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The Drivers Behind the Rapid Expansion of Genetically Modified Soya Production into the Chaco Region of Argentina

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1. Introduction

The global demand for biofuels is increasing rapidly. Such measures as the European Biofuel Directive (2003/30/EC) promoting the use of biofuels for EU transport¹ are giving an impulse to the cultivation of soya, especially in Argentina, the source of most European biodiesel imports. The EU goal of replacing fossil fuels with biofuels, combined with the growing demand from China and the USA, is contributing to the expansion of soya for feed and fuel in the Southern Cone, turning its countries into potential energy crops providers for Northern markets. The soya frontier is rapidly expanding in Argentina and beyond its borders (e.g. in Paraguay, Bolivia, Brazil and Uruguay).

Argentina is the world's largest exporter of soya bean oil and soya meal (it supplies about 45 per cent of the world market) and the third largest exporter of soya beans, after the USA and Brazil. Its main customers are China and the EU. Soya covers about 19 million ha of the country's territory, representing about 50% of Argentina's total cultivated area. Over the last 15 years, genetically modified (GM) soya production has expanded dramatically. GM soya was first grown in the central Pampean region, initially on pasture land and in rotation with cattle wheat. Later, it was introduced to other regions, displacing other types of land use and occupying land, increasingly at great cost to native forests and *monte*.^{2, 3} Most of the soya

¹ This Directive on the promotion of the use of biofuels and other renewable fuels for transport, which entered into force in May 2003, stipulates that EU Member States countries must take national measures to replace 5.75% of all transport fossil fuels (petrol and diesel) with biofuels by 2010.

² Designates non-cultivated land with native vegetation that could include a range of types and density of trees, bushes and plants, but also designates a full ecosystem, which are constitutive of peasant livelihoods in northern Argentina.

produced today is GM.⁴ Soya production is now moving northwards, especially into the Chaco region, and also towards other countries in South America. Conditions that made this expansion possible included the dissemination of direct tillage technologies, favourable international prices, changes in the scale and organization of agricultural companies (including new forms of land administration and the concentration of control), and the availability of new land through deforestation.⁵ Soya expansion was also promoted by the government as a 'green' way to increase foreign currency reserves and to boost rural development and energy self-sufficiency.

This expansion of the soya frontier has many implications. It leads to land-use changes and deforestation, for example in the Chaco region. Soya expansion entails the 'monocultivation of the land' and the 'soyization of the pampas and forest'. Production is extremely large scale and capital intensive, which is especially a result of the introduction of zero-tillage techniques. There are, however, also indirect effects. Small-scale farmers and indigenous communities are affected, as are cattle and food producers, who are pushed away towards new zones. In addition, the expansion of the soya frontier is more than simply a change of land use: it is a basic transformation involving new technologies (zero-tillage techniques), new power relations (large companies taking over), and a shift from labour-intensive to capital-intensive production regimes, and is being accompanied by new dependencies (the reliance on a small number of firms that provide agrochemical packages). The rapid expansion of the soya frontier also puts pressure on the land, leading to speculation; it is also seen as a manifestation of land grabbing.

This chapter is based on fieldwork carried out in Argentina in between 2011 and 2012. It provides a critical analysis of the transformations that are taking place as a consequence of the rapid expansion of soya. In it, we look at the features of the current and earlier soya expansion, the actors involved and the consequences, especially for the Chaco region. More particularly, we focus on the extent to which local populations are displaced and/or enclosed, and the role of land governance and territorial planning in bringing the frontier under control.

2. The expansion of the soya frontier: How it happened

No other part of the world has devoted so much land to a single GM crop as Latin America. In 2009, the area covered with GM soya in South America was around 40 million ha [2]. In Argentina – the world's largest exporter of soya oil and meal (supplying about 45% of the world market) – more than 50 per cent of the agricultural land is covered with this crop, reaching a production level of 54 million tons^{6, 7} and covering an area of about 19 million ha

3 Paruelo, J.M, Oesterheld, M. Patrones espaciales y temporales de la expansión de Soja en Argentina. Relación con factores socio-económicos y ambientales. LART / FAUBA (2005) http://www.agro.uba.ar/users/lart/bancomundial/INFORME_final.pdf/ (accessed July 2012)

4 The legalization of Roundup Ready soya in Argentina in 1996 was followed by the illegal introduction of GM soya, first in Brazil and Paraguay, and lately in Bolivia.

5 Paruelo et al. (idem).

(2009–10). After the USA and Brazil, Argentina is the world's third largest soya bean producer; it exports soya beans mainly to China and the EU.

In Argentina, the industrial production of soya started in the late 1970s in the 'nucleus zone' or pampas region, where it contributed to the intensification of land use: there was a shift from labour-intensive cattle ranching and dairy activities to capital-intensive agricultural activities.



Figure 1. South American Chaco region

An important moment for the expansion of soya (and its incursion into neighbouring countries) was 1996, when Argentina approved the production of GM soya,⁸ which at the time was forbidden in all its neighbouring countries.^{9,10} By doing this, Argentina became an outlet for

6 The soya yield in Argentina is almost the same as in the USA and over 20% higher than the average of the other top 5 exporters (USDA: 2010).

7 USDA. Northern Argentina Production Potential Continues to Grow. Foreign Agricultural Services. 2010 <http://www.pecad.fas.usda.gov/highlights/2010/06/Argentina/2010jun24publictravelmwill.pdf/> (accessed April 2012).

8 Today, Argentina is the world's second largest producer of GM crops after the USA. GM crops (e.g. soya, corn and cotton) cover a total area of 22 million ha.

9 'Brazilian farmers bought the illegal seeds (from Argentina) on such a scale that the official ban on GMOs became meaningless and was revoked by President Lula. Similar tactics were used to spread RR soya into Paraguay and Bolivia'. (GRAIN, 2009)

the massive and rapid expansion of 'illegal' transgenic soya beans. Soya is now the main export crop of Brazil and Paraguay and is one of the largest in weight in Bolivia and Uruguay, leading to their nickname 'Repúblicas unidas de la soja'.

2.1. The technology frontier

Following its introduction in 1996, GM soya spread rapidly throughout the continent. Large companies started to expand production by leasing land from small and medium-sized producers. Expansion began in the core Pampean region and is now moving towards the north, and even into and from Brazil, and into Paraguay, Uruguay and Bolivia in a trans-regional capital move [2], in order to reduce climate risks. Brazilian soya entrepreneurs (such as the Brazilian 'king of soya', the Andre Maggi group) are now purchasing land in Argentina, arguing that some costs are cheaper there. And soya growers in Paraguay – mostly Brazilian migrants or their descendants (the *brasiguayos*) – are expanding their soya plantations into the Paraguayan Chaco region, since they realize that the original production area in eastern Paraguay is reaching its limits.

At the same time, there are clear indications that the GM soya frontier is likely to move across the Atlantic towards Africa, where 'bridges' between countries such as Brazil and Mozambique are the starting points for connections to bring in know-how, machinery and GM technologies, and to increased interest in African land. Argentina's machinery producers and land speculators are unlikely to miss out on this business opportunity.

The production of GM soya expanded at a breakneck pace: in 1997–99, the area expanded by an average of 2 million ha per year. In 2002, Roundup Ready soya beans already accounted for 99 per cent of total soya production. The attraction of using GM soya instead of conventional soya was based not so much on yields (the productivity of conventional varieties is sometime higher), as on the compatibility with no-tilling systems, easy field operations and the simplicity of weed management.¹¹ The new GM seeds facilitated pest control over large areas of land and made expansion much more viable. The introduction of GM soya, however, made producers highly dependent on herbicides and fertilizers. This resulted in the rapid increase in herbicide use, raising questions about the economic and environmental sustainability of this production system.

With the massive introduction of the GM soya technological package, this production model started to expand towards areas that had not been considered suitable for agriculture. Examples are Argentina's northeast and the Chaco region, which are vulnerable in both environmental and social terms [3, 4]. Due to new technologies and soft innovations, such as new management models (introducing sowing pools and the leasing of land by extra-regional farmers), the soya frontier shifted towards semiarid areas, such as the Chaco region.¹² In the

10 GRAIN, Las consecuencias inevitables de un modelo genocida y ecocida. 2009. <http://www.grain.org/article/entries/1232-las-consecuencias-inevitables-de-un-modelo-genocida-y-ecocida/> (accessed 30 January 2011).

11 Benbrook, C. Rust, resistance, run-down soils and rising costs. Problems facing soya bean producers in Argentina. Technical Paper no. 8. Benbrook Consulting Services & Ag BioTechInfoNet. 2005. http://www.greenpeace.de/fileadmin/gpd/user_upload/themen/gentechnik/Benbrook-StudieEngl.pdf/ (accessed 30 October 2011).

last 50 years, 2 million ha of forest have been cut in the centre and south of this region for the cultivation of cotton and soya, leading to environmental degradation.

After its introduction, the use of the GM soya technological package expanded very quickly. Technology has become a tool to control access to land, based on techno-fix approaches to sustainability.¹³ In Argentina, the total soya bean area has expanded more than that of any other crop since 1996, and especially since the introduction of direct tilling techniques and Roundup (glyphosate) Resistant soya, combined with the intensive use of fertilizers and agrochemicals. This technological innovation made soya cultivation economically feasible, even in agro-ecological zones where soya beans would not grow before. The combination in one package of direct tillage techniques and machinery with Roundup Ready soya is fundamental for expansion to other ecological regions out of the core areas.

In addition, a new way of organizing production through planting management pools, machinery and labour contractors, and storage facilities, allowed decreasing costs through the scaling of production, which in turn generated even more incentives for territorial expansion [5]. Production is increasingly becoming large scale, because medium and smaller producers are unable to make the required investments in technological innovation (new seeds, agrochemicals, less crop rotation, tendency to monoculture and less sustainable agricultural practices). By applying techno-fix solutions, large-scale enterprises have better possibilities to 'correct' environmental and social costs, which they consider externalities of the business model.

In conclusion, technological innovation (direct tillage plus genetically modified glyphosate resistant soya) in Argentina has changed the way in and scale at which land can be devoted to a single crop, cultivated in large production units, and managed by few hands and with almost no human labour. Interested actors, such as seed and agrochemical multinationals, have actively promoted this model, with the paradigmatic case of Monsanto allowing Argentinean farmers to produce and multiply GM soya without paying royalties and for years ignoring the illegal distribution of the seed across the South American region. The commercialization of Monsanto RR soya and such inputs as glyphosate was authorized in obscure circumstances by the secretary of Agriculture in 1996: the scientific evaluations were performed by directly interested private actors and there was no public debate. The report from the secretary of Agriculture – which did not include a biosafety assessment, was not made public and lacked a peer-reviewed assessment – was approved in just 81 days, and included a large section in English written by Monsanto [6, 7]. Other regions are going to be opened for soya production through biotechnological innovation. For instance, the Obispo Colombres Experimental Station¹⁴ is working on biotech soya development and the improvement of farmers' practices in the northwest region of the country [7]. As a result, yields have improved in this region, and storage facilities and crushing facilities are moving up north. It shows that technological

12 46% of the Chaco belongs to Argentina, 34% to Paraguay (3 departments) and 20% to Bolivia (3 departments).

13 Levidow, L., Papaioannou, T. Innovation narratives in European agricultural research, Crepe research reports. 2010. http://crepeweb.net/?page_id=339/ (accessed November 2010).

14 Estación Experimental Agroindustrial Obispo Colombres is an autonomous entity of the Ministerio de Desarrollo Productivo del Gobierno de Tucumán.

innovation is a key factor in the advance of the agricultural frontier, allowing GM soya to be produced on various types of land and in various climates.

2.2. The land frontier

While it is widely acknowledged that international prices plus technology innovation were responsible for the expansion of soya into the 'marginal' lands of the Chaco region, other factors are also responsible for the rapid expansion of the soya frontier. It was not just the combination in a single package of the application of zero-tillage techniques and glyphosate-resistant soya seeds developed by the multinational Monsanto; it was also the fact that when the new technology appeared, large areas of underused hacienda land were available in the pampas for new and relatively quick occupation, and that extra-sector financial capital was ready to be invested.

There had for a long time (including during the period of import substitution industrialization) been a decreasing interest in farmland in Argentina; large areas of *latifundia* land (land reforms have never taken place there) were increasingly abandoned, and especially in the 1990s people lost interest in farming; capital flowed to the industrial and other sectors, especially after 1991, when in the context of the Washington Consensus, interest in agricultural production decreased. The national grain board (Junta Nacional de Granos) was closed, putting an end to state support to the agricultural sector.

It was in this context of the widespread availability of 'underused' land that technological innovation took place. Large companies and investment funds took the initiative of organizing 'sowing pools', establishing and managing the use of the technological package, controlling large tracts of land and starting to control the whole production chain, based on the previous dissemination of direct-tillage technologies among producers. It is the combination of this new form of organization (sowing pools), technological innovation (direct tillage, GM seeds) and the availability of large areas of unused land that explain the rapid expansion of soya production in the Pampas region. In the core area provinces like Santa Fe – the cradle of direct tillage – soya production advanced [rapidly, on the basis of land leases to achieve scale.]

This rapid expansion pushed annual crops and cattle ranching out of the Pampean region. In the Chaco region, deforestation also increased rapidly, due to the displacement of cattle raising to northern provinces and direct investments in land clearing for new soya plantations. This was accompanied by social conflicts, since the area was occupied by smallholders (peasants) and indigenous groups. By the end of the 1990s, high international soya bean prices and the saturation of the core area led to shifts in the investment pattern, namely from the Pampean region to the northwest of the country and into the Chaco forest, to acquire land for soya production, through either land-use change or the clearing of native forests.¹⁵ According to Benbrook [6], between 1996 (when GM soya was legalized) and 2004, 32 per cent of the expansion of soya plantations in Argentina took place on land previously used for other crops,

15 Slutzky, D. Situaciones Problemáticas de Tenencia de la Tierra en Argentina, Prodinder, 2008.[http://www.proind-er.gov.ar/productos/Biblioteca/contenidos/estinv.14.situaciones% 20problematicas% 20de% 20tenencia% 20de% 20la% 20tierra.pdf/](http://www.proind-er.gov.ar/productos/Biblioteca/contenidos/estinv.14.situaciones%20problematicas%20de%20tenencia%20de%20la%20tierra.pdf/) (accessed June 2011).

27 per cent on former pastures and hay fields, and 41 per cent on newly cleared forest and savannah.



Figure 2. Argentina. Current soya producing provinces

Whereas soya expansion was realized in the pampas region without major transformations in property relationships, the situation was very different in the Chaco region. Here, the expansion was accompanied by large-scale land transfers, the purchase of large areas of land at 'nonsense' prices [8] and the converting new land into agricultural land. In the northwest of Argentina, soya expansion was horizontal; the cultivated area grew by 48 per cent between 1988 and 2002, especially in the provinces of Santiago del Estero and Salta, where the agricultural area doubled between 1988 and 2008 [9]. In both provinces, this process led to the destruction of native forestland (that had carob and quebracho trees) and to the end of small-scale farming, which had mainly been developed on land occupied by peasants, family producers and indigenous groups who lacked legal land titles. The possession and indigenous territory status compete with commercial pressure on this land, causing tensions and often even open conflicts with local land dwellers, and former land use was replaced by soya or livestock.

Because of the boom, soya bean producers in the Pampas, who already controlled the land in this area through ownership or management, made good money. Many of them decided to use their profits to purchase or lease additional land in the northern regions. It is therefore mainly the successful producers from the pampas provinces, such as Buenos Aires, Córdoba and Santa Fe, who are now buying land in the northern provinces, such as Santiago de Estero. Since land users in this area often do not hold legal land titles, land transfers are fairly easy and can depend on different mechanisms of shifting land control. For investors, in terms of opportunity costs, the purchase or occupation through fraudulent or legal eviction of relatively cheap land compensates for unstable yields, the cost of vegetation clearance and higher transport costs. The combination of ownership and other forms of access to land, such as lease contracts, continued to increase nationally by 25 per cent in the period 1988–2002, and these mixed forms, which are typical of the Pampean region, also are becoming more common in the Chaco region. The process has been described as the ‘pampeanization of the Chaco’, and allows new players that were already present in the nucleus region to produce in larger units. ‘Accidental contracts’ in particular have been instrumental as a strategy to enlarge the production units for soya bean and wheat, sunflower and livestock. Thus, the expansion of agriculture, and particularly livestock and soya, is linked not necessarily to large properties in the cadastral sense, but to large production units. Between 1988 and 2002, the agricultural area increased by 15 per cent in the whole country and but 50.3 per cent in the regions outside the pampas.

Besides the ‘soyization’ of the pampas and the ‘agriculturization’ of the Chaco region, which has brought soya into the forests and onto the land of indigenous groups and peasants, there is a third development taking place: the growth of cattle raising as a result of displacement from the pampas to other regions. In the province of Santiago del Estero, the dynamics of the land market set in train by the ‘soya boom’ at the end of the 1990s, soon left new investors with no ‘empty’ land for agriculture. Financial operations with land during the soya boom (2002–07) were among private buyers and sellers, and large-scale soya plantations were relatively easily developed since this land was the best in the province (mainly because of the availability of water); it was easily controlled and accessed through purchase and, if necessary, easily cleared, since forest protection and territorial planning legislation was not yet in place. However, once the way had been paved by soya, cattle ranching activities also increased, mainly on the remaining land, which was considered ‘marginal’ (or not so apt for agriculture) and was in general inhabited by holders with possession or territorial rights. In other words, soya expansion led to both a push and a pull process of cattle raising. These combined processes are reflected in a 2 per cent increase in the cattle population of the northern region. As a result, Santiago del Estero is one of the most affected provinces in terms of land-use change and the arrival of investors from other provinces. Its cattle herd increased by 40 per cent between 1988 and 2002 [10].

At the beginning of the soya era, individual entrepreneurs could afford to invest in land in the Chaco region. But prices in the increasingly dynamic land market recently rose so high that larger extra-provincial and extra-regional companies, investment pools and foreign investors have displaced local capital on the demand side. Even with rising land prices, pools are still

able to invest in estates of 40–50 thousand ha. In many cases, these are only speculative investment funds, which acquire land in order to rent it out. Those who lead this process are mainly producers from the Pampean region such as Buenos Aires, Cordoba and Santa Fe. The investors find cheaper land, less regulation than in the Pampean region, and small producers with precarious tenure situations. Developing land in the Chaco region is expensive, because of deforestation, transport, irregular yields due to climate instability and the need to deal with conflicts with the holders of possession rights; nevertheless, it seems that cheap prices and short-term benefits compensate for these costs.

Although evidence shows that both rent and purchase land prices have been rising considerably in the last few years.

To sum up, the consolidation of the GM soya hegemony in Argentina's Pampean region displaced traditional cattle ranching to the north. But GM soya also made inroads into the Chaco forests, because the availability of cheap land, a lack of regulation and the underlying myth of 'empty land' [11]¹⁶ attracted new actors, such as real estate speculators, cattle growers and soya producers into the *monte*, including those of local, extra-regional and international origin. In territorial terms, soya has occupied the region's more productive land; it arrived in the early 2000s, in a violent and massive way, and in many cases at the expense of the forest, peasants' land and the *monte*. In general, extra-regional investors, with local connections especially in the field of technical support, have dominated the soyization of the Chaco. In general, the areas targeted for soya investments were easily accessible through purchase, while land conversion was carried out through the deforestation of vast areas, not necessarily empty but probably difficult to control by locals, even if they held rights to the land. The relationship with the local people was, in fact, less personalized; investors were generally represented by managers, which has both advantages and disadvantages when it comes to conflicts with the local communities and individuals with weak tenure rights.

2.3. Actors and interest groups

Thus, new frontiers of expansion are leading to new forms of land control, and to new actors and new types of alliances and relations among them. During the neoliberal period, medium- and large-scale farmers tried to alleviate the crisis by leasing land within and outside the core area to increase the size of their farms and the productivity of fixed factors using zero-tillage (*siembra directa*) techniques. Others were in a worse situation and were forced to rent out their land to those with the investment capacity. In order to minimize production costs, producers needed to use adequate technology. However, not all agricultural producers were able to incorporate new technology and upscale their level of operation. The indebted small farmer had no chance. Thus, a new type of actor appeared: the small renters, namely farmers who rent out their land to pools (*contratistas*) or to other landowners. This explains the rise of larger holdings through 'accidental' lease contracts (3 years). In this sense, there is a process of capital concentration rather than land concentration.

16 GAIA Foundation, Biofuelwatch, The African Biodiversity Network, Salva La Selva, Watch Indonesia, EconNexus, Agrofuel and the myth of marginal land. <http://www.cbd.int/doc/biofuel/Econexus%20Briefing%20AgrofuelsMarginalMyth.pdf/> (accessed 19 November 2009).

Larger producers are those that can better address the costs through economies of scale, since the input sellers and traders who buy their grain have oligopolistic positions in the market. The purchasing power of larger producers allows them to get better input prices and cheaper access to transport access, as well as to store their production while awaiting better prices, and to reduce climate risks by producing in different geographical areas. Thus, small and medium-sized producers are ceding control over their production unit to other actors, such as larger landowners, contractors and sowing pools (*pools de siembra*). Actors that had different or even opposed interests in the past, now found a reason to establish an alliance, especially when political struggles against market regulation were perceived as necessary. The decrease in production units between 1988 and 2002 was mainly due to these processes of land cession (about 50,000 production units of less than 101 ha) and scaling up. The sector of small renters is now earning around 5–6 times more than they earned when they were producers. Apart from these changes in land tenure, GM soya development would not have been possible without the role of actors devoted to the dissemination and adoption of new technologies. This is the case of the direct-tillage system that was widely promoted by AAPRESID within Argentina, and that at the moment is lobbying to disseminate it globally, under the label of sustainability.

The following table presents more detail about the range of actors and interest groups in the soya sector.

Land based – traditional actors	Description	Example
Traditional large land owners	Abandon cattle growing activities and commence financial speculation Invest in modernized agriculture – technology package Keep their land and work it "/> 100,000 ha Expanding	Alzaga Unzué, Leloir, Blaquier, Fortabat, Bemberg, Duhau, Ayerza,
Medium- and large-scale producers (> 500 ha)	Increase the area of the land they rent to others (small, medium). Persisting	
Producers on 200–500 ha		
Producers on < 200 ha		
Land based – new actors		
Small renters (many of them in the group on < 200 ha)	Survived disappearance of 50,000 producers in the 1990s Now get 5–6 times their income as producers just by renting out their land Mainly in the pampas region	

Land based – traditional actors	Description	Example
New large owners coming from industrial sector	Invest in activities based on the foreignization of their industries in the agricultural sector. > 100,000 ha Expanding	Ratazzi, Terrabusi, Blanco Villegas
Absentee owners	Years later, they or their heirs claim land that is in the hands of occupants. Some falsely claim to be absentee owners	
Investment groups, trusts and sowing pools	From within and outside the agricultural sector. They work as investment funds. Rent land and manage it, and distribute benefits at the end of each agricultural cycle. Diversify production regions and contract machinery and services to avoid risks. Also work with foreign investors Expanding into Mercosur	Los Grobo, El Tejar, Cazenave, MSU-Uribelarra, Lartirigoyen
Foreign investors in land	Comparatively cheap land, especially in the northeast and northwest Small incidence in the pampas region > 100,000 ha Expanding	Adecoagro-Soros, Lliag Argentina, Dreyfus
Real estate intermediaries & land speculators	Buy cheap land (sometimes from possessors and then get the titles) and sell it at a higher price	
Machinery contractors (<i>contratistas</i>)	Machinery and services for planting, fumigation and harvest in return for a share of production (used to be individuals, now a growing share of capitalized companies)	
Machinery producers	Increasingly concentrated and globalized with transnational and local actors.	Local companies: Deutz, Ferguson, Zanello
Storing infrastructure and Collectors (Acopiadores)	Buy the soya beans from producers and find a buyer. Deal with 80% of the production and large part of the value paid by exporters. They play an important role in ensuring the conservation and grain quality and supporting the business strategies of producers, allowing them to decide when to sell the crop Role in technical assistance and financing the producer	Aceitera General Deheza SACIC is one of the most important.

Land based – traditional actors	Description	Example
Biodiesel companies	This is a growing sector but there is already a large capacity installed	The 45% of the internal quota of biodiesel in hands of: UnitedBio, Viluco, Explora and Diaser. The remaining 55% goes to 15 companies, including Rosario Bioenergy, Biomadero and AOM
Input sellers	Few big transnationals selling seeds and some domestic companies. In the field of agrochemicals, the monopoly of Monsanto.	Seeds TNCs: Monsanto, Pioneer, Novartis, DuPont, Ciba Agrochemicals: Monsanto
Technical Assistance	Important role of the private sector Also transnationals providing inputs	AAPRESID (Argentinean Direct Tillage Producers Association) AACREA (Argentinean Association of Regional Consortia for Agricultural Experimentation)
Exporters	Buy soya beans and derivatives from producers, collectors and industry Fewer than 10 companies concentrate all exports of the chain Exporter condition industry, collection-storage, inputs selling and producers	83% soya beans exported by Cargill, Noble Argentina, ADM, Bunge, LDC-Dreyfus, AC Toepfer and Nidera. 82% soya oil exported by Bunge, LDC-Dreyfus, Cargill, ADG and Molinos Río de la Plata 90% other soya derivatives are exported by Cargill, Bunge, Dreyfus, AGD, Vicentín and Molinos Río de la Plata

*Sources: [12], [13], [14] and [15], and own elaboration.

Table 1. Actors and interest groups in the Argentinean soya sector*

2.4. The state: An actor again?

While soya expansion is promoted in the region as a 'green' way of increasing foreign currency reserves and boosting rural development and energy self-sufficiency, it is well documented that monoculture expansion is bringing about land-use change and the expansion of the agricultural frontier, which is advancing through the Chaco rainforest, small-scale farms and

indigenous communities, displacing food, cattle and regional crops production and leading to deforestation.

If we consider the state as an actor (which, of course, has analytical implications), in the case of Argentina – and in that of other Latin American countries – the state has returned to centre stage. The Kirchners' administrations era from 2003 to the present day have had a lot to do with re-establishing the power of the national state and its political initiative, and getting the country out of one of its deepest crises by taking progressive measures and in many cases reversing many of the neoliberal achievements. To some extent, the main success of this administration has been to give space back to politics, that is, introducing into the usual work of state institutions debates that were not widely discussed in society. Nevertheless, in the fields of rural development and the regulation of extractive activities (e.g. mining, forestry and soya monoculture), the state has failed in many ways and has acted only to create economic incentives for the further expansion of these activities. It has not properly addressed regulations for sustainability or protected rights.

First of all, the soya boom, and the income from export taxes, was used by the government to pay the external debt and provide social aid in the struggle against indigence, poverty and unemployment, in a period when more than half of the population was living below the poverty line. The main active policy measures to promote the development of the GM soya model were taken in the 1990s (when the government was openly neoliberal), namely through the Deregulation Decree in 1991, privatization, liberalization of the market and the liberalization of transgenic soya in 1996, giving impulse to its generalized expansion and the consolidation of the agribusiness model. After that, apart from the export taxes regime, state policy in relation to the expansion of the GM soya model was a complete *laissez-faire*, within which the agribusiness started to gain public technical and scientific knowledge arenas (such as INTA, SENASA and some areas of CONICET) as well as winning the battle of common sense in relation to the question which rural development path was desirable. Even when the government tried to be active in imposing a mobile export taxes system in 2008 that implied an increase in costs for producers, Cristina Kirchner faced the fierce opposition of the entire soya sector and a part of urban middle classes.

Nevertheless, in the last few years increasing awareness of the negative impacts of the development model – which had been denounced for years by social movements and NGOs – started to attract media interest, as well as spaces within, or in dialogue with, the state. Although with limited scope, the fact that the state is regaining the initiative in executive, legislative and judicial matters opens possibilities for regulation, whereas before there was only the market. With the conflict between the government and the soya-producing sector of 2008 over export rights, the hegemony and the problems involved in the soya model were put up for public discussion, albeit with many limitations, contradictions and omissions. While this conflict over who should benefit and how to distribute the income from soya exports was going on, another sector was ignored: *campesino* economies, the indigenous communities and the producers for the domestic food market, which are still not a target for rural development and agricultural policies.

3. Constructing a biodiesel market and sector: a new frontier of profitability?

The creation of a biofuels market through policies such as the European directive on biofuels is perceived by the governments of South American countries, as well as by actors in the production chain of soya, as an opportunity to diversify products and markets. In the Argentine case, the conditions for biodiesel production are already in place due to the existence of a highly efficient, integrated soya sector [16], which is mainly dominated by domestic and transnational industry players and traders. Biodiesel can be produced from the same biomass that produces soya oil and meal, and is highly dependent on an industrialized agriculture that is able to homogenize raw material for processing into the various by-products [17]. Argentina meets these conditions. Discourses justifying these policies refer to objectives such as diversifying the energy supply, environmental protection and rural development. In South America and in Europe, promotional discourses do not differ radically from these discourses, although they are much more centred on energy diversification and economic development – but not necessarily of rural areas.

Global drivers of GM soya expansion in South America are clearly related to the growing demand for animal protein food in Europe (and more recently also in China and other Asian countries), which demands large amounts of soya oil. In 2006, MERCOSUR member countries (Argentina, Brazil, Paraguay, Uruguay and Venezuela) signed a memorandum of understanding to encourage and promote biofuel production and consumption. The creation of a new biofuel market in the EU that will depend on Southern countries to reach the blending targets, opens a space for Argentinean biodiesel exports.¹⁷ In this sense, the Argentinean authorities have been keen on setting policies with the aim of domestically creating value added and reduce energy imports, such as a differential export tax to promote biofuel development beyond domestic consumption, which is also being stimulated by compulsory mix quotas and presented as an alternative use for soya and thus diversifying markets. Measures to stimulate the production of biofuels have been aggressively lobbied for by the domestic soya bean sector. Therefore, on the domestic side, there is a huge demand for biofuel also in Argentina. Nevertheless, because the large companies are not interested in a domestic biofuels sector, most of the biodiesel produced by them, and the majority of total biodiesel production, continues to go to export markets, meaning that the land in Argentina continues to produce products that the population does not consume.

However, the tendency changed when the Argentine government promoted the creation of a domestic market, and thereby encouraged the soya sector to diversify, through Law 26.093 (2006), through which it established blending targets of 5 per cent for 2010, 7 per cent in 2011 and with the expectation of increasing it to 10 per cent in the next years. The exported volume started to decrease as long as the new policy was implemented. Most exports go to Europe; Spain is the main buyer. Today, 15–20 per cent of the soya bean crop in Argentina is used to

17 Friends of the Earth International. Fuelling destruction in Latin America – the real price of agrofuels 2008. <http://www.foei.org/en/resources/publications/pdfs/2008/biofuels-fuelling-destruction-latinamerica/view/> (accessed January 2009).

produce biodiesel.¹⁸ Investments in the sector have been growing since 2006 in the expectation of increasing exports and market diversification. Most of the investments in the biodiesel industry come from the usual big players in the international soya sector [25], such as Glencore, Nidera and Dreyfus, Bunge and Cargill, with alliances with the powerful domestic soya-processing sector and financial investors. To encourage investments in the biodiesel industry, the national government imposed a differential export tax that favours the production of biofuels over soya oil and meal (the difference is more than 17 percentage points). Local governments also encourage investments by providing tax exemptions. Prior to the legislation in Argentina, there was almost no domestic demand for products from soya beans, which made it difficult to justify a paradox for many defenders of the oilseed. However, the taxes on soya exports are estimated to account for around 12.5 per cent of the national budget [16].

The supply of seeds continues to be dominated by Monsanto and Syngenta, along with some big local companies. As mentioned, the dominant players in the biodiesel sector are the big transnational and domestic corporations that have dominated the soya sector for many years. They control about 80 per cent of the sector and in many cases integrate production and processing. As a subsector within the soya sector,¹⁹ the biodiesel industry is a rather clustered sector at the cultivation and processing levels [16], since many of the domestic actors are located in the same geographical area, that is, around the Paraná river. But the domestic biofuels sector is also very dependent on international networks [16, 18].

Legislation and incentives	
Argentina	<ul style="list-style-type: none"> ● Law 26.093 Compulsory biofuels blending (2006) ● National Bioenergy programme ● Differential export taxes vis-à-vis soya oil ● Native Forests Law 26.331 (2007) ● CARBIO voluntary certification scheme presented to EU ● INTA: biofuels research

Table 2. Biodiesel promotion in Argentina

While additional demand for soya may lead to the further expansion of the agricultural frontier – exacerbating the social and environmental problems resulting from both past and current GM soya cultivation, and commercial pressures on land in the Chaco region – recent central government measures and an increasing conflict with EU import markets, put some question marks and bring contradiction to the biodiesel sector in Argentina. A recent announcement by

18 USDA Foreign Agricultural Services (2011) Global Agriculture Information Network Report, Argentina, Biofuels Annual 2011. [http://gain.fas.usda.gov/Recent% 20GAIN% 20Publications/Biofuels% 20Annual_Buenos% 20Aires_Argentina_7-8-2011.pdf/](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Buenos%20Aires_Argentina_7-8-2011.pdf/) (accessed July 2012).

19 Actors from the soya sector particularly involved in the biodiesel promotion and production are: sowing pools, large farmers, renters, international agribusiness companies, vegetable oil refiners, service contractors, transport, storage/ collection, biotechnology multinationals (seeds, fertilizer, pesticides, etc.), traders/exporters, processing industry (oil, meal, biodiesel), machinery input providers, research institutions (public and private) and business associations (AAPRESID, ACREA, CARBIO, ACSOJA, Comisión de Enlace).

Spain (the buyer of 70 per cent of all Argentinean biodiesel exports) that it would prohibit biodiesel imports from outside the EU, led Argentina to complain to the WTO. At the same time, the national government raised the taxes on biodiesel exports to the level of the other soya by-products, thereby changing the thrust of the main promotional policy. This seems to be exacerbated by the 15 per cent reduction in the price of biodiesel for the domestic market, which has negative impacts on medium and smaller non-integrated enterprises. Still the EU had been denouncing Argentinean dumping, through tax exemptions, and claiming the existence of more efficient biofuels from rapeseed and palm oil. In consequence, due to both national and international factors, there is uncertainty about the future of the biodiesel sector.

4. Main impacts of, and dilemmas posed by the expanding GM soya frontier in relation to sustainability, governance and development

The economy has recently been working quite well for the actors and interest groups linked to the soya and biodiesel industries. But the impacts of the dynamics emerging from the GM soya sector also have implications for rural actors that are not part of the production and distribution chain. In areas outside the core region, where soya has become rather hegemonic, other rural dwellers find their access to land, water and forests affected by the GM soya pressure.

4.1. Sustainable development for whom?

The rapid expansion of soya monoculture in the Argentinean Chaco region implies massive land-use changes and pressure on land whose users have weak tenure rights, or on land that is being claimed by different actors, such as companies, *campesinos*, indigenous communities and landless workers. The tensions lead to claims for the regularization of possession and indigenous rights. The problems arise because in the Argentinean Chaco provinces a larger number of peasants do not hold titles to the land they occupy and work on. For instance, around 75 per cent of peasants in Santiago del Estero are in this situation. Different mechanisms of pressure on the indigenous and peasant population as well as mechanisms of enclosure occur. These include violent evictions, unequal legal disputes, the pollution of water, soil and crops, and the clearance of forests, which are sources of livelihoods of the communities in the region.

The holders of possession rights are not so common in the Pampas, but are still a very relevant population in the northern provinces and, together with the indigenous communities, are the groups that find their access to land threatened or increasingly controlled by more powerful local, translocal and foreign actors. In particular, holders of possession rights have become vulnerable to commercial pressure on the land they occupy. As for this group, the mechanism to acquire land from them could imply the purchase of possession rights, which presents an advantage to the buyer who pays a price that is considerably under market value, since there are no property titles. A common situation that these holders face in most of the northern provinces, as well as in some areas of the core region, is the appearance of absentee owners or their descendants who claim ownership of land that have been occupied for decades by

families, including former workers of the owners who got paid in land rather than receiving a salary. The expansion of the frontier only speeds up this process, since the price of formerly 'unproductive' land rises, attracting not only new land users but also speculators.

Mention should also be made of swindling by dubious land claimants and of the fact that some of the holders of possession rights lose their access to land through direct displacement and enclosure. We observed in Santiago del Estero the use of lies, deceptive contracts and procedures, and intimidation and violence. In this sense, also *comodato* contracts imply only the beginning of the story or the process of gaining access, which can continue until the possessor leaves the land – perhaps still believing that he had no option but to cede the land. There are a range of situations between the extremes, such as ex-possession rights holders paying a rent to the new land user to raise cattle on the land they had lived on for decades. Incidentally, intimidation and threats occur not only in the Chaco region, but also in other areas, as Roodhuyzen (2010) showed for the islanders in the Argentinean Delta region.

The national campesino–indigenous movement (MNCI–Via Campesina) estimates that around 200,000 rural families have been forced off their land due to the advance of soya. The provinces where this process has been the most violent are Santiago del Estero and Córdoba, where heavy machinery owned by sowing pools and landowners drove over peasants' houses and parcels. REDAF documented that around 950,000 people – inhabitants of indigenous and *campesino* territories – are affected by land or environmental conflicts related to the expansion of the agricultural frontier, led by GM soya. Most of these conflicts began in 2000, when the GM soya model reached its height [22]. Many of these groups were occupants and holders of possession rights that, according to Argentinean law, imply a form of tenure security. Possessors of these rights are occupants who have been living on the land for more than 20 years and have performed 'possession acts', that is, they have worked on, cared for and improved the land. If these conditions are met, they can virtually apply for land ownership. In the northern provinces these groups are also threatened with the loss of access to the use of forests and common land for pasture. Threats usually occur explicitly and with the use of physical and verbal violence, as has been widely denounced by representatives of MOCASE.²⁰ In other words, the consensus that GM soya expansion had success in the core region seems to be contested at least in Chaco provinces. Here, tensions related to rights, social organization, judicial and political strategies to defend them, and claims for the institutionalization of this defence, have become a new space for land governance that might challenge dominant discourses legitimizing processes of the commoditization of land and the privatization of nature.

4.2. Environmental sustainability

Besides forest clearing for soya, there is also deforestation due to the incursion of cattle raising into the forest of the Argentinean Chaco: the equivalent of 2500 football fields is occupied every day. In Salta alone, 609,323 ha of forest disappeared between 1998 and 2006 (Greenpeace). Córdoba is the province where the process is most devastating, followed by Santiago del Estero

²⁰ Movimiento Campesino de Santiago del Estero.

and Salta. This was particularly visible in the town of Tartagal, where violent floods occurred between 2006 and 2009, leaving behind death, destruction and homeless families, particularly indigenous families. According to local organizations there is a direct link between illegal deforestation and climate change, which led to the floods. As forests make way for monoculture, the soil cannot absorb enough water; as a consequence, there are increasing river flows and floods. Quite remarkable in this case is that expectations about the imminent implementation of a Native Forests Law (N° 26.331) aimed at protecting forest areas, led to deforestation at an unprecedented speed, which was to blame for the violent flooding. Biodiversity is highly affected by deforestation, and by the poisoning of water and soils with herbicides, such as the massive application of glyphosate, which kills animals and microorganism, contaminates food crops and affects people's health. The excessive use of pesticides and little crop rotation turn the soil sterile through the years.

In addition to environmental harm, several (mainly poor) communities in various towns and cities in the main soya producing provinces in Argentina have been affected by serious health problems caused by indiscriminate fumigation practices in areas neighbouring the plantations, and in poor urban settlements where pesticides are stored. In 2003, Ituzaingó-Anexo reported that the incidence of cancer in children was 50 per cent higher than the national average, which was partly attributed to illegal fumigations in neighbouring GM soya fields. This diagnosis pushed a group of mothers (Madres de Ituzaingó-Anexo) to organize themselves politically and to make public their confrontation with local soya producers, by initiating legal actions against fumigation with Roundup. This was a pioneer case in the country, one that served as a precedent for many other localities where illegal fumigations had to be prohibited and legal ones regulated.²¹

4.3. Development and governance

In connection with the advance of the agricultural frontier into bio-diverse and socially vulnerable rain forests and savannahs [3, 4], we can observe the emergence of new actors and the trans-location of actors who put into practice new forms of control over land and natural resources with non-local capital. Translocal actors [19] have played and still play an important role in introducing capital, technologies and modes of production and management, which historically developed in the Pampas, into the Chaco region through the process of *pampeanization*. Some authors have put too much emphasis on the foreign character of the investments. However, the case of Argentina clearly shows that for the moment the relevance of foreignization is emblematic but not necessarily the mainstream, and that the role of the domestic and translocal private sector is more important than we thought.

As for the government, the purely economic argument of not losing an opportunity has been its leitmotiv and has led to the massive and unsustainable expansion of GM soya in the core region. The lack of policy was justified by arguing that it is best not to put limits on the market. The same type of argument was later used to justify *laissez-faire* policy with regard to the

²¹ In August 2012, the entrepreneur and pilot responsible for one of the cases of fumigation were taken to court, convicted and put on probation. This has created a precedent for future legal processes.

expansion into the Chaco region, allowing more powerful actors to impose their particular interests and make them seem universal. In fact, not much has been done in Argentina to define an agricultural policy for sustainable development. Associated measures were for a long time aimed at supporting the dissemination of GM soya seeds and ignored the protection of the rights of those with weak land rights (such as indigenous communities and holders of possession rights), the protection of those affected by environmental harm and the protection of the environment.

At the same time, Argentina, like some other Latin American countries, is becoming increasingly dependent on extractive activities (like GM soya cultivation), which are confronting the country with a real development paradox. The case of soya, and particularly biodiesel, raises questions regarding sustainability in a broader sense, since short-term economic development objectives and enjoyment increasingly conflict with long-term man–land relations across generations. In other words, the intrinsic logic of global capitalism makes national soya producers follow market signs without paying attention to ecological and social precautions, and the government opens the way to do that. It is therefore not surprising that the socio-historical process of the introduction, promotion, adoption and expansion of GM soya in the core region of Argentina determined to some extent the way in which the second phase of expansion is taking place in the northern provinces, where the scale of the changes has been much greater. Until 2007, tobacco and sugarcane competed with soya for land; however, soya has become dominant in recent years and is expected to continue to expand more than those other crops [3].²² The increased demand for land is and will be accompanied by accumulation, privatization, enclosure and displacement [20, 21], redirecting resources away from local communities as commodities for distant consumers.

As stated, the expansion of the agricultural frontier in the Chaco region has been an historically ungoverned process. But if we consider governance as a synonym of control, different social groups have controlled and benefited from this process in different phases, although it was rather chaotic, with periods of land appropriation and others of land abandonment, and the taking over by other groups. In other words, the drivers of the expansion of the agricultural frontier into the Chaco were part of the process of governance. The public sector, however, remained relatively inactive for more than 15 years, that is, after the liberalization of GM soya in 1996. It was a way of acting that paved the way for development by letting it advance in an unregulated manner. This does not mean that nothing was done. Quite significant public resources were used to support scientific and technical public–private partnerships among national institutions such as INTA and CONICET and private actors in the soya chain. In addition, the taxation of crude soya exports did not address incentives to produce more, but only triggered controversies over the distribution of benefits among private and public actors.

The national government has recently taken a more proactive role in relation to policies for the agricultural sector, particularly with the launching of the new national PEA2 (Federal and Participative Agro-food and Agribusiness Strategic Plan, 2010/2016), through which Argentina seeks to achieve a privileged position as a global provider of food. The main goal is to increase

²² USDA (*idem*).

the amount of agricultural land in production by 6 million ha, but the plan neglects the existence of peasant production systems and excludes the Chaco region from the group defined as fragile ecosystems. An active policy of disseminating the PEA across society would show that it will seriously affect the future of rural people and the relationship between society and nature in the long run. However, it is already giving positive signals to investors in industrial agriculture and cattle raising. Moreover, some historically poor provinces that have been neglected by the state have recently been targeted for the Historic Reparation Acts, which include a range of infrastructural projects, many of them aimed at incorporating land to and converting land for agriculture production, as was the case with the Figueroa dam, which was built in 2011 to include 30,000 ha for agricultural and cattle production. Mention should also be made of the IIRSA project aimed at constructing a new infrastructural network on the South American continent, which will particularly affect the future of the South American Chaco region as a whole.

The only national and provincial legislation aimed at reducing the negative impacts of frontier expansion is the Forests Law (and the territorial planning measures linked to it), which deals with the environmental dimension of the advancing agricultural frontier through forest clearing. The results of territorial planning processes have so far been very heterogeneous in different provinces and are still open to negotiation and contestation, while the capacity of this type of regulation to protect vulnerable ecosystems has not been proven. At the same time, in many northern provinces peasant and indigenous resistance to the advance of the agricultural frontier has taken the form of a struggle organized around the recognition of possession rights, in order to gain, maintain and control access to land. However, there is no policy to defend the peasant production systems and their particular relation with the land against the social and economic impacts of frontier expansion. This means that the tensions related to possession rights, social organization, judicial and political strategies to defend peasants and claims for the institutionalization of this defence have become a new field of land governance.

5. Conclusions

The expansion of soya production in Argentina developed relatively uncontrolled and without subsidies, through the initiatives of private interests in alliance with some state powers, which left its regulation to market forces. The expansion started in the 1970s in the pampas region where land and agriculture had gradually been abandoned during the period of ISI policies and where it advanced at the expense of cattle raising and diversified grain production. In the neoliberal period – when new production models (zero tillage) and new technology became available (from 1996 onwards) – the expansion of soya took place more rapidly. This was possible because large tracts of underused land were available and could easily be converted into new production units by a limited number of old and new large landowners and investors, who started to lease land. There was no major need for property change since flexible lease contracts provided the necessary scale. In other words, there was a process of capital concentration rather than of land concentration. This, together with zero-tillage practices and machinery, the introduction of GM soya (Roundup Ready (RR) resistant soya), and an

innovative way of managing and organizing production by sowing pools, constituted the basis for the soya boom.

The process that started in the pampas region was accompanied by crop change and the migration of cattle farming towards the northern provinces, mainly the Chaco region. There, direct investments in soya production were generally made by soya producers originating from the pampas, since this group had succeeded in making good money from soya and decided to buy additional land in the Chaco. New land users found cheaper land, less regulation than in the Pampean region and small producers with precarious tenure situations. Investing in the Chaco implied additional costs because of the need to clear vegetation, the more expensive transport, irregular yields due to climate instability and conflicts with holders of possession rights. However, cheap land and short-term benefits compensated for these costs.

The expansion of soya production in the pampas region did not lead to major changes in landownership relations, and new alliances emerged among the actors. In the Chaco, however, forests were cleared and local peasants and indigenous groups were bought out or were legally or illegally displaced; they lost their land and were excluded from the benefits of soya growing. Nevertheless, the state largely remained inactive in the fields of rural development and the regulation of extractive activities, such as mining, forestry and soya monoculture. It acted only in the sense that it created incentives for the further expansion of these activities. Regulation for sustainability and the protection of the rights of local farmers has not been properly addressed. Therefore, the main problems are the failure to implement the existing law and to protect the rights of weaker interest groups, and the lack of a long-term vision regarding the extent to which the use of glyphosate and other pesticides – which cause land degradation, the contamination of other crops, water pollution, health problems, etc. – is compatible with the need to bring about sustainable development.

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