# CONSERVATION POLICES AND CONTROL OF HABITAT FRAGMENTATION IN THE BRAZILIAN CERRADO BIOME

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## Introduction

Fragmentation of habitats caused by human interventions is defined as the process by which a continuous stretch of habitats is broken up into several smaller units (CERQUEIRA *et al.*, 2003). It occurs when these interventions remove incomplete and large areas of habitats, resulting in smaller areas of original native ecosystems separated from each other by an anthropogenic matrix of landscapes shaped by agriculture, animal husbandry, mines, roads, transmission lines and lakes behind reservoirs, etc. (ARAÚJO, 2007). This occurs in almost every biome that supports long-lasting human settlement and has been a notorious and historic feature of the human occupation of the Brazilian Atlantic Forest and *Cerrado* biomes.

Originally, the Brazilian Cerrado biome covered about 2,039,386 km$^2$, just under 24% of the national territory, with smaller areas in Paraguay and Bolivia (MMA, 2009a). The Brazilian Ministry of the Environment, on the basis of satellite images from 2002, claimed that the biome, up to that point, had lost about 40% of its original expanse in Brazil. More recent data allowed the Ministry to state that an additional 127,564 km$^2$ (6.2%) were lost between 2002 and 2008. In late 2009, the total deforestation figure computed by the Ministry rose to 48.2%. These rates translate into a formidable average deforestation rate of approximately 21,300 km$^2$/year. This is more than the corresponding rate for the much larger Amazonian biome between 2001 and 2008 (16,893 km$^2$/year) (INPE, 2009). This large-scale deforestation, combined with the *Cerrado*'s high incidence of endemic life forms, has placed the biome among the world's "hot spots" (MITTERMEIER *et al.*, 1999; JENKINS & PIMM, 2006; ALHO, 2005). Figure 1 shows us that the biome is being subjected to an intensive process of habitat fragmentation.

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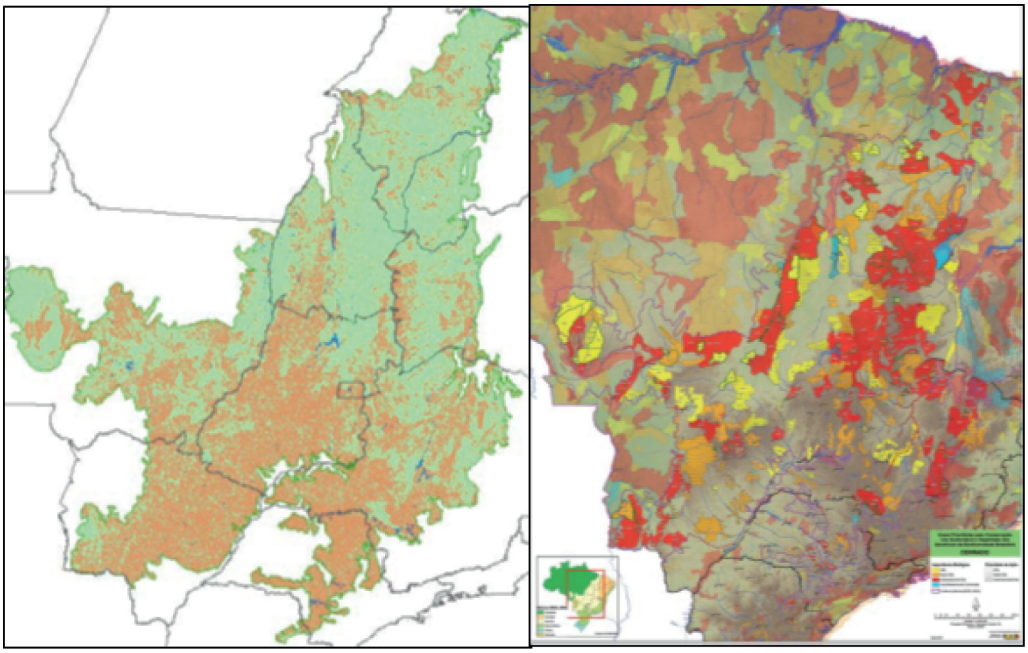

Figure 1. Left: Cerrado biome in Brazil, 2008, contrasting deforested areas (brown) and remaining native formations (green), as well as major rivers (blue). Source: MMA, 2009a. Right: Priority Areas for the Conservation of the Cerrado: high importance (yellow); very high importance (orange); extremely high importance (red); insufficiently studied areas (blue). Source: MMA/SBF, 2007.

A revision of Brazil's major biodiversity conservation strategies is necessary in order to contain fragmentation. Historically, these strategies have been centered around conservation units. Rambaldi & Oliveira (2003) state that this strategy does not lead to the long-term conservation of biodiversity, as conservation units end up being scattered spatially and are not associated with a more far-reaching perspective of their respective landscapes. A simultaneous strategy is needed which addresses the management of lands adjacent to conservation units. Conservation units have become "an archipelago of isolated parks and preserves, frequently pressured on all sides and inadequate for the long-term protection of the plant and animal species that they contain" (MMA/SCA/IBAMA, 2001, p. 10). As the isolation of forest fragments rapidly leads to their deterioration, conservation units alone will not prevent the collapse of native ecosystems and their associated biodiversity (Prado *et al.*, 2003). Although parks and reserves are the oldest form of protecting biodiversity, the protection that they offer is far from satisfactory due to failures in related policies, among them land-use policies focused on private land (DRUMMOND *et al.*, 2005).

This text investigates if governmental and non-governmental initiatives in the field of biodiversity conservation have encouraged the emergence of an integrated policy for the protection and connectivity of remnants of the *Cerrado* biome. This necessitated the

examination of relevant policies introduced across the entire biome (particularly federal policies) and of specific projects implemented by government agencies and/or NGOs.

The main sources of data we used were analytical and descriptive texts and interviews with policy makers, NGO project leaders and private landowners. Field trips generated first-hand material also used in the text. Brazil's Federal District and the Northeastern region of the state of Goiás were selected for case studies. They were chosen because they have large *Cerrado* remnants, although agribusiness frontiers are closing in on them. The region also has two national parks – Brasília and Chapada dos Veadeiros – and several other conservation units that are representative samples of such units in the *Cerrado* biome.

## Conservation plans

Federal government initiatives for the conservation of biodiversity in Brazil are (not exclusively in the *Cerrado* biome): (i) the National Biological Diversity Policy; (ii) the National Plan for Protected Areas; (iii) the identification of Priority Areas for Conservation; and (iv) the identification of floral cover. Specifically covering the Federal District and Northeastern Goiás, there is also (v) the Environmental Zoning of the Integrated Development Region of the Federal District and Adjacent Areas. Each is examined in turn below.

(i) Created by Decree 4,399/2002, it defines directives for *in situ* conservation. Its goals for 2010 include: protection of at least 30% of the Amazonia biome and of 10% of all other biomes by means of conservation units; conservation of the biodiversity of at least two thirds of the Priority Areas for Conservation, using conservation units, indigenous homelands and *quilombola*[1] lands; a 100% reduction of deforestation in the Atlantic Forest biome, 75% in Amazonia and 50% in other biomes; a 25% reduction of heat focal points in all biomes; and the creation of a national biodiversity monitoring network.

(ii) Approved by Decree 7,578, it lists initiatives to be taken until 2015 relative to conservation units, indigenous homelands and *quilombola*[i] lands. Among its goals are connectivity between ecosystems, integration between landscapes and protected areas, and the creation of conservation units in priority areas and in places where species and ecosystems require special protection.

(iii) This was completed in 1998 and updated in 2007 (MMA/SBF, 2007). It identified and mapped well-preserved areas, taking into account their vulnerability to settlement and ranking their priority for emergency conservation measures (Figure 1, above). 431 areas were identified for the core area[ii] of the *Cerrado*, and of these, 181 were already under the protection of federal and state conservation units or indigenous homelands. The other 250 areas correspond to 37.58% of the biome. For this second group the policy proposed new conservation units, the reclamation of degraded areas, the establishment of corridors or mosaics and support to the sustainable use of biodiversity (MMA/SBF, 2007).

(iv) Identification of Brazil's floral cover was based on Landsat images from 2002. The only previous nationwide flora survey in Brazil had been done by *Projeto Radam* (1970-1985), employing side-looking radar technology combined with extensive field research

(MMA, 2007a). This new survey defined as native all areas in which native vegetation (including recovering secondary formations) was prevalent, even if human-induced changes were recorded in these areas. Therefore, native grasslands used for grazing were classified as native (MMA, 2007a).

Native floral cover in 2002 amounted to 60.41% of the core area of the biome. 36.73% (752,000 km$^2$) were native forests and 23.68% (485 mil km$^2$) were non-forest formations. When native grazing areas are excluded, the figure for native floral cover drops to 46.74% (MMA 2007a). Previous non-official surveys cited by Ribeiro *et al.* (2005) and Machado *et al.* (2005) had indicated much higher losses, ranging from 40% in 1995 to 55% in 2002. However, comparisons based on the results of these studies are difficult to make, as they employed different methodologies. Nonetheless, all the studies point to the urgent need to implement control measures. The Ministry of the Environment itself calculated total *Cerrado* deforestation in 2008 to be 48.2% (983.091 km$^2$), indicating that the aforementioned goal of reducing the deforestation rate by 50% in relation to 2006 is not being attained.

## Conservation units in the *Cerrado* biome[iii]

According to our data, federal conservation units protect only 3.9% of the biome. This is far below the corresponding figure of 14.74% in the Amazonian biome (BARBOSA, 2009). Fully protected units cover 4,421,848 ha while sustainable use units cover 3,401,210 ha. These figures correspond to 2.2% and 1.7% of the area of the biome, respectively[iv].

The first conservation unit in the biome was the Araguaia National Park, established in 1959, covering 2,000,000 ha. By 1961, three new parks expanded the protected area to approximately 2,800,000 ha. However, considerable reductions in the size of the two parks reduced that figure substantially over the following 12 years. Therefore, the growth of the number of units did not result in a larger total protected area. New units were created in the *Cerrado* in the 1980s, but only in 2000 was the 1961 figure (2,395,660 ha) surpassed. After 2004, fully protected areas in the biome stagnated (Figure 2).

The first sustainable use units in the Cerrado were created in 1983 - the Environmental Protection Areas São Bartolomeu and Rio Descoberto, both in the Federal District. Since then, their numbers and areas have grown continuously (Figure 2). Since 1996 many large units have been added, including the largest one in the biome, the Environmental Protection Area of Serra do Ibiapaba, with more than 1,500,000 ha. Fully protected units are, on average, larger than sustainable use units. However, the combined area of the former type only surpassed that of the latter in the mid-2000s, after the creation of three national parks (Appendix I).

The state conservation units (fully protected and sustainable use) account for 9,102,352 ha, or 4.4% of the biome. Fully protected units amount to only 1,828,996 ha (0.9%) while sustainable use units cover 7, 272,356 ha (3.6%).

The total of 167 federal and state conservation units comprise 6,250,844 ha fully protected and 10,674,566 ha designated for sustainable use (3.1% and 5.2% of the biome respectively). The total area of these units is 16,925,410 ha, or 8.3% of the biome. This

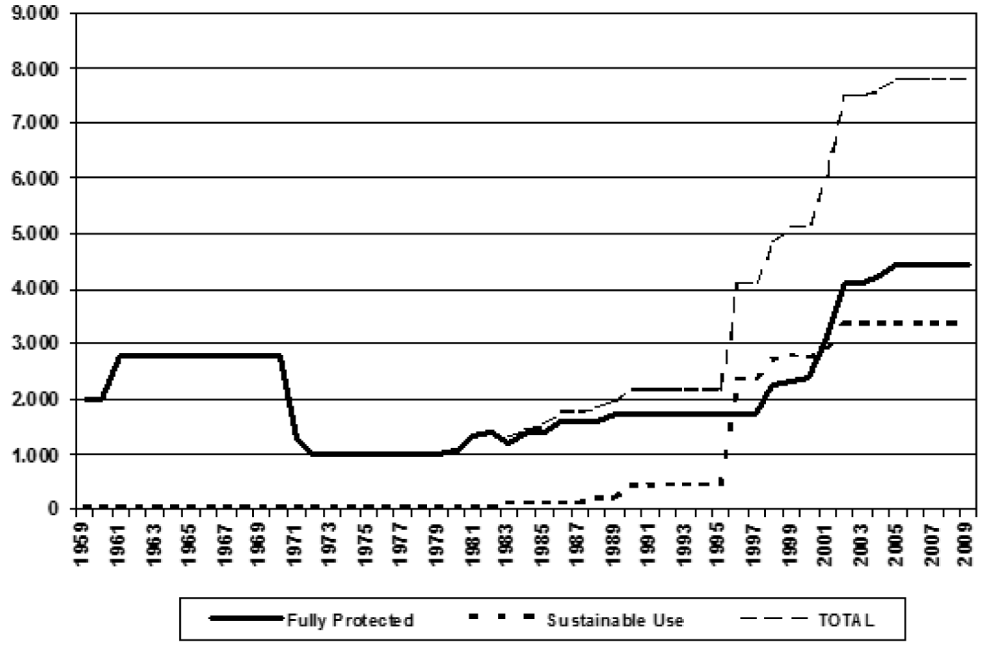


Figure 2. Cerrado Biome: total area protected by federal conservation units, 1959-2009 (1.000 ha). Source: compiled by authors based on MMA (2009b).

figure should be treated with caution, as it does not consider overlapping. In any case, it was below the official target of protecting 10% of the biome by 2010.

While conservation units have grown slowly, the agricultural frontier has expanded rapidly since 1970. *Cerrado* fragmentation has made it difficult to find areas for large conservation units.

## Other conservation initiatives in the *Cerrado* biome

Other identified conservation initiatives in the *Cerrado* are (i) the National Program for the Conservation and Sustainable Use of the *Cerrado* Biome; (ii) the Fire and Deforestation Prevention and Control Plan for the *Cerrado*; (iii) the *Cerrado* Biosphere Reserve; (iv) the Strategic Development Plan for the Midwest, 2006-2020; and (v) biodiversity corridors.

(i) The Ministry of the Environment has managed this program since 2005. It aims to implement socioeconomic policies, such as monitoring, conserving and supporting the sustainable use of biodiversity and the sustainability of agriculture, cattle farming and tree planting. The Ministry signed an agreement with the World Bank and the Global Environmental Facility (GEF), with funding of about US$ 50 million (MMA, 2007b). A committee was established to steer the program, but it made little progress (GANEM, 2007).

(ii) Launched in late 2009, this program is still in the phase of public hearings. It was devised to monitor floral cover, create new conservation units, devise the macro-zoning of the biome and promote local productive chains (MMA, 2009a).

(iii) The first of the four predicted phases of the *Cerrado* Biosphere Reserve was limited to the Federal District. It was created in 1992, with 230,000 ha. It was extended three times (2000, 2001 and 2002), reaching areas of the states of Goiás, Tocantins, Maranhão, Piauí, Mato Grosso, Mato Grosso do Sul, Bahia, Minas Gerais, São Paulo and Paraná. Its goal is to protect core and transition areas of the biome (COBRAMAB, 2002), but so far it has failed to create a significant number of new protected areas (GANEM, 2007).

(iv) This plan was proposed by the Ministry of National Integration, as part of a National Policy for Regional Development. It includes several initiatives concerning biodiversity protection, such as recovery of watersheds and floodplain vegetation, protection of endangered species, control over deforestation, sustainable use of biodiversity, sustainable forest management, creation of new conservation units and solutions for their land tenure situation, and creation of ecological corridors (MIN, 2006). However, all these initiatives are under the responsibility of the Ministry of the Environment and state environmental agencies who did not subscribe to the plan. It remains unclear how the agencies involved should work together.

(v) Five governmental projects concerning biodiversity corridors in the *Cerrado* biome were identified - Araguaia-Bananal, *Cerrado*/Pantanal, Guaporé-Itenez/Mamoré (part of the West Amazonian Corridor), Jalapão and Paranã-Pireneus (CASES, 2006). Only the final one is examined in this text.

NGOs have also been active in relation to biodiversity corridors. Conservation International (CI) participated in the creation of a network of protected areas in the *Cerrado* biome, in conjunction with efforts to make rural property owners comply with legal requirements concerning the preservation of remnants of native flora. In 2007 CI was working on five corridors: Uruçuí-Mirador, Jalapão-Oeste da Bahia, Espinhaço, Emas-Taquari and Araguaia.

The Nature Conservancy (TNC) has also worked with *Cerrado* corridors. In Lucas do Rio Verde (Mato Grosso), the TNC is working with individual agribusiness farmers to encourage compliance with native flora preservation requirements in order to promote connectivity among remnants. *Instituto Sociedade, Proteção e Natureza* (ISPN) manages a GEF-funded "Small Ecosocial Projects" program that affects dozens of small agricultural or extractive communities in *Cerrado* areas. Residents receive support for engaging in sustainable activities (GUIMARÃES, 2005; NOGUEIRA, 2009). Between 1995 and 2006, the program has supported 228 projects and 161 organizations (ISPN, 2007). These projects were concentrated in the states of Goiás, Tocantins, Distrito Federal and Minas Gerais (GANEM, 2007).

## Conservation measures in the Federal District and in northeastern Goiás

The conservation measures that we identified in connection with these two areas are: (i) the Paranã-Pireneus Ecological Corridor; (ii) Zoning of the Integrated Develop-

ment Region of the Federal District and Neighboring Areas; and (iii) Conservation and Management of the Biodiversity of the *Cerrado* Biome. Additionally, (iv) we observed local measures taken in the Federal District.

(i) This resulted from cooperation between IBAMA (the national environmental policy agency) and JICA (Japan's international cooperation agency) between 2003 and 2006. The project included eight federal conservation units and nine state units, although it focused on two pilot areas located in Goiás. However, it did not help to expand protected areas in the affected municipalities. Indeed, JICA (2006) claims that this goal was not clearly defined. It offered educational programs, trained guides, supported the management council of Chapada dos Veadeiros National Park and helped form the management council (still not operational) of another conservation unit. Very little was achieved in terms of defining the limits of protected areas and training and involving farmers in the creation of privately protected areas and environmental compliance. No new conservation units were created. The organization of extractive production and sales of *Cerrado* extractive products was also unsuccessful.

(ii) This zoning encompasses the Federal District and 21 neighboring municipalities. An environmental assessment, funded by the ministries of the Environment and National Integration, was undertaken with the cooperation of the Army and the Census Agency. Although suitable areas for conservation were identified, by 2007 the project had even failed to define its own area of intervention (RODRIGUES, 2007).

(iii) This project was executed between 1997 and 2005 by EMBRAPA (an agricultural research company owned by the federal government). It was funded by DFID, the United Kingdom's international cooperation agency. Its goal was to train local partners and disseminate knowledge about conservation and management of the *Cerrado*'s natural resources. It was active in 34 municipalities of the state of Goiás (EMBRAPA/CPAC, 2005). Among its main accomplishments are the compilation of numerous scientific texts about social and natural aspects of the biome, and the support given to 20 small, community-based projects (household pharmacies, production of native seedlings, rearing of wild animals, environmental education and eco-tourism) (EMBRAPA/CPAC, 2005).

(iv) Federal District agencies have only engaged in small-scale, short-term local projects. Funding has been quite irregular. No progress has been made in establishing new conservation units, controlling deforestation or conserving *Cerrado* remnants in private properties. Extensionists do not have mandates to engage in environmental conservation activities. Thus, the number of properties that comply with environmental laws is still minimal (GANEM, 2007).

NGOs based in the Federal District engage in a variety of projects. Small environmental organizations invest in environmental education, in training for sustainable use of biodiversity and in organizing market-oriented production. The *Rede Cerrado*, for example, disseminates information, advertises products and supports access to programs that provide resources (TEIXEIRA *et al.*, 2005). FUNATURA stimulated landowners to create private preserves around the edges of Chapada dos Veadeiros National Park. It organized meetings, supported the drafting of management plans and helped devise trails and visitor areas (SANTO, 2006).

Between 1996 and 2006 the World Wildlife Fund (WWF) had an office in Alto Paraíso (Goiás). Its work was focused on the area surrounding the Chapada dos Veadeiros National Park. It stimulated the creation of private preserves, ran environmental education projects, supported ecotourism and agroforestry systems, and trained community-based environmental leaders (GANEM, 2007).

## Overlap and lack of coordination of conservation initiatives

As can be seen from the brief descriptions above conservation initiatives in the region under study frequently overlap. There is no shortage of initiatives. If each of them had attained their goals, the region would now have economic-ecological zoning, new conservation units and biodiversity corridors would be in place. Additionally, private preserves would be numerous, private properties would have a high degree of compliance with environmental requirements, environmental training and education would be active, farmers and communities would be engaged in conservation, and extractive goods would be produced more consistently and would find their way to local, regional, national and even international markets. None of this has happened. Although not environmentally damaged, northeastern Goiás remains threatened by the expanding wave of frontier settlement, against which nothing has been done.

Overlaps illustrate the lack of coordination between governmental agencies. The ministries of the Environment and National Integration do not have common initiatives. The best example of this is the overlap, geographical and managerial, of the *Cerrado* Biosphere Preserve, the Paranã-Pireneus Ecological Corridor and the Planalto Central Environmental Protection Area, all of which fall under the responsibility of the Ministry of the Environment and its executive agency IBAMA[v]. This entails three different management councils and three different management teams. Much of the work is focused on the same area, making it redundant.

This leads to serious managerial "gaps". Poorly spent resources reduce the scope of important programs which, despite their ambitious goals, end up as pilot programs. These types of programs are important, but insufficient, because long-lasting, far-reaching public policies are required for the conservation of the biome. Efforts designed specifically to pull together these numerous initiatives have not flourished.

Pertinent information is not lacking either. There is more than enough information available to plan efficiently and synchronize conservation measures throughout the biome. For instance, priority areas for conservation coincide to a great degree with larger blocks of remaining native vegetation (Figure 1). It is thus reasonable to expect that federal and state agencies take advantage of this background work to create adequately zoned biodiversity corridors and conservation units, and to support conservation in lands under private ownership.

## Effectiveness of conservation policies

Government agencies and environmental groups have little interaction with local actors. Rural landowners and workers should be major targets of conservation policies

because the permanence of the native floral cover majorly depends on them. Given this, conservation policies, even when designed in a participatory manner by local governments, have little effectiveness. These policies do not generate lasting partnerships with local communities.

This is especially true in the Federal District, despite the large numbers of conservation units and various master plans for territorial settlement. Biodiversity lying outside conservation units is practically unprotected and the units themselves are largely in a fragile state in the face of the pressures generated by neighboring populations.

A huge gap remains between planning and implementation of environmental policies. Most citizens usually ignore plans and regulations, unless they are confronted by an authority who informs them that they are doing something illegal. Rural extensionists informed us that environmental agencies only act when prompted by complaints. Even in the nation's capital the authority of the state is absent in rural areas. Farmers are able to constantly ignore laws and regulations concerning the protection of biodiversity as they receive no sanctions. A number of measures, although taken in a participatory manner and comprising a large number of partnerships, are focused on planning (not execution) and are strongly dependent on international funding.

Partnerships between NGOs and farmers are rare. Large NGOs made efforts to engage in such partnerships and in relationships with international sources of funding. Nonetheless, agribusiness, environmental policies and environmental organizations are worlds apart. As highlighted by rural extensionists, farmers are suspicious of environmentalists because the absence of productive activities from parts of their properties entails losses. Farmers believe that environmentalists understand nothing about the rural world and should focus on urban environmental problems.

This line of argument draws attention to a specific issue – the ingrained manner in which Brazilian society looks at nature. There seems no clear perception about the importance of ecological processes and biodiversity. Dean (1996) argues that this perception has deep roots in Brazilian society as the Portuguese colonizers engaged in a "biotic conquest", introducing exotic agricultural species and ignoring local biodiversity. Many Brazilians continue to ignore the potential of the country's biodiversity. In Brasília, the national capital located in the core of the *Cerrado*, ice creams made by a local company (Sorbê) from native *Cerrado* fruit and their inclusion in school lunches is still a novelty.

The prevalence of exotic species in Brazilian agriculture is also evident in the germoplasm collection of the country's major agricultural research institution, Embrapa. It is the second largest collection in the world though most items are cultivated exotics. Native flora species are a small minority of the collection (DIAS, 2007). A genuine biodiversity conservation program, if geared toward stimulating commercial opportunities, would necessitate research involving native species.

Surveys conducted regularly since 1992, however, show that Brazilians have become more sensitive to environmental issues (ISER/Vox Populi, 2009). Respondents have been increasingly concerned about deforestation, biodiversity, transgenic organisms and organic agriculture. However, such changes have not been deep or extensive enough to change traditional behaviors.

The instability of environmental regulations is also significant. Brazil's forest code has been under attack for years from dozens of congressmen linked to agricultural interests. This creates the expectation that farmers who have not complied with legal conservation requirements will be absolved (GANEM, 2009). This indicates that among farmers the centuries old urge for opening up new frontiers with "virgin lands" (Dean, 1996) strongly prevails over the notion of better stewardship of currently used lands.

Deforestation in the *Cerrado* biome has been exacerbated by the production of charcoal which is mostly used in metallurgical plants, particularly in the state of Minas Gerais where the world's largest concentration of plants fired exclusively by charcoal is located. Farmers commonly sell wood from deforestation to charcoal producers who sometimes manufacture charcoal in the same place where deforestation is occurring. Another common arrangement sees landowners hiring charcoal producers to cut trees and open pastures. Payment is made in wood or charcoal (ALHO & MARTINS, 1995; CIRAD, 2007; CAMPOS, 2007). The Carajás Metallurgical Pole, operational since the 1980s, opened another charcoal producing front, located in *Cerrado* lands further to the north. Martins (2007) states that Brazil has a deficit of tree plantations in order to supply enough wood for charcoal. This generates logging pressures on native *Cerrado* formations.

## A new production model based on the value of biodiversity

Recently, there has been a positive evaluation of the products of biodiversity and of the environmental services provided by native ecosystems. This opens up new opportunities for economic gains by private landowners. Natura is a company that produces cosmetics based on Amazonian biodiversity. The use of Amazonian products is part of the marketing strategy of many companies and this may expand to the *Cerrado*, as seen in the aforementioned Sorbê ice-cream brand, based in Brasília. This company has been so successful that it was obliged to bring *Cerrado* fruit from other states (GANEM, 2007).

No governmental regulations exist to induce landowners to maintain native floral cover or to create business opportunities linked to the sustainable use of biodiversity, inside or outside the *Cerrado*. The PPP-Ecos program supports such opportunities with small grants given to community-based projects, but it is not a public initiative and lacks the scale to become an all-encompassing policy. Such a policy would also have to support agroforestry systems, processing plants and marketing efforts.

The creation of economic incentives for landowners who comply with environmental regulations and/or go beyond them may be yet another way to engage them more closely with environmental conservation values. This can be achieved by mechanisms which foster payments for ecosystem services.

Measures that support sustainable agricultural practices also aid the conservation of biodiversity. Direct planting and integration of plant and animal cultivation aid in the recovery of degraded pastures (WWF, 2009; LANDERS, 2006; SANO, 2007). Financial and technical support should be made available to those who adopt such technologies.

It should be taken into account that modern agribusiness ventures have no technical need for continuous deforestation. The best option for intensifying agribusiness farms is

a better use of available infrastructure, and not a move into isolated or remote areas in which biodiversity is less altered. However, land speculation has a dynamics of its own and stimulates illegal deforestation in isolated areas. Here, logging and cattle farming generate strong financial returns which stimulate more deforestation, regardless of the technical and logistical needs of the agribusiness sector.

The adoption of a new productive agricultural model depends on the level of information among landowners. Dependence between ecological processes and agriculture should be strengthened among landowners. For example, in our interviews we found that threats to the availability of water is a very important issue for them It is a topic that is likely to bring them closer to the concerns of environmentalists.

Private reserves, in association with rural tourism and ecotourism, are a distinct topic to be explored. The creation of private reserves is an initiative that merits better official recognition and much more support (Câmara, 2001). A private NGO (FUNATURA) supported the creation of 14 private reserves in the vicinity of the Chapada dos Veadeiros National Park (ICMBio, 2009). The federal government has no similar program. On the contrary, farmers interviewed complained that IBAMA drags its feet in approving private reserves. Several private reserves around the Chapada dos Veadeiros National Park were recognized by the municipality of Cavalcante, but this initiative received no support from federal government. Support for rural tourism and ecotourism is also lacking according to the farmers interviewed.

Farmers interested in conservation face a lack of funding and a lack of information about technology and partnerships. They also have difficulty in writing grant proposals, business plans and technical projects. Again, we see that environmental agencies, NGOs and extension workers fail to provide support to landowners.

## Conservation and bioregional management

In many areas that are appropriate for conservation measures there is a different and more wide-ranging set of obstacles – the lack of infrastructure and socioeconomic policies. Productive activities and tourism, for example, require transportation, energy and communication infrastructure as well as heath and educational services, police, etc. Local and regional development therefore affects the success of biodiversity protection initiatives. This does not mean spending the scarce resources allotted for conservation on socioeconomic policies or infrastructure, but moving towards an integrated bioregional planning model (MILLER, 1997). In this model, other agencies and sources of funding assist conservation merely by doing their own jobs, with their own resources. In Brazil, the lack of integration between conservation policies and local development policies is very visible when parks are created in remote or isolated regions. The people who work in the park are immediately overwhelmed by all sorts of demands and conflicts that pertain to other agencies and that they cannot solve. Confusion and frustration can spread among park personnel and the local population. Social participation occurs during the process of the creation of conservation units so as to build trust and cooperation between local interests and conservation goals. However, such trust rapidly erodes when the

environmental agency in charge fails to solve local social problems and fails to interact with other agencies responsible for different types of policies.

It must be conceded that conservation measures are often negatively perceived by local populations, as they restrict their use of resources. We understand, however, that conservation can benefit local populations, attracting investments and introducing initiatives based on the principles of sustainability.

Effective *Cerrado* conservation implies an additional requirement – society and public authorities must develop a new outlook on the biome. Brazilians concerned with environmental issues are prone to focus on rainforests. They are also the focus of contemporary issues such as climate change because the huge number of large trees ostensibly accumulate large stocks of carbon. The small trees typical of the *Cerrado* seem to be poor competitors. However, IPCC estimates do not compute carbon present in roots (MCT, 2006). Indeed, most of the *Cerrado* biomass is stored in root systems. Therefore, the biome's contribution to the carbon balance is likely to be seriously underestimated (KLINK & MACHADO, 2005).

## Conclusion

Our research demonstrated that the creation of parks and reserves remains the most important conservationist public policy in the *Cerrado*. Nonetheless, the percentage of the biome protected by these units is very low – 8.3% (this figure includes state units), less than half of this in the form of fully protected units. The low percentage of fully protected units is a handicap, because they serve as nuclei for broadly conceived protection policies, such as biosphere reserves and biodiversity corridors.

We also found that while government agencies have been involved in planning, they are rarely engaged in execution. Most stated goals are not achieved. Large remnants of *Cerrado* were identified but not protected. Biodiversity corridors have not gone beyond the stage of public hearings, educational events and participatory planning. Even their design has serious problems, as corridors should conform to *Cerrado* remnants rather than municipal borders.

At the property level, productive activities and technologies have not been changed, recovery of degraded areas is rare, geo-referencing of properties has not taken place, control of deforestation and fires is weak, production of charcoal persists, little support is given to extractive activities, private reserves are not stimulated and eco-tourism sites have not been pinpointed.

The federal government announced a program to monitor *Cerrado* deforestation, following the technical standards applied in the monitoring of the Amazonian biome, but it was not implemented.

Many programs and projects are too dependent on international funding. Conservation initiatives within properties under private ownership lack financial support. Compliance with environmental regulations in private properties could benefit from both a policy of payments for ecosystem services and economic incentives that support farmers who conserve and penalize farmers who deforest.

It should be remembered that deforestation in the *Cerrado* biome has not been the sole responsibility of agribusiness farms as native vegetation removal was supported by federal government programs that implicitly considered the *Cerrado* to be expendable. These programs had the same general approach and destructiveness of previous extractive and agricultural cycles in other parts of the country. The more recent biofuels program, focused on the *Cerrado,* threatens to be as destructive to native vegetation, fauna and landscapes as older programs. Many voices defend the Amazonian biome while the *Cerrado* remains undervalued and under-protected.

*Cerrado* conservation depends both on the expansion of conservation units and on the induction of conservation in lands under private ownership. Private landowners must be included in conservation policies. So much land and so many resources are at stake that it is possible to maintain a powerful agricultural sector (including family farming), expand protected areas and even make strides towards a zero deforestation policy in the Biome.

## Notes

[i] Quilombolas is a term that designates people who belong to communities descending from escaped slaves. These communities themselves are called quilombos.

[ii] This core area comprises the continuous formations that affect all or sections of the following states - Goiás, Tocantins, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Bahia, Maranhão, Piauí, Rondônia, Paraná, São Paulo and the Distrito Federal (Figure 1), as IBGE's map (2004). Smaller Cerrado enclaves in other states were excluded.

[iii] IBGE, 2004 was used to define the limits of the biome. Isolated formations were excluded. Also excluded were RPPNs, privately held reserves. Although rather numerous (ICMBio 2009 recorded 532 of them), they are usually very small.

[iv] Fully protected units only allow visits, recreation, research and education. Sustainable use units allow a variety of uses – hunting, fishing, collecting, agriculture, animal husbandry, mining, logging etc.

[v] The Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) (created in 2007) inherited IBAMA's responsibilities for biodiversity conservation projects and conservation units.

## References

ALHO, C. J. R. Desafios para a conservação do Cerrado, em face das atuais tendências de uso e ocupação. In: SCARIOT, A.; SOUSA-SILVA, J. C. & FELFILI, J. M. (org.). Cerrado: ecologia, biodiversidade e conservação. Brasília: Ministério do Meio Ambiente. 2005. p. 376-381.

ALHO, C. J. R. & MARTINS, E. de S. (eds.). De grão em grão, o Cerrado perde espaço. Brasília: WWF. 1995.

Ambiente Brasil. Unidades de conservação. http://www.ambientebrasil.com.br/. Accessed on 17 March 2009.

ARAÚJO, M. A. R. Unidades de conservação no Brasil: da república à gestão de classe mundial Belo Horizonte: SEGRAC, 2007.

BARBOSA, S. M. da S (Instituto Chico Mendes de Conservação da Biodiversidade). Personal contact via e-mail, on 19 November 2009.

CÂMARA, I. de G. Megabiodiversidade. Rio de Janeiro: Sextante, 2001.

CAMPOS, M. G. Speech made at a public hearing of the Commission on the Environment and Sustainable Development. Brasília, Chamber of Deputies. 25 October 2007.

CASES, M. O. Síntese das experiências existentes de corredores no Brasil. Documento-base da Oficina de Consulta sobre Metodologias de Gestão de Corredores Ecológicos no Brasil. MMA/Ibama. Brasília, 16 e 17 de novembro de 2006.

CERQUEIRA, R.; BRANT, A.; NASCIMENTO, M. T. & PARDINI, R. Fragmentação: alguns conceitos. *In*: RAMBALDI, D. M. & OLIVEIRA, D. A. S. (orgs.). Fragmentação de Ecossistemas: causas, efeitos sobre a biodiversidade e recomendações de políticas públicas. Brasília: MMA/SBF. 2003. p. 23-40.

CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement). A visão do CIRAD sobre a biomassa em siderurgia: novos processos de carvoejamento em desenvolvimento. Painel sobre a indústria do gusa – produtores independentes. Salvador, Bahia. 18 a 21 de setembro de 2007.

COBRAMAB Comissão Brasileira para o Programa *Man and Biosphere*. Cerrado Biosphere Reserve. Brasília, Cobramab. 2002. Trabalho não publicado.

DEAN, W. A ferro e fogo: a história e a devastação da Mata Atlântica brasileira. São Paulo: Companhia das Letras. 1996.

DIAS, J. M. C. de S. Pesquisa e desenvolvimento na Embrapa Recursos Genéticos e Biotecnologia. Palestra proferida na visita de alunos do CDS/UnB. Brasília (DF), 24 de agosto de 2007.

DRUMMOND, J. A.; FRANCO, J. L. de A. & NINIS, A. B. O estado das áreas protegidas no Brasil. Brasília: UnB/CDS. 2006. http://www.unbcds.pro.br/pub/index.cfm?code=01&cod=27&x=219.Extraído em 18 de novembro de 2009.

EMBRAPA/CPAC (Empresa Brasileira de Pesquisa Agropecuária/Centro de Pesquisa Agropecuária do Cerrado). Relatório de Produtos do Projeto de Conservação e Manejo da Biodiversidade do Bioma Cerrado. Brasília, CPAC. 2005. Trabalho não publicado.

GANEM, R. S. Políticas de conservação da biodiversidade e conectividade entre remanescentes de Cerrado. Tese de doutorado. Centro de Desenvolvimento Sustentável, Universidade de Brasília, Brasília. 2007.

_____. Prazo para destruição do berço esplêndido: até quando? Boletim Análise de Conjuntura nº 33, p. 1-10. 2009. http://camara.gov.br/internet/publicacoes/estnottec/copy_of_analisedeconjuntura/Boletim%20no%2033.pdf. Acesso em 6 de novembro de 2009.

GANEM, R.S. & SCHWINGEL, A.C.F. Reserva legal: por que conservar. Brasília: Câmara dos Deputados, Consultoria Legislativa. Estudo, maio/2007. Trabalho não publicado.

GUIMARÃES, S. H. Cerrado que te quero vivo! Produtos e meios de vida sustentáveis apoiados pelo Programa de Pequenos Projetos Ecossociais (PPP-Ecos). Brasília: ISPN. 2005.

IBGE (Instituto Brasileiro de Geografia e Estatística). Mapa de biomas do Brasil escala 1:5.000.000. Rio de Janeiro: IBGE. 2004.

ICMBio (Instituto Chico Mendes de Conservação da Biodiversidade). 2009. Relatório resumido das RPPN por Estado. http://www.ibama.gov.br/rppn/. Acesso em 27 de outubro de 2009.

IEF. Áreas protegidas. http://www.ief.mg.gov.br/. Extraído em 17 de março de 2009.

INPE (Instituto de Pesquisas Espaciais). Projeto Prodes: monitoramento da Floresta Amazônica por satélite. www.obt.inpe.br/prodes. Extraído em 18 de novembro de 2009.

ISER/Vox Populi (Instituto de Estudos da Religião/Instituto Vox Populi). O que os brasileiros pensam sobre a biodiversidade. http://www.wwf.org.br/informacoes/bliblioteca/?3640. Extraído em 6 de novembro de 2009.

ISPN (Instituto Sociedade, População e Natureza). Lista de projetos aprovados. www.ispn.org.br. Extraído em 06 de agosto de 2007.

JENKINS, C. N. & PIMM, S. Definindo prioridades de conservação em um *hotspot* de biodiversidade global. *In* ROCHA, C. F. D.; BERGALLO, H. G.; SLUYS, M. V. & ALVES, M. A. S. (orgs.) Biologia da conservação: essências. São Carlos: RiMa. 2006. p. 41-52.

JICA (Agência de Cooperação Internacional do Japão). Projeto de conservação de ecossistemas do Cerrado: Corredor Ecológico do Cerrado Paranã-Pireneus. Relatório de Avaliação Final. Brasília: JICA BRAZIL. 2006.

KLINK, C. A. & MACHADO, R. B. A conservação do Cerrado brasileiro. Megadiversidade, 1 (1), julho de 2005: 147-155.

LANDERS. J. (ASSOCIAÇÃO DE PLANTIO DIRETO NO CERRADO). Entrevista concedida a Roseli Senna Ganem, em Brasília (DF), 18 de outubro de 2006.

MACHADO, R. B.; RAMOS NETO, M. B.; PEREIRA, P. G. P.; CALDAS, E. F.; GONÇALVES, D.; SANTOS, N. S.; TABOR, K. e STEININGER, M. Estimativas da perda do Cerrado brasileiro. www.conservacao.org. Extraído em 09 de novembro de 2005.

MARTINS, E. Passivo ambiental decorrente da exploração de carvão vegetal. Audiência Pública da Comissão de Meio Ambiente e Desenvolvimento Sustentável. Brasília, Câmara dos Deputados. 25 de outubro de 2007.

MCT (Ministério de Ciência e Tecnologia). Primeiro inventário brasileiro de emissões antrópicas de gases de efeito estufa - Relatórios de Referência. Emissões e remoções de carbono por conversão de florestas e abandono de terras cultivadas. Brasília: MCT. 2006.

MILLER, K. R. Em busca de um novo equilíbrio: diretrizes para aumentar as oportunidades de conservação da biodiversidade por meio do manejo biorregional. Brasília: IBAMA. 1997.

MIN (Ministério da Integração Nacional). Plano Estratégico de Desenvolvimento do Centro-Oeste 2006-2020. Brasília. 2006. *CD-Rom.*

MITTERMEIER, R. A.; MYERS, N. & MITTERMEIER, C. G. Hotspots: earths's biologically richest and most endangered terrestrial ecoregions. México: Agrupación Sierra Madre. 1999.

MMA (Ministério do Meio Ambiente). Mapas de cobertura vegetal dos biomas brasileiros. Brasília: MMA. 2007a.

_____. Comitê GEF-Cerrado anuncia sub-projetos selecionados. www.mma.gov.br. Acesso em 06 de agosto de 2007. 2007b.

_____. Plano de ação para prevenção e controle do desmatamento e das queimadas no Cerrado. http://www.mma.gov.br/sitio/index.php?ido=conteudo.monta&idEstrutura=1&idConteudo=9410. Consulta pública em setembro de 2009. Acesso em 11 de setembro de 2009. 2009a.

_____. Cadastro Nacional de Unidades de Conservação. http://www.mma.gov.br/sitio/index.php?ido=conteudo.monta&idEstrutura=119. Acesso em 2 de março de 2009. 2009b.

MMA/SBF (Ministério do Meio Ambiente/Secretaria de Biodiversidade e Florestas). Áreas Prioritárias para a Conservação, Uso Sustentável e Repartição de Benefícios da Biodiversidade Brasileira: atualização – Portaria nº 9, de 23 de janeiro de 2007. Brasília: MMA, 2007.

MMA/SCA/IBAMA (Ministério do Meio Ambiente/Secretaria de Coordenação da Amazônia/Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis). Programa Piloto para a Proteção das Florestas Tropicais do Brasil – PPG7; Projeto Corredores Ecológicos. 2001.

NOGUEIRA, M. C. R. *Gerais a dentro e a fora: identidade e territorialidade entre Geraizeiros do Norte de Minas Gerais*. Tese de Doutorado apresentada ao Departamento de Antropologia como requisito parcial à obtenção do título de doutora. Orientador: Prof. Paul E. Little. Universidade de Brasília, Brasília, 2009.

PRADO, P. I.; LANDAU, E. C.; MOURA, R. T.; PINTO, L. P. S.; FONSECA, G. A. B. & ALGER, K. (orgs.). Corredor de Biodiversidade da Mata Atlântica do Sul da Bahia. Publicação em CD-ROM, Ilhéus, IESB/CI/CABS/UFMG/UNICAMP. 2003.

RAMBALDI, D. M. & OLIVEIRA, D. A. S. (orgs.). Fragmentação de Ecossistemas: causas, efeitos sobre a biodiversidade e recomendações de políticas públicas. Brasília: MMA/SBF. 2003.

RIBEIRO, J. F.; BRIDGEWATER, S.; RATTER, J. A. & SOUSA-SILVA, J. C. Ocupação do bioma Cerrado e conservação da sua diversidade vegetal. In: SCARIOT, A.; SOUSA-SILVA, J. C. & FELFILI, J. M. (org.). Cerrado: ecologia, biodiversidade e conservação. Brasília: Ministério do Meio Ambiente. 2005, p. 383-399.

RODRIGUES, J. Entrevista concedida a Roseli Senna Ganem em Brasília (DF), 05 de fevereiro de 2007.

SANO, E. (Centro de Pesquisa Agropecuária do Cerrado). Entrevista concedida a Roseli Senna Ganem, em 7 de março de 2007.

SANTO, C. V. do E. Entrevista concedida a Roseli Senna Ganem, em Brasília (DF), 8 de novembro de 2006.

SEDUMA (Secretaria de Desenvolvimento urbano e Meio Ambiente do Distrito Federal). 2009. Unidades de conservação. http://www.semarh.df.gov.br/. extraído em 12 de março de 2009.

SEMA-BA. Unidades de conservação. http://www.meioambiente.ba.gov.br/default.aspx. Acesso em 18 de março de 2009.

SEMA-MA. Unidades de conservação. http://www.meioambiente.ba.gov.br. Extraído em 19 de março de 2009.

SEMA-MT/CUCO (Secretaria do Meio Ambiente do Estado de Mato Grosso/Coordenadoria de Unidades de Conservação). 2009. Unidades de Conservação no Estado do Mato Grosso. http://www.sema.mt.gov.br/cuco/arquivos2 Extraído em 13 de março de 2009.

SEMA-PR (Secretaria de Estado do Meio Ambiente e dos recursos Hídricos). 2009. Lista geral de unidades de conservação estaduais. http://www.sema.pr.gov.br/. Extraído e, 13 de março de 2009.

STRAUBE, F. C. O Cerrado no Paraná: ocorrência original e atual e subsídios para sua conservação. Cadernos de Biodiversidade, 1, dez/1998:12-24.

TEIXEIRA, A. C. C.; ALMEIDA, A. L.; BRANCO, A. L. C.; SÃ, F. de O.; ANDRADE, J. C. S.; FERREIRA, M. C. L.; VIANA, M. B.; GANEM, R. S. & AGUIAR JÚNIOR, S. R. Redes sociais, estudo de caso: Rede Cerrado de ONGs. Brasília: CDS. 2005. Trabalho não publicado.

WWF (World Wildlife Fund). Plantio direto. http://www.wwf.org.br/index.cfm. Acessado em 6 de março de 2009.

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# CONSERVATION POLICES AND CONTROL OF HABITAT FRAGMENTATION IN THE BRAZILIAN CERRADO BIOME

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***Resumo:*** O Cerrado constitui a savana mais biodiversa e mais ameaçada do Planeta. O bioma já perdeu 48,2% de sua cobertura original e sofre com um intenso processo de fragmentação de habitats. Este trabalho verificou em que medida as ações governamentais e não-governamentais de conservação da biodiversidade proporcionam uma política integrada que proteja os remanescentes de vegetação nativa do Cerrado, com intuito de e fomentar a sua conectividade. A pesquisa mostrou que os efeitos do esforço de criação de unidades de conservação neste ambiente ainda são poucos, pois apenas 3,1% do bioma estão protegidos em unidades de proteção integral. Além disso, os órgãos públicos envolvem-se com o planejamento da conservação. Devido à falta de articulação, ocorre comumente a sobreposição de projetos num mesmo território e, consequentemente, há desperdício de recursos e falta de efetividade. Os projetos dependem de recursos internacionais e há carência de ações básicas de fomento à conservação nas terras privadas, incluindo a adoção de estímulos econômicos aos proprietários rurais.

***Palavras-chave:*** Cerrado; Conservação da natureza; Biodiversidade; Fragmentação de habitats; Políticas públicas.

***Abstract:*** The Brazilian *Cerrado* is the most bio-diverse and threatened savannah on the planet. This biome has already lost 48.2 percent of its original floral cover and is being affected by an intense process of habitat fragmentation. The purpose of this article is to verify if and how governmental and non-governmental conservation measures are protecting the remaining native *Cerrado* vegetation and whether these measures are encouraging connectivity. Results show that the effects of conservation units are limited, since only 3.1 percent of the biome is within fully protected areas. It was also found that public agencies are much more involved in conservation planning than actions in the field. Conservation projects are often implemented in the same territories, leading to the squandering of resources and ineffective results. Another problem is that many projects are dependent on international organizations and resources. Conservation initiatives in areas under private ownership are rare and economic or fiscal incentives that support such initiatives are sporadic and ina-

dequate. The article concludes by suggesting that the *Cerrado* should become the focus of specific conservation policies, integrating governments, civil society and economic sectors and actors, especially farmers.

***Keywords:*** *Cerrado*; Nature conservation; Biodiversity; Habitat; Fragmentation; Environmental policies.

**Resumen:** El Cerrado es la sabana de mayor biodiversidad y la más amenazada de la Tierra. El bioma ha perdido 48,2% de su cobertura original y está sufriendo un proceso de intensa fragmentación de sus hábitats. El objetivo de este articulo fue evaluar el grado en que las acciones gubernamentales y no gubernamentales de conservación de la biodiversidad resultan en una política integrada para proteger los remanentes de vegetación nativa en el Cerrado y fomentar su conectividad. La investigación ha demostrado que los efectos del esfuerzo de creación de áreas protegidas en el cerrado son escasos, ya que sólo 3,1% del bioma están protegidos en unidades de protección integral. Además, los organismos públicos están involucrados en la planificación de la conservación. Debido a la falta de articulación, proyectos comunes sobreponen-se en el mismo territorio y por lo tanto hay desperdicio de recursos y falta de efectividad. Los proyectos dependen de los recursos internacionales y no hay acciones básicas que fomenten la conservación en tierras privadas, como la adopción de incentivos económicos a los propietarios rurales. Concluimos con la sugestión de que el Cerrado debe ser objeto de una política específica de conservación que integra el Gobierno, la sociedad civil y los sectores económicos importantes en la región, especialmente en el campo.

**Palabras clave:** Savannah; Conservación de la naturaleza; Biodiversidad; Fragmentación del hábitat; Políticas públicas.