.obt.inpe.br/prodes/index.php (accessed 1 October 2018).

5. Deforestation after 2012 in the Brazilian Amazon Legal area: 5,891 km² (2013), 5,012 km² (2014), 6,207 km² (2015), 5,783 km² (2016), 6,947 km² (2017). (INPE, Monitoramento da Floresta Amazônica Brasileira por Satélite - Instituto Nacional de Pesquisas Espaciais Projeto Prodes, 2018), http://www.obt.inpe.br/prodes/index.php (accessed 30 September 2018); M. Klingler, P. D. Richards, and R. Osseen, “Cattle Vaccination Records Questions the Impact of Recent Zero-Deforestation Agreement in the Amazon,” Regional Environmental Change 18 (2018): 33–46.

6. M. Lahsen, M. M. C. Bustamante, and E. L. Dall’Nora, “Undervaluing and Overexploiting the Brazilian Cerrado at Our Peril,” Environment 58, no. 6 (2016): 4–15.

7. G. Baldi et al., “Cultivating the Dry Forests of South America: Diversity of Land Users and Impacts on Ecosystem Functioning,” Journal of Arid Environment 121 (2015): 47–59. M. Baumann, V. Fehlenberg, G. G. Pizarro, and D. McGrath, “Defending Public Interests in Private Lands: Compliance, Costs and Potential Environmental Consequences of the Brazilian Forest Code in Mato Grosso,” Philosophical Transactions of the Royal Society B 368 (2013): 1–13.

8. A. A. R. Ioris, “Places of Agribusiness: Displacement, Replacement, and Misplacement in Mato Grosso, Brazil,” Geographical Review 107, no. 3 (2017): 452–75.

9. T. Weis, “The Meat of the Global Food Crisis,” Journal of Peasant Studies 40, no. 1 (2013): 65–85. P. Meyfroidt, E. F. Lambin, K.-H. Erb, and T. W. Hertel, “Globalization of Land Use: Distant Drivers of Land Change and Geographic Displacement of Land Use.” Current Opinion in Environmental Sustainability 5 (2013): 438–444.

10. H. R. Grau and M. Aide, “Globalization and Land-Use Transitions in Latin America,” Ecology and Society 13, no. 2 (2008): 16.

11. The Arc of Fire refers to Brazilian regions in the southern flank of the Amazon, which have been sacrificed to enable the soybean and livestock expansion: S. B. Hecht, “From Eco-Catastrophe to Zero Deforestation? Interdisciplinary Politics, Environmentalisms and Reduced Clearing in Amazonia,” Environmental Conservation 39, no. 1 (2012): 4–19.

12. J. Schienlein and J. Börner, “Recent Transformations of Land-Use and Land-Cover Dynamics Across Different Deforestation Frontiers in the Brazilian Amazon,” Land Use Policy 76 (2018): 81–94; ICV, Análise do Desmatamento em Mato Grosso (2017). (Instituto de Defesa do Cerrado, 2018), https://www.icv.org.br/wp-content/uploads/2018/01/desmatamento-mato-grosso-2017.pdf (accessed 26 November 2018).

13. R. Müller, P. Facheo, and J. C. Montero, The Contests of Deforestation and Forest Depredation in Brazil: Drivers, Agents and Institutions, Occasional Paper 108, Center for International Forestry Research, Bogor, Indonesia, 2014.

14. Groups of fortune hunters mostly originating from the São Paulo region, who penetrated the interior of Brazil far south and west of the Tordesillas Line of 1494.

15. W. Jepson, “Producing a Modern Agricultural Frontier: Firms and Cooperatives in Eastern Mato Grosso, Brazil,” Economic Geography 82, no. 3 (2006): 285–316.

16. P. M. Fearnsride, “The Roles and Movements of Actors in the Deforestation of Brazilian Amazonia,” Ecology and Society 13, no. 1 (2008): 23.

17. M. C. Klingler, M. Kolkhehp, “De frontier até pós-frontier,” Confinis, 2017, https://doi.org/10.4000/confins.11683.

18. The use of genetically modified seeds was Brazil was legalized via the Lei da Bioseguranca, in 2005.

19. World Bank, “Commodity Markets Outlook (October),” World Bank, 2018. http://www.worldbank.org/en/research/commodity-markets (accessed 7 January 2019).

20. A. L. Castilo, Partido de Terra: como os políticos conquistam o território brasileiro, São Paulo: Contexto, 2012, 239 p.

21. IMEA, “Agronegócio no Brasil e em Mato Grosso,” Instituto Mato-grossense de Economia Agropecuária, 2018. http://www.imea.com.br/imea-site/view/uploads/relatorios-mercado/R405_Apresentacao%20-%C3%A3o%20MT_Portugues%20A4s.pdf (accessed 31 October 2018).

22. From the 1980s to the beginning of 2000s, Mato Grosso ranked highest in terms of annual deforestation rates in the Amazon Legal area, and in 2017, it still held the second position with a total deforestation of 1,561 km².

23. Lahsen et al., note 6.

24. R. Beuchle et al., “Land Cover Changes in the Brazilian Cerrado and Caatinga Biomes From 1990 to 2015 Based on a Systematic Remote Sensing Monitoring Approach,” Applied Geography 58 (2015): 116–27; Instituto Nacional de Pesquisas Espaciais (INPE) Projeto Monitoramento Cerrado “INPE divulga dados sobre o desmatamento do bioma Cerrado,” 2018, http://www.obt.inpe.br/IOB/noticias/inpe-divulga-dados-sobre-o-desmatamento-no-do-bioma-cerrado (accessed 31 October 2018)
for peasant and indigenous communities, see A. C. de
to the central government, which can
Evo Morales in 2005.
against the MAS government soon after the election of
the Bolivian Lowlands: An Analysis of Spatial Dynamics, "
and P. Pacheco, "Proximate Causes of Deforestation in
Revista de Documentación e Información Boliviana, Cochabamba,
Costa Rica: A Case Study."
Exclusion, "
for peasant and indigenous communities, see A. C. de

Evo Morales in 2005.
against the MAS government soon after the election of
the Bolivian Lowlands: An Analysis of Spatial Dynamics, "
and P. Pacheco, "Proximate Causes of Deforestation in
Revista de Documentación e Información Boliviana, Cochabamba,
Costa Rica: A Case Study."
Exclusion, "
for peasant and indigenous communities, see A. C. de

Evo Morales in 2005.
against the MAS government soon after the election of
the Bolivian Lowlands: An Analysis of Spatial Dynamics, "
and P. Pacheco, "Proximate Causes of Deforestation in
Revista de Documentación e Información Boliviana, Cochabamba,
Costa Rica: A Case Study."
Exclusion, "
for peasant and indigenous communities, see A. C. de

Evo Morales in 2005.
against the MAS government soon after the election of
the Bolivian Lowlands: An Analysis of Spatial Dynamics, "
and P. Pacheco, "Proximate Causes of Deforestation in
Revista de Documentación e Información Boliviana, Cochabamba,
Costa Rica: A Case Study."
Exclusion, "
for peasant and indigenous communities, see A. C. de

Evo Morales in 2005.
against the MAS government soon after the election of
the Bolivian Lowlands: An Analysis of Spatial Dynamics, "
and P. Pacheco, "Proximate Causes of Deforestation in
Revista de Documentación e Información Boliviana, Cochabamba,
Costa Rica: A Case Study."
Exclusion, "
for peasant and indigenous communities, see A. C. de

Evo Morales in 2005.
against the MAS government soon after the election of
the Bolivian Lowlands: An Analysis of Spatial Dynamics, "
and P. Pacheco, "Proximate Causes of Deforestation in
Revista de Documentación e Información Boliviana, Cochabamba,
Costa Rica: A Case Study."
Exclusion, "
for peasant and indigenous communities, see A. C. de

Evo Morales in 2005.
against the MAS government soon after the election of
the Bolivian Lowlands: An Analysis of Spatial Dynamics, "
and P. Pacheco, "Proximate Causes of Deforestation in
Revista de Documentación e Información Boliviana, Cochabamba,
Costa Rica: A Case Study."
Exclusion, "
for peasant and indigenous communities, see A. C. de

Evo Morales in 2005.
against the MAS government soon after the election of
the Bolivian Lowlands: An Analysis of Spatial Dynamics, "
and P. Pacheco, "Proximate Causes of Deforestation in
Revista de Documentación e Información Boliviana, Cochabamba,
Costa Rica: A Case Study."
Exclusion, "
for peasant and indigenous communities, see A. C. de

Evo Morales in 2005.
against the MAS government soon after the election of
the Bolivian Lowlands: An Analysis of Spatial Dynamics, "
and P. Pacheco, "Proximate Causes of Deforestation in
Revista de Documentación e Información Boliviana, Cochabamba,
Costa Rica: A Case Study."
Exclusion, "
for peasant and indigenous communities, see A. C. de

Evo Morales in 2005.