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On the margins of soy farms: traditional populations and selective environmental policies in the Brazilian Cerrado

Ludivine Eloy, Catherine Aubertin, Fabiano Toni, Silvia Laine Borges Lúcio and Marion Bosgiraud

In the Cerrado, the expansion of soybean cultivation since the 1990s has coincided with the strengthening of environmental regulations. We analyze how the two main environmental policies – Protected Areas and the Forest Code – have played out at the ground level in western Bahia state. These policies in Cerrado have not been designed to curb the expansion of this agricultural frontier. These norms have, on the contrary, accommodated this expansion because the way environmental managers selectively choose environmental problems and publicize them through specific information systems depreciates traditional fire-dependent production systems. These ‘politics of selection’ are likely to increase competition for resources in the margins of soybean agriculture, which is where traditional populations have now become confined.

Keywords: deforestation; environmental norms; fire policies; soybean; political ecology; Cerrado

1. Introduction

Confrontations and interactions between conservation and agricultural development have intensified during recent decades in Latin America. Several countries have emerged as global centers of environmental conservation while, at the same time, encouraging land-use modernization under neoliberal policies, such as the widespread expansion of soybean agriculture (Zimmerer 2011). In the mid- and late 1990s, Brazil witnessed an acceleration in the spread of large-scale soybean monoculture. At the same time, the country has also seen a significant expansion of protected areas since 1985 (Rylands and Brandon 2005), accompanied by successful efforts to enforce environmental legislation to curb deforestation (Nepstad et al. 2002).

The most dynamic agricultural frontier in Brazil is the central savanna, called the ‘Cerrado’. This biome was the source of more than 60 percent of the soybean harvest of 2012–2013 (Terra-AFP 2013). In 2013, Brazil was the largest soybean and sugarcane producer in the world. Since the 1990s, most of the country’s beef and grain has been produced in this region. This trend has been recognized domestically and internationally, and the Cerrado has been praised as Brazil’s breadbasket. During the 2000s, agriculture and ranching made a remarkable contribution to the country’s economic growth, and exports of primary goods helped balance its current account. This economic success, however, came at a price. In the mid-2000s, the Cerrado overtook Amazonia as the leader in deforestation in Brazil (MMA 2011a).¹

¹Legal Amazonia covers nearly 4 million km², of which 19 percent of native forest has already been deforested. The Cerrado has half the size of Legal Amazonia (2 million km²) and, in 2012, 49 percent of its natural vegetation had been cleared (IBGE 2012).

The Cerrado is also home to traditional populations² whose livelihoods involve subsistence farming, extensive cattle ranching and multiple forms of extractivism. Although these populations have been living in the Cerrado since long before the advent of soybean agriculture, most of them do not have titles to the lands they live on. In a context in which land is being rapidly converted to agro-industrial production or targeted by conservation policies, what are the impacts on traditional populations? In this contribution, we analyze how these policies play out at the ground level in the Cerrado in western Bahia state, the main area of rapid expansion of high-input soybean agriculture in the Cerrado.

Our main argument in this paper is that the recent strengthening of environmental policies in the Cerrado relies on 'politics of selection' that converge on fire fighting and set-aside forest reserves, while glossing over other major environmental issues, which do not affect soybean producers and traditional populations in equal measure.

The paper is organized as follows: In section 2, we present our theoretical and methodological framework. In section 3, we briefly describe existing land use in the Cerrado biome, with an emphasis on the role of public policies and the direct and indirect impacts of soybean agriculture in this process. We also discuss how environmental concerns have been raised about the Cerrado, in particular because of increased deforestation. We show that despite the strengthening of environmental regulations, the soybean frontier is still advancing. We briefly discuss two important aspects of Brazilian environmental policy: the Forest Code and the National System of Protected Areas. Using the data collected during our field studies, in section 4 we show how these policies converge on fire fighting and their various implications for traditional populations and soybean producers. Drawing from these results, we discuss the causes and consequences of these politics of selection for the formation and the future of the territories that have been forced into 'the soybean margins'.

2. Theoretical framework and methods

2.1. *Environmental norms and politics of selection*

As part of a global phenomenon (Aubertin and Rodary 2011), the Cerrado biome basin has experienced the diversification and expansion of protected areas since the early 1990s, a process which has allowed some communities to reassert their collective rights over territories and resources. As a result, there has been a notable shift in the governance of protected areas from a model of strict protection to one of participatory management, which involves peasants, indigenous people and resource-user groups in decision-making.

At the same time, however, environmental policies also respond to the evolution of representation of stakeholders and their power relationships. As a result, environmental norms can be seen as indicators of policy choices, what we call the 'politics of selection', which can be divided into three interrelated processes: spatial selection, selection of environmental problems to address and selection of information.

²We define traditional populations (or traditional farmers) in a broad sense, independently from their political mobilization and their cultural affirmation: communities that are historical heirs of different forms of use, management, knowledge and symbolic representations of the Cerrado, characterized by their historical relationship with the territory they claim, and by low-input production systems. This expression clubs together different social groups, such as indigenous and quilombola (descendants of Maroon slaves) communities, farmers (in agricultural settlements or members of rural communities), artisans, fishermen, extractivists, etc.

First, conservation development initiatives increasingly rely on spatial representations that emerge from ‘hidden’ power networks (Zimmerer 2011). Methods of ‘prioritization’ serve to define the spatial targeting of protected areas, but they take little account of social issues and the diversity of land uses (Milian and Rodary 2010). After being applied at a global scale, these methods were used at national and smaller scales (biomes), like in Amazonia or the Cerrado (Scaramuzza, Machado, and Rodrigues 2005; MMA 2011b). Furthermore, participatory management programs place great emphasis on planning and zoning within conservation territories. In practice, this spatial fixing is usually designed to allow certain activities and restrict numerous others. Moreover, protection is clearly concentrated in tropical forest environments (Zimmerer 2000).

Second, environmental norms may derive from the selection of environmental problems to address and the formulation of simplified and official discourses to explain these problems (Bassett and Zueli 2000; Mathews 2005). Conservation booms in Latin America have generally focused on biodiversity conservation and fighting deforestation. Forest protection has taken the form of an indiscriminating fight against fires, irrespective of their objectives and conditions. Other environmental concerns, such as soil conservation and water management, have become less important in the mainstream environmental-conservation agenda (Zimmerer 2000).

Third, selection also takes place through the choice and design of environmental information systems – that is, the material inputs and outcomes of knowledge that are produced and disseminated. Indeed, advances in geographical information systems (GIS) and remote sensing now power the formulation and implementation of environmental norms. But a focus on remotely sensed data is not strictly a methodological choice; it is also a political one, since pixels can be interpreted in different ways, depending on stakeholders (Harwell 2000; Robbins 2003). Furthermore, the recent emphasis on creating transparency through mapping can also obscure some management practices, frauds and abuses. Foucault’s theory postulates that the power of government is based on the standardization and control of knowledge, which dictate good practices (Foucault 2001). Certain standards, such as the general prohibition of fire in savanna ecosystems, are also based on ignorance, since practices of silencing and concealment are inherent to the process of knowledge production (Mathew 2005).

2.2. *Methods*

In order to understand the spatial expansion of protected areas in conjunction with recent trends of deforestation and soybean expansion in the Cerrado, we superimposed data originating from different public databases and processed them through a GIS software application (ArcMap 10).

In order to verify how institutional changes are playing out at the ground level, we undertook fieldwork between 2012 and 2013 at three research sites, around and in three Protected Areas (PAs) which border the agricultural frontier of western Bahia state (Figure 1).³

The first PA is the Veredas do Acari Sustainable Development Reserve (RDS), which covers 609 km², in the municipality of Serra das Araras, northern Minas Gerais state. The RDS is a Sustainable Use Conservation Unit, managed by the environmental agency of the state of Minas Gerais (IEF). The second one is the Nascentes do Rio Vermelho

³Fieldwork was undertaken in collaboration with Brazilian institutions (see Acknowledgements).

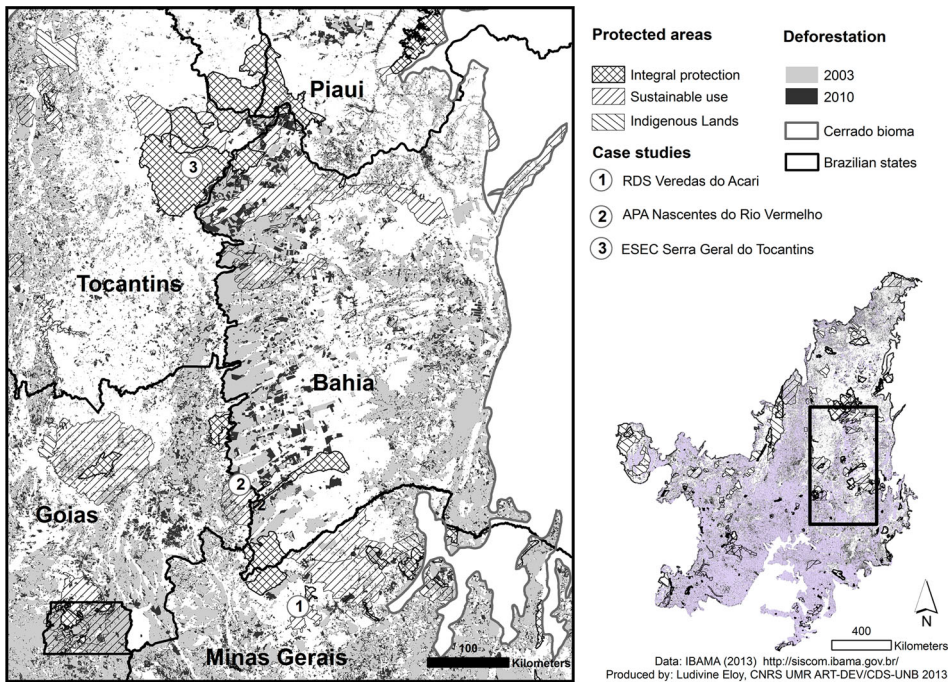


Figure 1. Protected areas and deforestation in the eastern Cerrado and location of study sites. Source: IBAMA (2013).

Environmental Protection Area (APA). Its 1761 km² are spread over four municipalities, but the majority of this PA is in the municipality of Mambá (Goiás state). This APA is a Federal Sustainable Use Protected Area, managed by the Chico Mendes Institute of Biodiversity Conservation (ICMbio). The last research site is the Serra Geral do Tocantins Ecological Station (EESGT). It covers 7070 km², spanning two municipalities, mainly Mateiros, in the Jalapão region of the state of Tocantins. This ESEC is also federal and, therefore, managed by ICMbio.

Most of the farmers who live within or depend on the use of these PAs are descendants of migrants from the northeast (Bahia state) or from southern Goiás state who settled in this remote region in the late nineteenth or early twentieth centuries to escape slavery and drought. Once they arrived in the region, they started working for ranchers and clearing some land for subsistence agriculture. Soybean producers originate, for the most part, from southern Brazil (Rio Grande do Sul, Paraná, São Paulo) and arrived in the 1980s and 1990s (Haesbaert 1997).

We combined socio-economic data at the household scale and land-cover data from satellite images to investigate local farming systems. Surveys were used to estimate the sources of income of each domestic unit. In order to understand the economic strategies of extended families, we also assessed the location of houses and sources of income of all the children of the head of the household. Participant observation, landscape interpretation and semi-structured interviews were used to understand the perceptions of traditional farmers about the environmental impact of their farming practices and about environmental policies that influence them. We interviewed a total of 57 heads of households (25, 20 and 12, respectively, in the three study sites; Table 1).

Table 1. Sample characteristics.

	Number of household heads	Minimum age	Maximum age	Mean age
Serra das Araras, MG	25	27	79	51
Mambai, GO	20	37	71	52
Mateiros, TO	12	45	71	56

Source: Field data.

The sampling criterion was to choose farmers who depend on access to and use of natural resources located within each PA. In Serra das Araras, we interviewed randomly selected members of the local association of herders of the RDS (nearly 50 members). In Mambai, we randomly selected farmers who lived in four agricultural settlements with a gradient of distance from the town. In Mateiros, we interviewed all heads of households who belonged to the association of users of the EESGT – Serra Geral do Tocantins Ecological Station (Ascolombas-Rios); they represented nearly 90 percent of all the families that use resources in this protected area (Eloy and Lúcio 2013).

To study the formulation and implementation of environmental norms at the local scale, we analyzed official texts, carried out participant observation during information meetings, and conducted six semi-directive interviews with the managers of these PAs. We also conducted five interviews with soybean producers in western Bahia (municipality of Jaborandi) and northern Minas Gerais (municipality of Chapada Gaúcha).

3. Land use, soybean expansion and the environment in the Cerrado: an historical overview

3.1. Soybeans in the Cerrado

The Portuguese treated the Cerrado, as they did most of the Brazilian backlands, as commercial rather than colonial territory. From these vast lands they extracted valuable resources, such as gold, silver and gemstones. They also had the intention of hunting and enslaving the indigenous populations. Over time, extensive cattle ranches occupied parts of the Cerrado and the Caatinga backlands.

The occupation of the Cerrado gained momentum during the second Vargas government, known as the Estado Novo, when the *Marcha para o Oeste* (March to the West) was launched in the 1940s. The *Marcha* was a bundle of policies, programs, projects and institutional innovations inspired by a modernizing ideology (Maia 2013). During this period, the government promoted land survey expeditions and established colonization sites in Dourados (Mato Grosso do Sul state) and Ceres (Goiás state) (Shiki, da Silva, and Ortega 1997). The most significant efforts made by the government to advance the frontier took the form of infrastructure building. This trend had been initiated a couple of decades earlier, when a railway connecting São Paulo to Anápolis spurred the occupation of southern Goiás and western Minas Gerais states. The integration of the Cerrado into Brazil's major urban markets was completed after the new capital city, Brasília, was constructed in 1960 (Silva 2000).

By the 1970s, the central–western portion of Brazil, which comprises most of the Cerrado, was the region with the largest area of pasturelands in the country (Rezende 2002). Cattle ranching had become remarkably extensive. The intensification of ranching, as well as the introduction of high-output agriculture, required public investments that went

far beyond the building of road networks. In the mid-1960s, the Brazilian government launched a series of programs for agricultural modernization and the occupation of Amazonia and the Cerrado.

Two federal programs specifically targeted the Cerrado: the Program for Development of the Cerrado (POLOCENTRO) and the Japanese Cooperation Program for Development of the Cerrado (PRODECER). POLOCENTRO channeled agricultural and ranching credit to rural areas where infrastructure was already present. Between 1975 and 1983, it reached some 3.7 million ha (aggregating credit of USD 577 million). POLOCENTRO mainly benefited large and medium producers: properties larger than 200 ha (81 percent of the projects) received 88 percent of credit resources, with properties over 1000 ha (39 percent of projects) absorbing 60 percent of the total resources (Coelho 2001). PRODECER, on the other hand, targeted smallholders and promoted colonization through cooperatives. Even though the program was partially aimed at curbing deforestation – a serious problem in POLOCENTRO – its goal was also to increase the production of commodities. These programs promoted the cultivation of soybeans, eucalyptus, grains, coffee, sugarcane and other crops.

The long-term policies that had the most impact in promoting the occupation of the Cerrado were those pertaining to science, technology and innovation, particularly as regards soybean production. Colonists from the South were already involved in the soybean commodity network, and were determinant in the introduction of the crop in the Cerrado (Sousa and Busch 1998). However, adapting soybeans to the Cerrado required a massive research effort, undertaken by an extensive network of private and public institutions, under the leadership of the Brazilian Agricultural Research Corporation (Embrapa). This research had two main components. The first one was the selective breeding of new cultivars adapted to low latitudes (Wilkinson and Sorj 1992). Between 1993 and 2007, the public research system introduced some 195 cultivars (FAO, 2007). Embrapa was instrumental in testing and adapting soybean and other grains to the Cerrado. In particular, it played a key role in developing new technologies for soil management to deal with the acidity and high aluminum content of Cerrado soils (Pessôa and Bonelli 1997). The adaptation of soybeans to the Cerrado was so successful that in the early 1980s, the average yield was comparable to that in the South. By 2001, the cultivated area in the Centro Oeste region surpassed that in the South (CONAB 2013). In addition, there has been a very strong expansion of sugarcane cultivation for ethanol on grazing lands.

Since the 2000s, soybean production grew in the region known as MAPITOBA (the southern parts of Maranhão, Tocantins and Piauí, and western Bahia), where the flat uplands (*chapadão*) of the Serra Geral offer prime farmlands (Figure 2). According to the Brazilian Institute of Geography and Statistics (IBGE), Mato Grosso state remains the national leader in the production of soybean with 20,800,544 tonnes produced in 2011, against 3,512,568 tonnes in Bahia state. However, within the boundaries of the Cerrado biome, the increase in production between 2005 and 2011 is higher in the MAPITOBA region (3,876,609 tonnes) than in the eastern part (Mato Grosso state with 3,372,569 tonnes). In this same period, harvested soybean areas expanded three times more in the eastern part than in the western part, which indicates a much more extensive production in the MAPITOBA region. Western Bahia is considered an example of the ‘Miracle of the Cerrado’, with farms there sustaining Brazil’s agroexports (Brannstrom and Brandão 2012).

Soybean expansion is similar to the eucalyptus expansion that took place in northern Minas Gerais during the 1970s and 1980s. Agro-industrial farmers preferred flat uplands, situated at altitudes between 700 and 1200 m, where the topography and conditions

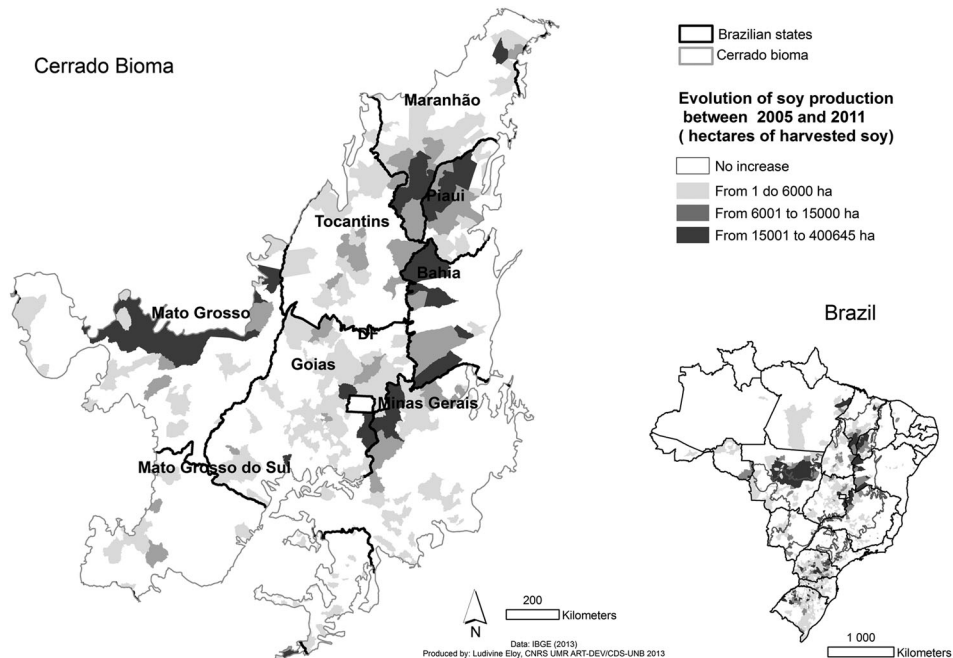


Figure 2. Soybean expansion in the Cerrado biome between 2005 and 2011. Source: IBGE (2013).

– such as regular precipitation, mild temperatures and well-weathered and drained soils – are suitable for mechanized farming. They tended to ignore the wet lowlands (*Veredas*), which were occupied by traditional populations displaced by agricultural expansion (Ribeiro 2008, 2010). In the mid-2000s, 94 percent of agricultural areas were on slopes up to 5 percent, with the rest on lands sloping between 5 percent and 10 percent. In contrast, cultivated and native pastures, less dependent on soil fertility and mechanization, were located over a wider variety of topographic gradients (Ferreira, Ferreira, and Latrubesse 2008).

Until the arrival of large-scale agriculture, the uplands were common areas, occasionally used by traditional populations as natural pastures and for extractivism. These populations were pushed out in the early and mid-1980s, creating marginalized groups of resource users, whose practices came into conflict with conservation policies adopted in the late 1990s. Traditional communities lost common-use access to significant portions of the Cerrado in the flat uplands and thus increased their use of forest environments in the lowlands, often already divided by their distribution among heirs, or by the expansion of large estates. Environmental legislation, meanwhile, imposed a number of restrictions on the use of resources by these populations, affecting hunting, fishing, slash-and-burn practices, removal of timber and fiber, extraction of wild honey, picking of flowers, collection of medicinal plants, production of coal and gold mining (Ribeiro 2008). Furthermore, the encouragement the federal and state governments provided to industrial eucalyptus plantations, and later to those of soybean, led to major environmental impacts such as deforestation, loss of biodiversity, soil erosion and water depletion (Ribeiro 2008). The movement of traditional populations of the Cerrado took place in the late 1990s in this context of land conflicts and environmental degradation (Nogueira 2009).

3.2. The emergence of the Cerrado as an environmental concern

The Cerrado covers about 22 percent of Brazil's landmass. It spans a large area of central Brazil and borders other major biomes: Amazonia to the north, Caatinga to the northeast, Pantanal to the west and the Atlantic Forest to the east and southeast,⁴ which gives it a very rich biodiversity. The headwaters of three major South American basins are located in the Cerrado: the Amazonas/Tocantins, the São Francisco and the La Plata. Despite its size and importance, the Cerrado biome is one of the most threatened environments in the world. Even though it was designated a biodiversity hotspot in the early 2000s (Myers et al. 2000), deforestation has reached an alarming average rate of three million ha/year during the 2000s, in particular due to the expansion of eucalyptus, soybean and sugarcane plantations.

Social movements and environmentalists took up the defense of the Cerrado following the 1992 Earth Summit. Those groups came together in a network of socio-environmentalist non-governmental organizations (NGOs), known as *Rede Cerrado*. A first national program of conservation and sustainable use of the Cerrado (*Programa Cerrado Sustentável* – PCS), funded by the Global Environmental Fund and the World Bank, was launched in 2005 (Sawyer and Souza Lobo 2008). However, it was only four years later, in 2009, that the Brazilian government included the fight against deforestation in Cerrado as part of its strategy to cope with climate change.

The Cerrado clearly emerged as a political and environmental issue in 2009, at the Copenhagen Conference on Climate Change (CoP15). Brazil presented there an ambitious program which included: (1) the reduction by 36.1 percent to 38.9 percent of CO₂-equivalent emissions by 2020; (2) an 80 percent reduction in the rate of deforestation in the Amazon based on the 1996–2005 period; (3) a reduction by 40 percent of deforestation in the Cerrado biome based on the 1999–2005 period; and (4) the restoration of 15 million ha of degraded pastures. These commitments shaped the national policy on climate change, which established action plans, including a plan for the prevention and control of deforestation and fires in the Cerrado (*PP Cerrado*).

At this conference, it became clear that the problem of deforestation in Brazil was far worse in the Cerrado than in Amazonia (Sawyer 2009). Between 2002 and 2008, the average annual rate of deforestation in the Cerrado was twice as high as in Amazonia. By 2008, 986,247 km², or 48.37 percent, of the Cerrado's original cover was already cleared, against only 19 percent for Amazonia (IBGE 2010).

Three main factors explain this situation. First, land in the Cerrado is more suited to agricultural modernization than that in Amazonia. Investors have thus applied pressure on the federal government not to limit the expansion of the Cerrado agricultural frontier. Second, unlike the lush Amazon rainforest, the savannas have never attracted public and media attention. Even more dramatic is the 'invisibility' of the local populations in the region. Traditional populations in the Cerrado are very diverse in terms of ethnicity, culture, land use and livelihoods. They are not organized politically and they have only recently started using their collective identities to fight for their territorial rights (Nogueira 2009). They are not linked to global environmental networks and funds, as has been the case of traditional and indigenous populations of Amazonia since the 1990s (Hecht 2012). However, there are very few, if any, spots in the Cerrado that have not been occupied by local communities (Ribeiro 2008).

⁴The Cerrado biome spreads across the states of Goiás, Tocantins, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Bahia, Maranhão, Piauí, Paraná and São Paulo, and the Federal District.

Third, controlling deforestation in the Cerrado, where private property prevails, is highly problematic: restricted-use Conservation Units can only be created through costly expropriations. The major political force of the *fazendeiros*, who have come together under the 'ruralist' banner, also has its roots in the resistance to all environmental policies of the federal government (Aubertin and Pinton 2013). Brazil has focused its conservation efforts on Amazonia, as shown by the soybean moratorium initiative. Under this pact, signed in 2006, the Brazilian Association of the Vegetable Oil Industry (Abiove) and the Brazilian Association of Cereal Exporters (ANEC) pledged not to market soybean from deforested areas in Amazonia Legal (encompassing all nine states in the Amazon basin). Large companies like Cargill, Bunge and ADM were therefore forced to concentrate their investments in the Cerrado. This moratorium has been a success and, according to the industry representatives, soybeans are responsible for only 0.39 percent of the total area cleared in the Amazonian states of Mato Grosso, Pará and Rondônia after the moratorium was adopted (ABIOVE 2013).

In 2009, the federal government issued a decree approving the agro-ecological zoning for sugarcane. Most of the expansion area – 64 million ha – is in the Cerrado. According to the zoning, sugarcane cultivation is banned from the Amazon, the Pantanal and the upper Paraguay basin. As a consequence, the expansion of agro-industry in the Cerrado and the promotion of green technologies for land sparing allowed the protection of Amazonia, with deforestation rates there decreasing significantly since 2004 (Aubertin and Pinton 2013).

At the same time, the policies of the federal and state governments for the protection of the Cerrado have relied on two main strategies: the stricter enforcement of the Forest Code and the expansion and diversification of PAs. We argue, however, that these strategies do not affect soybean producers and traditional populations equally.

3.3. The implementation of environmental legislation in the Cerrado

Brazilian environmental legislation has two important – and controversial – components aimed at conserving biodiversity: the Forest Code and the National System of Conservation Units (SNUC). The Forest Code regulates land use on private properties. The SNUC, on the other hand, mainly concerns public lands.

3.3.1. The Forest Code

The Brazilian Forest Code, passed in 1965 and revised many times thereafter, requires that landowners protect forest cover along all watercourses and steep hill slopes (Permanent Protection Areas – APP) and maintain a part of their lands under natural vegetation, in the so-called 'Legal Reserve'. In the Cerrado, the Legal Reserve must cover 20 percent of each property (against 80 percent in most parts of the Legal Amazon). Since the 2000s, remote sensing and GIS have helped reveal which farmers were engaged in illegal deforestation, as well as facilitating the issue of Environmental Licenses for Rural Properties.

Environmental licensing has been spreading in all Brazilian rural areas since 2008, when the government prohibited public and private banks from issuing credit to landowners who are not in compliance with land-tenure legal requirements and environmental rules. Partnerships between state and non-state actors at the municipal level have provided incentives to farmers to bring their lands into compliance with environmental laws in Amazonia, like in the municipalities of Lucas do Rio Verde, in Mato Grosso State and Paragominas in Pará State. These experiences have been upscaled to the state level in Mato Grosso, and also

replicated in the state of Bahia (Brannstrom and Brandão 2012). While these partnerships decrease the costs of environmental compliance, due to economies of scale they have so far mainly benefitted large landowners (Ferreira 2010).

3.3.2. Protected areas

Law No. 9985, of 18 July 2000, created the SNUC, which regulates all public Conservation Units (PAs), be they federal, state or municipal. Integral Protection Units, in which the exploitation of natural resources is completely prohibited, differ from Sustainable Use Units, which can be exploited in accordance with a management plan. In theory, PAs, which include Conservation Units defined by the SNUC, as well as indigenous lands and *quilombola* lands, can help curb deforestation.⁵ Currently, 8.2 percent of the Cerrado land is classified as PAs, against 26.1 percent in Amazonia (CNUC/MMA 2013). Indigenous lands represent 4.4 percent of the area of the Cerrado biome, while covering 21.7 percent of Amazonia (CNUC/MMA 2013).

Nevertheless, there has been a remarkable expansion and diversification of PAs in the Cerrado since the late 1990s. This period corresponds to the creation of large PAs for sustainable use, as opposed to the previous period, when integral protection areas were most common (Figure 3). The majority of these new PAs are Environmental Protection Areas (APAs), which, in 2013, covered 108,498 km². That figure represents 62.23 percent of all conservation units in the Cerrado and 97.25 percent of the sustainable use ones (CNUC/MMA 2013)

The expansion of APAs can be explained by the fact that these areas are the less strictly protected areas in Brazil. They aim at protecting biodiversity, controlling land use and ensuring the sustainable use of natural resources, considered as category IV in the International Union for Conservation of Nature (IUCN) Protected Areas Categories System. Yet they allow individual properties as well as urban and rural settlements, and, in practice, authorities have imposed relatively low obstacles or regulations relating to resource use. If an APA does not have a management plan (which is often the case), landowners just need to abide by the general environmental legislation – the Forest Code in the case of rural areas. Therefore, APAs do not prevent the expansion of soybean agriculture since landowners can deforest up to 80 percent of their properties for planting crops, and use irrigation water if they have a license to do so. On this latter point, Brannstrom (2005) showed how the agribusiness sector in western Bahia (represented by its main cooperative) controls the legal process for obtaining these licenses.

The large-scale creation of APAs brings political dividends to state and municipal governments. As APAs do not pose restrictions on land use, administrators meet little resistance from farmers and ranchers. Municipalities and states are able to increase their areas under protection and thus qualify to receive additional funding. This is particularly significant in states where there is a mechanism known as ICMS-ecológico (Imposto sobre Circulação de Mercadorias e Serviços), where the state government returns part of the sales taxes it collects to municipalities according to the proportion of PAs in their territories.

⁵The federal government is responsible for demarcating indigenous lands and is the formal owner of those lands. However, indigenous people have full rights to the natural resources on their lands and can use the land according to the Forest Code, as can any private landowner. Even so, indigenous lands in the Amazon are the least deforested areas in the region, particularly on the agricultural frontier (Nepstad et al. 2006).

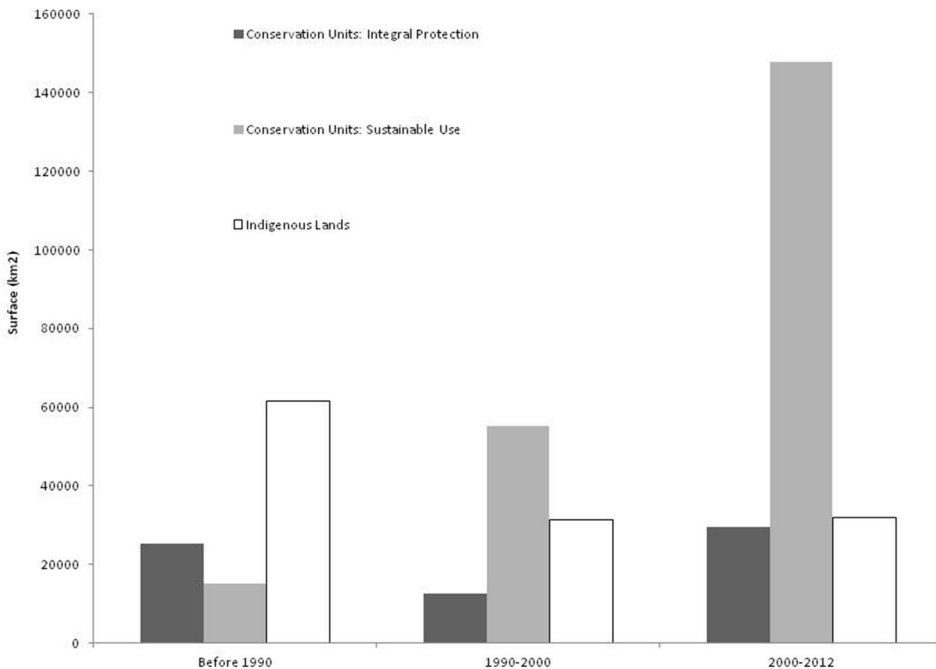


Figure 3. Evolution of the surface of protected areas in the Cerrado, within different categories. Source: IBAMA (2013).

4. Results: environmental policies around the soybean frontier – politics of selection and their implications for traditional farming systems

Large-scale farming and traditional farming systems have historically occupied different areas in the Cerrado, so conflicts between them arose only occasionally. In this section, we show how the selection of areas for conservation and recent changes in the Forest Code, as well as the focus on fire suppression, are likely to increase struggles for resources in the margins of the areas of expansion of soybean cultivation. To this end, we present our results in four parts, the first three according to our theoretical framework on the ‘politics of selection’ and the last on the implications of these policies for traditional populations and soybean producers.

4.1. Politics of selection

4.1.1. The spatial targeting of protected areas legitimizes the expansion of soybean agriculture

Since 1998, the Ministry of Environment and NGOs have undertaken studies for the prioritization of protected areas and environmental monitoring within Brazilian biomes (Probio project). On the basis of three fundamental principles – representativeness, persistence and vulnerability – these studies identified soybean expansion areas (western Bahia state, southern Maranhão and Piauí, and eastern Tocantins) as priority areas (MMA 2011b). However, PAs in the Cerrado are mainly delimited on lowlands, where soils and topography are not suitable for mechanization, and do not intrude on soybean expansion areas.

Figure 1 shows that around the soybean frontiers of the eastern Cerrado, in the states of Goiás, Minas Gerais and Tocantins, the majority of the PAs have been demarcated on the west of the plateau formed by the Serra Geral (in Bahia, Piauí and Maranhão states), where deforestation and soybean expansion have been prominent since the 2000s (cf. Figure 3). So PAs are mostly delimited on lowlands, in rough or hilly areas, where soils and topography are not suitable for the mechanization of agriculture. The only large PA that overlaps with the soybean frontier is an APA, which hardly affords any protection to the native vegetation. Parts of restricted-use PAs do encompass riverbanks, but such areas are, in any case, protected by the Forest Code.

Table 2 shows that the municipalities with the largest percentage of their territories under soybean cultivation have an average of 2.5 percent of their territories under PAs, while the average for all municipalities in the Cerrado is 4.6 percent.

As in other regions, the majority of PAs are created without regard to prioritization guidelines, mainly because of historical and political factors (Milian and Rodary 2010).

Moreover, the creation of PAs in areas of undulating topography offers new opportunities for soybean expansion, because such areas, even if located in another state, became target areas for Legal Reserve (LR) compensation. The new Forest Code (2013) also allows forest recovery (APP and LR) through payments for environmental services (article 41). It established a trading system for Legal Reserve compensation based on environmental assets (*cota de reserva ambiental*) which can operate at the scale of the entire biome (articles 44, 48, 66). In other words, farmers who do not want to preserve or reforest their Legal Reserve on prime farmland can purchase land elsewhere and set it aside as Legal Reserve. If this land is located inside a PA, farmers can avoid the responsibility of managing it (preventing fire, logging, etc.) by making a donation to the environmental institution that is in charge of the PA (*desoneração de reserva legal*). Areas of 'natural' vegetation acquire a new value, greater than the opportunity cost that would represent their clearing. This change leads to a new type of competition between large-scale farming and traditional agriculture.

4.1.2. *The focus on fire suppression undermines participative management of PAs*

The APA is a less strict conservation unit and is meant to be managed in collaboration with farmers. The RDS category was also created to promote participative management. In addition, the RDS and the EESGT belong to wider territorial-management units, called Mosaics of Protected Areas. Similar to ecological corridors, the mosaics are sets of adjacent or overlapping PAs and indigenous lands placed under integrated and participatory management. Mosaics are supposed to be not only tools for conservation but also land planning mechanisms which encourage stakeholder participation, strengthen local identities and help add value to local products and knowledge. Participatory local management used to be mediated by community interactions with non-local actors, such as NGOs, universities and international organizations. But in the Cerrado, this kind of alliance is mediated by the selection of productive activities that are perceived to be compatible with conservation. They include fire-free production techniques, like fruit and fiber gathering, handicrafts and ecotourism. Traditional agricultural systems, on the other hand, are usually ignored or regarded as harmful due to their use of fire.

Farming systems within PAs rely mainly on shifting cultivation, extensive grazing on native grasses and, in the case of Jalapão, extractivism of ornamental flowers. These activities depend on access to and use of riverside vegetation (*matas de galeria*), especially in

Table 2. Coverage of protected areas in areas of soybean expansion in the Cerrado.

	Total area (km ²)	Restrict use PAs			Sustainable use PAs			Indigenous lands			
		Number	Total area	% of the area	Number	Total area	% of the area	Number	Total area	% of the area	Average % of the area
Within the most rising soy production regions*	253553.1	10.0	3830.2	1.5	20.0	12453.9	4.9	10.0	2698.7	1.1	2.5
Within all the Cerrado biome	2189180.1	151.0	63658.0	2.9	314.0	146372.4	6.7	95.0	96789.3	4.4	4.6

Note: *Municipalities where the area of harvested soy expanded by more than 15,000 ha between 2004 and 2011 (33 in the Cerrado biome).

Sources: IBGE (2013) and IBAMA (2013).

upstream wetlands, called ‘veredas’, where soils are more fertile and humid, even during the long dry season (June to October). Fire is a key element in the management of these activities: it stimulates the regrowth of native pastures and flowers during the dry season and clears new agricultural fields.

However, environmental managers are focused on fighting fire, because fire is commonly regarded as a crime. They are particularly sensitive about the *veredas*, and their flagship palm species *Mauritia flexuosa*, which must be preserved, especially for its role in water regulation and biodiversity. In fact, *vereda* wetlands are vulnerable ecosystems. They host water springs, are rich in biodiversity and are fire-sensitive. Depending on their frequency and intensity, fires can affect the original vegetation, biodiversity and water regimes (Bahia et al. 2009; Maillard, Pereira, and Souza 2009). But the total prohibition of the use of agro-pastoral fire in these areas does not take into account the studies that suggest that regular fire practices can encourage the conservation of biodiversity and assist forest regeneration in savannas (Jeltsch et al. 2000; Laris 2002; Pivello 2006; Eloy and Lúcio 2013, Welch et al. 2013).

As a result, the ban on agro-pastoral fire and the prohibition of forest clearing along the riverbanks (APP), which are strictly enforced in PAs, turn traditional productive activities illegal. Since most smallholders have lost access to lands in downstream valleys (now used mainly by cattle ranchers) and on the plateau (now used by industrial plantations), these upstream riparian forests (*veredas*) are the only areas that can provide access through the managed use of fire to, at the same time, fertile soils for small-scale, low-input cultivation, access to water and natural grassland during the dry season. Only a minority of farmers can afford to modernize their farming systems to cultivate the less fertile and sandy soils of the open savannas.

Herders can be banned from the RDS if they use unauthorized fire. In the APA, the Forest Code is applied strictly: fire and clearing, as well as irrigation require a license from SEMARH, the State Secretariat of Environment, located in the distant state capital, Goiania. Obtaining a license is a complex administrative process, out of reach for the majority of farmers due to the lack of money, education or land title. In the EESGT, an agreement (*termo de compromisso*) was signed in 2011 between ICMBio and users to solve conflicts. According to this agreement, burning is tolerated under specific conditions for shifting cultivation, cattle grazing and extractivism. But this institutional innovation only the second case in protected areas of the Cerrado.

In practice, the ban on fire in PAs is hard to enforce because fires are common in the savannas. Also, the extension of PAs makes law enforcement expensive. In any case, the official anti-fire discourse is explicitly publicized, so some farmers continue to make use of fire discreetly while avoiding official fire control regulations. They do so with guilty feelings and under fear of denunciations, as was observed in our case studies (Figure 4). In particular, in APAs without management plans, the uncertainty arising from the complex and variable environmental rules creates a feeling of permanent insecurity among smallholders (see Matthews 2005 for similar cases in Mexico).

As a result, conflicts arise through varying identifications and interpretations of environmental problems. Environmental managers point at ranching and slash-and-burn agriculture as the sources of the region’s main environmental problem: uncontrolled wildfires. Smallholders, on the other hand, blame changes in land use, mainly the introduction of eucalyptus and soybean plantations, for the depletion of water resources, especially due to the use of central-pivot irrigation and soil erosion (Eloy and Lúcio 2013; Lúcio, Eloy, and Ludewigs 2014).

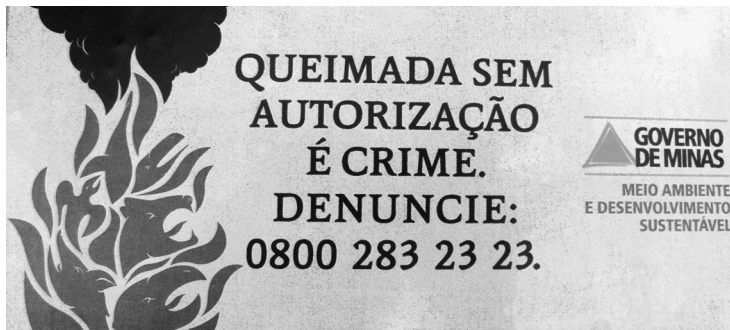


Figure 4. The criminalization of fire in the sustainable development reserve (RDS) Veredas do Acari.

Source: Photo by Ludivine Eloy, 2012.

At the same time, or maybe as compensation, environmental managers employ the sons of farmers in the fire brigades and involve them in the management of the PAs. They also promote fire-free activities, such as fruit and fiber gathering, handicrafts and ecotourism. Environmental managers perceive the membership of farmers and their sons in fire brigades as a way of implementing participatory management while providing new income for these families. But farmers remain subordinate to park managers. In general, farmers' needs and knowledge are not incorporated into decision making about fire management. Following Mistry and Bizerril's (2011) analysis, we observed that collective systems of fire control were undermined. The criminalization of fire, along with the prohibition to undertake primary productive activities, explains the increase in criminal wildfires, set intentionally during the peak of the dry season.

Three reasons can explain why traditional agro-pastoral practices are excluded or, at best, ignored in most participatory management policies in Cerrado. First, according to a federal environmental official, 'the problem is that fire and cattle are the main taboo of environmentalism in Brazil'. In fact, the use of fire for cattle grazing is historically linked to deforestation in most of the country, especially in tropical forests (Amazonia and Atlantic Forest) and southern Cerrado, where cultivated pastures replaced natural vegetation. But this is not the case for many places in northern Cerrado, usually incorporated into PAs, where shifting cultivation and pastoralism on native grasses are not associated with the suppression of the savanna and is central to production systems (Lúcio, Eloy, and Ludewigs 2014). Here, again, the Amazonian environmental model has played against the interests of the populations of the Cerrado. National and international conservation interests consistently dominate fire-management policy (Sorrensen 2009). The importance accorded to the topic of climate change and carbon markets has led to a total rejection of fire in development policies, as clearly illustrated by the PP-Cerrado. As a result, for environmental managers at the local level, preventing fire seems to be the easiest environmental strategy to apply, and the best way to obtain economic resources.

Second, the relative weakness of civil society (traditional populations and family farmers) in the Cerrado vis-à-vis other regions may explain why such environmental norms are not challenged (see section 3.2).

Third, the fire suppression and set-aside discourse is supported by soybean producers since it legitimizes their activity. In other words, the focus on fire management and set-aside does not hamper the expansion of soybean plantations, as soybean farmers do not

rely on the use of fire. The enforcement of the APP rule does not seem to be a big challenge to soybean farmers, for they can afford to buy marginal lands outside the plateau to compensate for the deforestation above the 80 percent limit. As mentioned in section 3.3, since the 2000s, large farmers in western Bahia have been benefitting from new public–private partnership programs that help them comply with the Forest Code. Moreover, even where PAs overlap with the soybean frontier, such PAs are mainly APAs, which permit agriculture. Large-scale farmers do not find it difficult to obtain deforestation and irrigation licenses,⁶ especially for central-pivot irrigation.

4.1.3. *Information systems help conceal other major environmental issues*

Agro-industrial production is causing major environmental damage in western Bahia, especially to water resources and soils (Gaspar 2006). Environmental agencies do not monitor and sanction these problems to the same extent that they do fire. This situation creates a feeling of injustice among the smallholders who suffer from strict environmental norms, and who have to bear the impact of plantations on water regimes, water quality and soils within PAs.

Recent technological and institutional changes have further spurred fire suppression. First, the introduction of Modis (Moderate-Resolution Imaging Spectroradiometer) made fire detection more effective and less expensive. Second, the registry of rural properties became mandatory after the 2012 reform of the Forest Code. Thus, it became easier for environmental managers to identify fire spots and penalize landowners.

The growing sophistication of fire detection tools has been accompanied by an increased access to data by ordinary citizens. The National Institute for Space Research (INPE) offers free access to a public system of fire monitoring. It provides precise geographical data, updated every three hours, on hot spots detected by more than a dozen satellites whose resolutions can go down to 30 m × 1 m. A particular system is proposed for protected areas. INPE calls users of the system to assist in the improving information to fight against fires through denunciations. It considers that fires are the result of ‘bad faith associated with laziness and ignorance’ (INPE, 2012).

In comparison, basic hydrological data are extremely poor, especially in western Bahia, where the state water agency (*Superintendência de Recursos Hídricos*, SRH) faces considerable problems in licensing stream-water use (Brannstrom 2005). Due to this lack of information, SRH over-licensed irrigation water to hundreds of central pivots, which has considerably reduced water flow. Indeed, on a few occasions, a downstream hydroelectricity plant had to shut down its turbines during the dry season. Soybean farmers, in turn, have begun drilling for groundwater, taking advantage of vague licensing procedures and poor regulation. In the area above the Urucuia aquifer, there was an increase of 125 percent in the number of licenses for the use of groundwater, and of 76 percent for surface waters between 2003 and 2006 (Gaspar 2006). Most wells do not have water meters so it is impossible to control the water uptake. Furthermore, the main organization of soybean producers in western Bahia (AIBA) seeks to control the production of information on water resources, working with state agencies to fund and implement research and monitoring of climate, land cover, stream flow and soil erosion (Brannstrom and Brandão 2012).

⁶In the 1990s, irrigation in Western Bahia began without proper licensing from the state (Brannstrom 2005).

4.2. Implications for traditional production systems

Over the past 20 years, the focus on fire suppression, in combination with the targeting of PAs, has discouraged traditional production systems. Shifting cultivation in gallery forests and cultivation through drainage in *veredas* wetlands have been, for the most part, abandoned, except in the remotest areas. As small-scale ranchers are not allowed to clear the savanna to plant pastures without licenses, nor to use fires to stimulate the regrowth of native grasses near *veredas*, they are left with few options to avoid overgrazing: (1) reduce the size of the herd, which means a decrease in assets and income; (2) rent pastures outside their lots, which incurs extra costs; or (3) plant grasses under the canopy of wooded areas to avoid monitoring. With this last option, the carrying capacity of the pastureland is severely reduced due to the shade. As a result, two trends were observed: while communities near cities decreased their production and increased purchases of food from nearby markets, families living in remoter areas, whose incomes depend mainly on agriculture, continued their fire-dependent practices. They continue to use fire at night, illegally.

Those changes have resulted in a reduction of agricultural production and may have accelerated a process of rural exodus that started in the 1970s. This situation has intensified in recent years because of new job opportunities in urban areas, as a result of public investments in infrastructure and the various social transfers implemented or intensified since 2003, particularly the *Bolsa familia*. The main source of income has now become employment in urban areas, often in the public sector. Land rental or land sale, often in land reform settlements, has also become a source of income. Table 3 shows that in the three study sites, families who depend primarily on agricultural income (class 3: 67–100 percent) are a minority ($n = 11$ in a total of 57). Agricultural income usually represents less than 50 percent of total income in most domestic groups. In this changing context, social inclusion and citizenship are obtained through social transfers rather than by agriculture (Sawyer 2011).

Table 4 shows that most women and more than 50 percent of children are engaged in urban services (domestic maid, construction, transportation). Youngsters from Serra das Araras work mainly in distant large urban centers, like Brasília, whereas youngsters from Mambai and Mateiros have migrated mainly to Goiânia or Palmas. Seasonal employment of farmers' sons as fire wardens (classified as 'local urban service') is an important source of income for some families, especially in Mateiros (TO), where the ICMBio funds a fire brigade with nearly 40 firefighters. Many family members rely also on social welfare. Only a few family members are employed regularly in the agricultural sector (10–15 percent). The highest proportion is found in Mambai, a municipality close (30–50 km) to the large-scale soybean farms in Bahia. In sum, most families rely on off-farm activities, mainly in regional or national urban centers, while soybean plantations offer seasonal jobs.

Table 3. Share of farm income within domestic groups.

Share of farm income in total income (%)	Serra das Araras ($n = 25$)	Mambai ($n = 20$)	Mateiros ($n = 12$)
Class 1: 0–33	13	7	6
Class 2: 34–66	9	8	3
Class 3: 67–100	3	5	3

Source: Authors' field data.

Table 4. Main source of income of traditional farmer families (household head, spouse and all children).

Main source of income	Localization	Serra das Araras, MG			Mambáí, GO			Mateiros, TO		
		Household heads (<i>n</i> = 25)	Spouse	Children	Household heads (<i>n</i> = 11)	Spouse	Children	Household heads (<i>n</i> = 12)	Spouse	Children
Farm activities (agriculture, ranching and handicraft)	Local*	16	2	6	10	2	4	9	4	5
Retail/rental properties		1	1	2						
Urban service (construction, carpentry, fire fighting, domestic maid)	Local	5	1	5		1	8			9
	Regional**			8			13			6
	National***			39			8			12
Agricultural services	Local*	2		3						6
	Regional**			15			8			3
Civil servant	Local*	1		3	1	2	4		2	3
Social subsidies (<i>Bolsa Família</i> , retirement, etc.)	Local*		15	9		5	4	3	5	6
Without source of income			6	16			8			11
Total		25	25	106	11	10	57	12	11	61

Source: Authors' field data.

*Same municipality **Same state, other municipality, ***Other state.

5. Discussion and conclusions

The enforcement of the Forest Code and the expansion of protected areas in the Cerrado coincided with the emergence of the soybean frontier in the late 1990s. Our results show how environmental policies in Cerrado rely on the combination of three processes of selection: spatial targeting of PAs in the lowlands, focus on fire as the main environmental problem and construction of related information systems that conceal major other environmental problems in flat uplands, where soybean agriculture is expanding, such as water depletion and soil erosion.

The model of fire fighting and forest set-aside applied in savanna ecosystems is influenced by the conservation models imported from forest ecosystems (in particular, from Amazonia) and by the negotiations on climate change. These selective policies put a disproportionate strain on smallholders and traditional populations. Although these groups are not responsible for most of the deforestation and the associated loss of biodiversity in the Cerrado, they have been penalized due to their traditional use of fire. As a result, these ‘politics of selection’ undermine participative management of PAs, while legitimizing the expansion of soybean agriculture around them.

These results permit us to discuss the socio-spatial effects of the concurrent processes of ‘conservation booms’ and the modernization of land use in Latin American countries (Zimmerer 2011). Some authors have described the political and social mechanisms that sustain the rapid expansion of monocultures in the Brazilian Cerrado since the 1980s, and the containment of traditional populations to the economic and geographic margins of soybean and eucalyptus farms (Brannstrom 2005; Ribeiro 2010). Hecht (2005) showed how agricultural lobbies influence the Brazilian states to allow unfettered use of resources in environmental ‘sacrifice zones’, which are created as territories for the development of agribusinesses. But few studies address the struggles and competitions for resources that take place in the margins of these sacrifice zones, where low-input production systems are located and where conservation policies focus their actions.

In fact, politics of selection are not new to the Cerrado: large-scale farming and traditional farming systems have historically occupied different areas, so conflicts between them arose only occasionally. The reduction of areas available to traditional farming systems and the rural exodus do not differ from what has happened elsewhere in Brazil, although the process in the Cerrado is more dramatic due to the rapid expansion of the soybean frontier. But the recent political, environmental and scientific changes, such as the reform of the Forest Code (flexibilization of compensation systems), the progressive rehabilitation of fire as a management tool, water depletion and new claims for land from traditional populations (especially *quilombolas*), may increase struggles at the margins of the soybean expansion zones.

These changes may have led to new relationships with PAs. As they are typically located in areas less suitable for agricultural mechanization, these PAs become targets for legal-reserve compensation, helping farmers who want to expand their plantations in the ‘*chapadão*’. This system of forest compensation may reduce even further the space available for agro-pastoral activities, usually carried out without land title.

According to Brannstrom and Brandão (2012), nature is central in the discourse of soy farmers of western Bahia when they emphasize their commitment to complying with existing state and federal environmental legislation. This discourse encourages environmental compensation that enables future soybean expansion through environmental compliance of the new Forest Code. States like Goiás are drafting their own legislation to organize a stock exchange system of environmental assets. A large amount of speculative activity takes place in this new market (Aubertin and Pinton 2013).

The production of knowledge, particularly the cartography of land use in the Cerrado, helps exacerbate these tensions. Simplified and official land-use maps classify land use in binary terms – deforested area or natural vegetation – thus obscuring traditional land uses, which are now located in areas eligible for environmental compensation through set-asides. As observed by Sorrensen (2009) in the Amazon, the predominance of geospatial technologies in environmental monitoring activities limits the problematization of fire hazard (and deforestation) to the behavior of individuals, and does not consider the regional development arrangements under which individuals operate. Hybrid technologies that incorporate remotely sensed data at the macro scale with local ethnographic inquiry may be more effective in understanding human-landscape relationships.

As a result, for traditional populations, the challenge is not only to tap niche markets, such as of extractivist and organic products, and to obtain or secure their land rights, but also to play new roles and occupy new spaces in scientific and political networks that help determine what constitutes an environmental harm and what is an acceptable farming system.

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