Chapter 13
Land-Use Competition in the South American Chaco

Matthias Baumann, María Piquer-Rodríguez, Verena Fehlenberg, Gregorio Gavier Pizarro and Tobias Kuemmerle

Abstract The dry forests of the Chaco in South America are under great land conversion pressure, mostly for establishing pastures and soybean fields. Taking recent estimates into account, the rates at which forests are disappearing are similar to those of the Amazon, but compared to the Amazon, the Chaco remains fairly understudied. The land transformations during the past decades went along with a substantial change in the type of actors dominating the Chaco landscape. In this chapter, we discuss the land changes in the Chaco during the past 30 years with emphasis on the actors driving these changes, as outlined in the conceptual chapter of this book section. In the Chaco, it appears that the competition over land is a competition in which the actors are endowed with varying degrees of power, resulting in highly unbalanced competition. This chapter highlights these differences and discusses the potential role of the state as an actor in the competition for land that may help to slow down deforestation in the area and guide the Chaco toward more sustainable land-use futures.

Keywords Transformation · Proximate causes · Underlying drivers · Deforestation

M. Baumann (✉) · M. Piquer-Rodríguez · V. Fehlenberg · T. Kuemmerle
Geography Department, Humboldt-Universität zu Berlin, Berlin, Germany
e-mail: matthias.baumann@geo.hu-berlin.de

G. Gavier Pizarro
Grupo de Biodiversidad, Ecología y Gestión Ambiental,
Instituto de Recursos Biológicos (CIRN), Instituto Nacional
de Tecnología Agropecuaria (INTA), CNIAINTA, Nicolas Repetto
y De los Reseros, Buenos Aires, Argentina

T. Kuemmerle
Integrative Research Institute Transformations of Human-Environment
Systems (IRI Thesys), Humboldt-Universität zu Berlin, Berlin, Germany

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13.1 Introduction

Deforestation has been of major global concern during the last decades since its identification as one of the major drivers of global environmental change. Its consequences for biodiversity are also profound, mostly because habitat for many species is lost when natural forests are converted into human-dominated landscapes. Deforestation also causes substantial carbon emissions and thus also contributes to global climate change. Although deforestation at the global level has been decreasing since 2000, it is still alarmingly high (Hansen et al. 2013). Between 2000 and 2010, the loss of natural forests amounted to 5.2 million ha per year globally. Despite the particular attention of conservation efforts on countries in South America, Southeast Asia, and Africa, which harbor globally valuable forests, these regions still suffer the largest net losses of forests.

In South America, the Amazon region has historically been a focus region for scientists. Deforestation rates here have been high, and the region plays a significant role in the context of global biodiversity, indigenous populations, and carbon budgets.

Interestingly, and also surprisingly, the South American Chaco has been largely overlooked in the literature. For example, using the same search terms in the ISI Web of Science, the number of studies focusing on the Amazon outnumber the studies in the Chaco by more than a factor of ten (Fig. 13.1). However, the South American Chaco is among the largest dry forest areas worldwide, and those forests

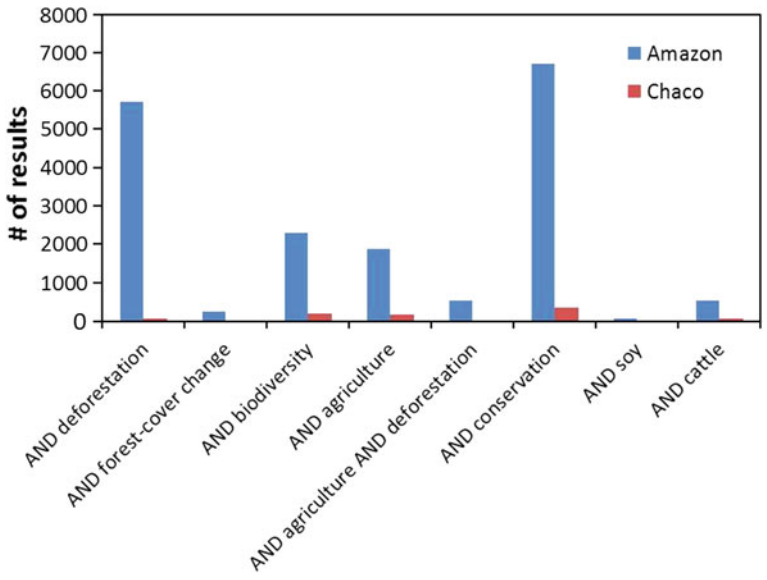

Fig. 13.1 Search results in the ISI Web of Science for Chaco and Amazon in combination with a number of terms used in relation to land-use competition (search conducted on December 10, 2015)

have been disappearing rapidly during the past decades (Hansen et al. 2013). Taking global estimates from the past 10 years, the Chaco has had rates of deforestation comparable to those of the Amazon. Moreover, the dry forests of the Chaco are rich in biodiversity.

The reasons for the ongoing deforestation in the Chaco are manifold and will be discussed in this chapter with a focus on the different actors competing for land. Most of the forests of the Chaco are disappearing in favor of agricultural production, mostly to fulfill increasing global demand in agricultural products resulting from population growth, diets richer in animal products, and the increasing use of agricultural products for biofuel production. This chapter sheds light on the land-use changes that have been shaping today's landscapes of the Chaco. It will discuss the different degrees of power actors possess with regard to land-use decisions and describe the competition over land in this region.

13.1.1 The Chaco

The Chaco is a large, dry forest region covering about 1.1 Mkm^2 located in Argentina (60 % of the Chaco), Bolivia (11 %), Paraguay (27 %), and Brazil (2 %) (Olson et al. 2001, Fig. 13.2). The climate is semiarid and highly seasonal, with a distinct dry season from May to September and a warm, wet season from November to April. The mean annual temperature is about 22 °C, with an average monthly maximum of 28 °C. Annual precipitation ranges from 1200 mm in the east (wet Chaco) to 450 mm in the west (dry Chaco). Elevation varies marginally except for the west and southwest of the Chaco where more hilly terrain prevails. The natural vegetation in the Chaco is a direct result of climate and topography and consists mostly of closed dry forest, open woodlands, shrublands, and palm savannas, which represent a globally significant carbon pool (Gasparri et al. 2008). Forests are the most characteristic vegetation formation and are typically dominated by species of the genera Schinopsis and Aspidosperma ("quebrachos"), Prosopisflexuosa, and shrubs of Larrea sp. (Prado 1993). The Chaco also hosts animal species of importance for local livelihoods and nature conservation. The rich biodiversity of the Chaco includes 145 mammal species (12 endemic), 409 birds (7), 54 reptiles (17), 34 amphibians (8), and more than 80 plant genera (3400 species, of which 46 are trees and with a total of 400 endemic plant species) (Bucher and Huszar 1999).

The diverse biodiversity worth hunting or gathering for their meat and skin is the reason why this region is named "Chaco." The word "Chaco" derives from the Quechua expression "chacu" which means "hunting place," and this is probably how the region was perceived by native settlers. Around 5000 years ago, native tribes from the Pampas (the "pampidos"), who were originally hunters, moved to the Chaco region probably looking for new hunting territories. Other communities inhabiting the Chaco came from the Andes and Amazonia regions. The original nomadic communities of hunters, fishers, and gatherers (estimated to be approximately 300,000 inhabitants) had to move deep into the "wild Chaco" after the onset

Fig. 13.2 The South American Chaco

of the Spanish-criollo invasions in the sixteenth century (Brown et al. 2010). These communities left a rich linguistic inheritance, including the languages of the groups of Zamuco, Gaycuru, Maskoi, and the Matako-Maka. Their agricultural activities were secondary to cattle ranching, and plots were small (below 100 m^2). Until the end of the nineteenth century, the most recent immigrant ethnic groups of the "gringos," "criollos," or "menonitas," largely of Spanish descent, had transformed the land at an unprecedented rate for sugar plantations, cotton, and maize.

13.1.2 Land-Use Change in the Chaco

The land-use pattern and agricultural practices prevailing in the Chaco today do not have much in common with what has been dominating the Chaco's landscape for the past centuries. Traditionally, small-scale subsistence agriculture and extensive cattle ranching characterized land use in the Chaco. Farms were sufficiently large to fulfill a family's own needs and generated only a marginal surplus that could be sold on markets. The predominance of subsistence agriculture resulted in a land-use pattern characterized by small agricultural fields and cattle ranches, with the latter being often referred to as the "puesto system," puesto referring to a particular type of range dwelling (see also Chap. 4).

Today, the picture differs strongly from what has been characterizing the Chaco's landscape for centuries. During the past decades, and in particular during the past 10–15 years, the agricultural system in the Chaco has become dominated by large-scale farms, both for the production of cash crops and for beef production (Altrichter and Basurto 2008; Grau et al. 2005). Agricultural crops today are mostly grown on farms with a size of several 1000 ha. Monocultures are widespread, mostly soy, but also sugarcane, wheat, and corn (maize). Pasture areas are of similar size. This agricultural system has been expanding dramatically in the past, and the expansion has mostly occurred at the expense of natural forest areas. During the past 30 years, almost 20 % of the natural forest area was converted into either croplands or pastures (Vallejos et al. 2015). The speed of deforestation has dramatically accelerated over the past 10 years (Caldas et al. 2015), only interrupted by a two-year slowdown during the economic crisis of the late 2000s (Graesser et al. 2015). In addition to agricultural expansion, agricultural land use has also changed. Many pasture areas have been converted into croplands over the past 15 years, particularly in Argentina (Baumann et al. in review-a) (Fig. 13.3).

The agricultural expansion with the particular focus on soy had substantial positive effects for the economies of the countries, particularly Argentina and Paraguay. In case of Argentina, the focus on soy helped the country recover from the deep economic crisis after 2001 that sent nearly half of the Argentine population into poverty (Leguizamon 2014). Following the introduction of genetically modified variants in 1996, soy production has spiked (Fig. 13.3, left) and the export of soybeans has been rising 8.6 % per year on average (Leguizamon 2014), substantially contributing to making agriculture responsible for more than half of all Argentine export earnings. GM soy is thus often promoted as a success story of how to boost socioeconomic development of poor countries elsewhere (Newell 2009). Likewise, the introduction of new highly productive exotic grasses such as Gatton panic (Panicum maximum) or Buffel grass (Cenchrusciliaris) and the adoption of improved farming techniques and cattle breeds (Vazquez 2013) resulted in productivity increases in cattle production (Ramirez and Laneri 1989; Fig 13.3, right), largely for export purposes (Fatecha 1989). Thus, deforestation and agricultural expansion helped the Chaco countries, particularly Argentina and Paraguay, to strengthen their economies and to recover from economic crises.

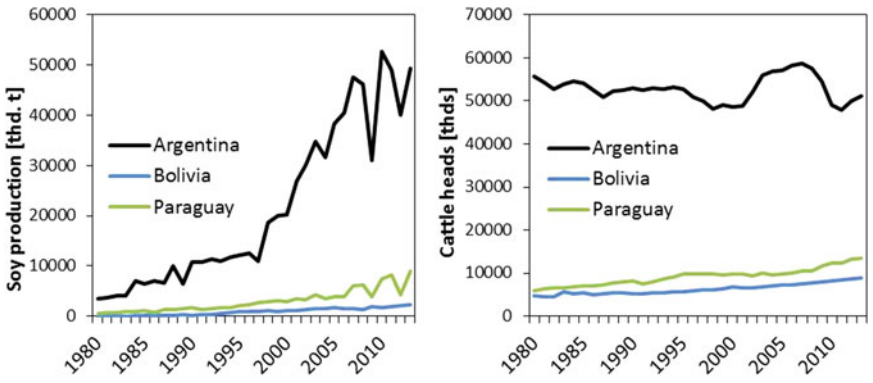

Fig. 13.3 Soy production and number of cattle head between 1980 and 2013 in the three countries that intersect the Chaco. The numbers represent national estimates from the FAO (FAOSTAT 2015)

However, the changes in agricultural practices in the Chaco have also had manifold and substantial consequences for society and the environment of the region, particularly in Argentina. For example, the transition of agricultural practices from traditional farming toward modern, capital intensive agriculture using genetically modified soybean involves the heavy use of herbicides, pesticides, and fertilizers (Gurtler et al. 2007). These chemicals are often used without strict regulations and safety instructions and thus pose substantial health threats to farmers and animals (e.g., for bees, which are important for the pollination process). Such health issues can include skin, lung, and heart diseases of the farmers and of people living close to the farms (Burghardt 2014). Moreover, malformations of newborn babies and early child deaths are increasingly reported and have been associated with the intensive use of herbicides and pesticides (Goldfarb and Zoomers 2013).

In addition, social conflicts have become more frequent. Many conflicts arise as a consequence of land acquisitions by big powerful external investors, irregularities in land titling (e.g., when farmers that have been living and working on the land for several generations are evicted from their land), or the sale of government-owned land to external investors at derisory prices. Further, the highly mechanized agricultural practices with fewer and fewer employees on large farms have been stimulating a rural exodus due to the absence of employment opportunities, leading to decimation of rural communities (Leguizamon 2014).

Besides the socioeconomic implications of the agricultural transition in the Chaco, the environment also experienced (and still experiences) the consequences of the agricultural land changes. Inefficient agricultural practices, resulting either from a lack of knowledge or from a lack of interest in efficient agricultural production, resulted in a loss of nutrients as well as in degradation and soil erosion across large areas (Bucher and Huszar 1999). In addition, the establishment of monocultures has impacted the amount of birds and mammals in the region during the last century (Gavier-Pizarro et al. 2012). Water pollution from the uncontrolled

use of pesticides and herbicides is endangering aquatic species. Nutrient and water cycles have been modified due to the intensification of cattle ranching and agricultural production. Overall, the agricultural expansion resulted in some economic development in the Chaco, but there are also substantial negative effects that may outweigh positive developments.

13.2 Drivers of Land-Use Change in the Chaco

Recognizing the dramatic land conversions from natural forest ecosystems into human-dominated agricultural landscapes and their consequences for society, economy, and environment raises the question of the drivers of these land-use changes. Here, we present a selection of dominant drivers that we suggest can account for a significant portion of the observed land-use changes in the Chaco.

13.2.1 Proximate Causes

The most dominant proximate causes of land-use change in the Chaco are agricultural expansion for both crop production and cattle ranching (Fehlenberg 2015). Pasture expansion appears to be the dominant proximate cause of deforestation, as rates of pasture expansion are substantially higher than those of cropland. The picture is becoming more diverse, however, when subdividing the Chaco into the dry Chaco to the west, which is mostly located in Argentina, and the wet Chaco to the east, which is mostly on Paraguayan territory. Analyses of remote sensing data and national statistical information of soybean and cattle production suggest that during the past 12 years the causes diverged substantially between the dry and the wet Chaco. In the wet Chaco, pasture expansion appears to be the most dominant proximate cause of deforestation (Caldas et al. 2015), to the extent that during the past 12 years almost 25 % of natural forests in the wet Chaco were lost to the creation of pastures (Baumann et al. in review-a). The vast majority of these forest-to-pasture conversions were made primarily in areas around Filadelfia (Baumann et al. in review-b). Filadelfia is a Mennonite colony in which traditional farming practices prevailed for a long time (Dana and Dana 2007).

In the dry Chaco, which is to a large proportion on Argentine territory, cropland expansion is the most dominant proximate driver of deforestation (Baumann et al. in review-a; Fehlenberg 2015), although pasture expansion is widespread as well. Across large areas of the Argentine, Chaco soy is grown in monocultures, over 90 % using genetically modified crop varieties (Leguizamon 2014; Reenberg and Fenger 2011). These patterns have been developed in the past despite of partially unfavorable economic conditions including a 2007 Forest Law and high taxes on soy exports (Fehlenberg 2015).

13.2.2 Underlying Drivers

The proximate drivers of land-use change in the Chaco are fueled by and interact with a number of underlying drivers, of which we name only two predominant ones. Similar to many other regions in the world, the underlying drivers are hard to quantify, as they do not originate from the countries within the Chaco region itself but instead have their origin in other places (see also Sect. 13.1). The most important underlying driver of deforestation and cropland expansion in the Chaco is the growing demand for agricultural products, primarily soy. For the last few decades, population growth coupled with increasing affluence that went hand in hand with changing dietary preferences toward more animal protein caused a substantial increase in the demand for animal agriculture. Overall, caloric intake of the world's population is increasing, but also, and this is probably from an environmental point of view more severe, diets are becoming richer in meat. This is problematic because in order to produce more meat, more production of soy as protein-rich animals feed is required. In 2011, 35 % of all crops produced worldwide were used for animal feed which is a highly inefficient use of agricultural products (Reenberg and Fenger 2011) and fundamentally contributed to the increase in demand for agricultural products.

A second dominant underlying driver of the rapid agricultural expansion and the introduction of a system in which monocultures dominate are technological advances, which have revolutionized agricultural practices. In particular, the introduction of genetically modified (GM) soy is a major technological advance that substantially drove and is still driving agricultural expansion in the Chaco. GM soy was introduced in Argentina in the Pampas region in 1996. At present, the vast majority of arable lands are planted with GM soy and that are further expanding (Leguizamon 2014). The GM soy variants are known for the glyphosate resistance, which improves resistance to droughts at reduced pesticide and fuel cost. Other technological advances, including the development of direct tilling techniques or the increasing use of fertilizers and agrochemicals, have fostered the expansion of total soy area in Argentina at rates above those of all other crops (Goldfarb and Zoomers 2013).

The impact of soybean expansion as an underlying driver of deforestation is not immediately visible though. Not entirely understood yet, it is increasingly becoming clearer that forest-to-pasture conversions in the Chaco are often a result of conversions from pastures into soybean elsewhere, through what has been termed leakage effects (Gasparri and le Polain de Waroux 2014). This is particularly true for regions in which forest-to-pasture conversions are dominant, such as in Paraguay but also across wide areas of Argentina. For example, in the Pampas region to the south of the Chaco, many former pasture areas were converted into soybean areas (Graesser et al. 2015), which in turn pushed pasture areas into more marginal areas such as the Argentine Chaco (Manuel-Navarrete et al. 2009; Santarcángelo and Fal 2009). This is likely because converting existing pasture areas into croplands while at the same time deforesting new areas for pastures is

overall less costly compared to preparing forestlands for crop production in the Chaco. Similarly, Uruguayan farmers are increasingly selling their land to (foreign) soybean producers and reinvest the revenues by purchasing land in the Paraguayan Chaco to engage in cattle ranching there (Bertello 2008; Gonzales 2013). Moreover, in Paraguay's Atlantic forest region, deforestation for soybean was banned (Huang et al. 2007), which resulted in substantial conversions from pastures into croplands there and the subsequent displacement of pasture expansion into the Paraguayan Chaco where restrictions on deforestation are missing (World Wildlife Fund 2015).[1] All three examples highlight that, although in many areas of the Chaco pasture expansion appears to be the dominant proximate cause of deforestation, the global demand of soybean is actually driving these processes through leakage effects, in many cases across borders. This is, at least in part, a consequence of the change in agricultural actors from local and national land users to internationally operating companies (Gasparri and le Polain de Waroux 2014), which we discuss in the next section.

13.3 Land Competition in the Chaco

The observed land-use changes and their drivers in the Chaco enable us to examine the competition over land that is happening in this region. As highlighted in the conceptual chapter of this book section, competition over land entails a number of strongly interacting factors. In this chapter, we reflect on the competition in the Chaco by applying the theoretical framework of the conceptual chapter on the competition of land-based ecosystem services. Thereby, we pay particular attention to the actors that compete over land, which in case of the Chaco seems to be of substantially different strengths and power with regard to land-use decision making, resulting in an unbalanced competition. Subsequently, there may be clear winners and losers of the competition that can be identified.

The main actors in the competition over land in the Chaco are the actors that actually use the land. These are, on one side, the small landowners including both crop producers and farmers in the puesto system that raise cattle at a small scale. On the other side, the second major group of actors can be characterized as large-scale agribusiness. While historically the small-scale landowners were the biggest group in the Chaco and used most of the agricultural land, during the past decades the landscape of the Chaco has become more and more dominated by large-scale agribusinesses, which often operate simultaneously in different countries (Gasparri and le Polain de Waroux 2014). One important reason for this domination is that large agribusinesses are capable of making substantial investments in technological innovation, which allow them to produce crops at a relatively lower price.

[1]Although particularly in the case of Paraguay, this resulted in the undesirable outcome of accelerated deforestation in the Paraguayan Chaco.

Small-scale farmers, however, lack resources and financial means, often resulting in production costs per unit area that are higher compared to those by agribusinesses. Consequently, small-scale farmers and their products are less competitive on international markets. Over the course of the past few decades, this resulted in the decrease of the number of small-scale farmers. As a consequence, many small-scale farm owners rented out their land to large-scale businesses and shifted to other income opportunities. In other words, this actor type transitioned from a small- or medium-sized producer to an actor renting out land to large-scale agricultural producers on a contractual basis, typically over a relatively short time period of three years (Goldfarb and Zoomers 2013). This process has been widespread in South America in general, and in the Chaco in particular, leading to the concentration of use rights for agricultural land (Goldfarb and Zoomers 2013).

In addition, other actors have been appearing in the Chaco's landscape during the past 30 years. For example, the large-scale agribusinesses are increasingly dominated by so-called sowing pools, formed by groups of international investors that lease land (as well as machinery, seeds, etc.) to produce crops with the goal to maximize profits. Among other reasons, their financial power enables them to act in a similar way as agribusinesses, with the result that small-scale farmers are being marginalized further. Altogether, this development has further advanced the concentration of agricultural activities on fewer but larger farms in the Chaco (Goldfarb and Zoomers 2013). Between 1988 and 2008, the overall number of active agricultural enterprises in Argentina decreased by almost 50 %. Large-scale enterprises and sowing pools increasingly dominate the agricultural sector. Today, only 2 % of all agricultural enterprises farm more than half of the agricultural land in Argentina, whereas 57 % of enterprises only farm 3 % of all agricultural land (Alvarez Kalverkamp 2013; Goldfarb and Zoomers 2013).

Other actors play only a minor role in the competition over land in the Chaco. There are, for example, actors that pursue the goal to conserve natural habitats. In the Chaco, these conservation actors are often nongovernmental organizations, which act entirely from inside of the Chaco but may also be international initiatives. For example, The Nature Conservancy (TNC) has designated a set of priority areas for conservation for the Gran Chaco ("Conservation Portfolio of Priority Areas for Biodiversity"). Experts on Chaco wildlife, conservation, and ecology from Argentina, Paraguay, and Bolivia outlined so-called areas of biodiversity significance (ABS) for each major taxon (birds, amphibians and reptiles, mammals, and vegetation) based on regional knowledge. Based on this ABS, TNC established priority areas taking into account particular threats from current human pressure. These priority areas cover 470,000 km^2 in the entire Chaco, of which 238,000 km^2 are in Argentina (representing 36 % of Argentina), 148,000 km^2 are in Paraguay (49 % of Paraguay), and 83,500 km^2 are in Bolivia (68 % of Bolivia). However, these priority areas do not necessarily imply that land being designated as ABS is under protection. In fact, only a small proportion of the Chaco's land is under some kind of nature protection (less than 65,000 km^2 across the entire Chaco) partly because land acquisition, land management, and land regulation of protected areas entail administrative and bureaucratic hurdles to overcome and require substantial

amounts of funds. Overall, conservation actors currently appear to only play a minor role in the competition over land in the Chaco.

This may be one reason why in some cases the state as an actor is in the debate, particularly in Argentina (Goldfarb and Zoomers 2013). At the moment, however, the states of the different countries in the Chaco maintain an ambivalent role, characterized in Argentina, for example, by the existence of procedures of "doubtful legality around administration and handover of land" as well as by a government that supports large-scale farming operations as a policy of rural development (Sili and Soumoulou 2011). Likewise, in Paraguay, the expansion of large-scale cattle farms is one major governmental instrument to promote economic growth (Vazquez 2013), rendering the state as an actor that promotes and supports deforestation at least indirectly. At the same time, the state acts toward reducing deforestation by defining and imposing legal frameworks for enforcing environmental protection. For example, Argentina released the Forest Law in 2007 (Ley de Proteccion ambiental de Bosques nativos 2007) that divides the forests into different zones with the goal to slow down deforestation (Piquer-Rodríguez et al. 2015). Likewise Paraguay released a deforestation moratorium in the Atlantic forests, which essentially stopped deforestation there (World Wildlife Fund 2015). Thus, government policies toward protecting natural forests open the room for discussion of potential mechanisms and interventions that may be effective in doing so.

Protected areas and zoning policies (e.g., the Argentinian Forest Law from 2007) are examples of a restriction-oriented policy mechanism. However, as already noted, protected areas in the Chaco are historically underrepresented. Although being partially successful in slowing down deforestation, the problem with forest zoning policies is that although they impose restrictions on forest conversion and legal forest reserves, such zoning policies are often highly variable and insufficiently enforced (Le Polain de Waroux et al. in review). Nevertheless, given that an expansion of the protected area network for the Chaco currently seems politically unfeasible and therefore unlikely to happen any time soon, the development of effective zoning policies such as the Forest Law seems to be the more promising policy mechanism to slow down deforestation.

Deforestation and agricultural expansion often result in substantial emissions of carbon, which renders deforestation a main contributor to climate change (Houghton 2003; Houghton and Hackler 2001). Payments for ecosystem services (PES) are a mechanism making use of that relationship by paying landowners a compensation for not deforesting their land. This has been promoted as a mechanism to reduce deforestation rates in several world regions with partially good success (Börner et al. 2010; Wendland et al. 2010; Wunder 2007). However, PES schemes are underdeveloped in the Chaco with only a handful of projects in the preparation phase. Further, it is questionable whether the implementation of PES schemes can be successful in the Chaco due to the nature of the actors in the competition for land in the Chaco. Large-scale agricultural businesses produce soy in the Chaco at a comparatively low cost resulting in high net returns, which any payment-oriented conservation tool would have to compete with. Although soy prices have not been increasing substantially during the past years, it is at least

questionable whether PES mechanisms can be equipped with sufficient funding to compete with soybean revenues. In sum, given the high revenues from soybean production, the success of payment-oriented tools to protect forest resources in the Chaco seems questionable.

A higher potential for success in conserving natural forests in the Chaco may be seen in policies that incentivize sustainable production in concert with regulation of forest clearing such as the Forest Law in Argentina. The combination of these components may present a promising tool to reduce deforestation while at the same time maintaining production levels. Policy incentives to promote more production could include, for example, the subsidization of the introduction and development of yield-improving technologies (Diaz-Zorita et al. 2002) and the promotion of systems that integrate crop and livestock production (Lemaire et al. 2014). With a simultaneous forest clearing regulation, this would lead to production increases while at the same time reducing deforestation. At the moment, however, the outcomes of such measures are unclear. For example, promoting intensified soybean production may result in conversions of more pastures into croplands, a process which has already been observed in the Chaco (Baumann et al. in review-a) and which may in the short run increase carbon emission related to land-use change due to the pasture-to-cropland conversions (Baumann et al. in review-a). However, in a long-term view, the benefits of reduced deforestation while maintaining production levels may outweigh the disadvantages of having higher short-term emissions.

It is also questionable whether national efforts are enough to curb deforestation rates in the Chaco. Recent studies suggest that the Chaco absorbs substantial deforestation leakages from neighboring countries (Baumann et al. in review-a). Some of these leakages are at least in part a result of strong conservation policies and enforcement of these policies in these countries. For example, Paraguay banned deforestation for cropland expansion in its Atlantic Forests in 2009. This resulted in a conversion from existing pasture areas into croplands and a subsequent displacement of these pastures into the Chaco forests (World Wildlife Fund 2015). Likewise, following stricter conservation policies in the Amazon (Nepstad et al. 2009), many large-scale farmers reinvested their revenues into land acquisitions in the Chaco where they deforested for pasture expansion. Thus, conservation efforts in one place result in deforestation in another place that is subject to less conservation efforts. These shifts and leakage effects are aided by the fact that large-scale agribusinesses are increasingly highly mobile actors within the region and beyond, particularly compared to small-scale local farmers within the traditional puesto system. Agribusinesses have their disposal strategic knowledge, financial resources, and high-level political influence, and their business structures allow them the necessary degree of independence from individual sites and specific local contexts of production. The state as an actor could possibly increase the efficiency of its conservation actions by coordinating and implementing conservation policies internationally in order to regulate the actions of such mobile actors and prevent displacement and unintended outcomes.

Overall, it seems that the competition over land in the Chaco is far from "perfect," as outlined in the introduction to this section (Chap. 8). Instead, the competition in the Chaco is an example, in which large-scale, international actors dominate the land sector, resulting in the land-use changes observed throughout the past decades. It is reasonable to assume that this process will continue in the future and may even accelerate. For example, it is unlikely that the global demand in agricultural products will decrease any time soon. With more people living on the planet, increasing wealth, and, as it appears at the moment, changing diets toward more meat consumption, the global demand for soybean will continue to rise. The current conditions in the Chaco that we outlined suggest that without appropriate land-use planning and regulation, the Chaco will likely absorb a substantial proportion of the additional need for agricultural land to grow soy in a business-as-usual scenario, with all associated environmental and social costs. There are pathways that may contribute toward decreasing deforestation rates, though to be successful will in many cases likely require stronger land-use regulation and enforcement.

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