

Chapter 36

Protection of the Soil Resource in the Brazilian Environmental Legislation

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Abstract Brazil has been attracting great interest in international environmental discussions because of its large territory and diverse natural resource base; a large part of which is still mostly pristine. Deforestation of the Atlantic and Amazonian rain forests and massive conversion of the Cerrado by haphazard land development, especially the expansion of livestock and grain/biofuel production, have sparked widespread concern of mounting soil and water degradation and loss of biodiversity. As a response to these ensuing risks of environmental degradation, comprehensive legislation has been enacted at the federal level to protect ecosystem services, with greater emphasis in waters and biodiversity. The recent revision of the Brazilian Forestry Code (BFC) in spite of the name clearly stands out as an environmental law, an overarching legislation dealing with key aspects of terrestrial ecosystems as well as land tenure. BFC contains conservation provisions that affect both private and public-owned land, not only remaining vegetation fragments but also extending onto farmed land. The word “solo” (soil) appears 40 times in the 82 articles that comprise BFC, in most instances associated with “protection” or “sustainable use.” The soil resource has been historically treated in an off-handed manner in Brazilian legislation, but more recently some Brazilian states have advanced supplemental legislation (known as *Leis do Solo* – “Soil Laws”) addressing specific conservation and management issues to safeguard this key resource for future generations. There is ample opportunity for soil scientists to engage in this new legal context, a grand effort to conserve natural resources and institutionalize sustainable land use in Brazil.

Keywords Soil quality • Soil conservation • Environmental legislation • Brazil

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36.1 Brazilian Environmental Legislation

Brazil has been long been a focal point of the global environmental debate mostly because of the threats to the Amazonian and Atlantic rain forest. Past and present threats to the Atlantic and Amazonian rain forests and other biomes such as the Cerrado and the grasslands (South American Pampas) include urban encroachment and haphazard land development, especially the expansion of livestock and grain/biofuel production (Lapola et al. 2014). In more recent times, the expansion and intensification of grain production and biofuel crops in other Brazilian biomes such as the Brazilian savanna (the Cerrado) have compounded concerns about soil degradation, water availability, and loss of biodiversity. The environmental legislation implemented at the federal level over the last decades, especially since the 1980s, aimed at consolidation of comprehensive safeguards to protect ecosystem functions nationwide with emphasis in biodiversity and soil and water quality.

The Brazilian Forestry Code (BFC) (Presidência da República 2012), since its inception in 1934, has developed from a timber conservation-focused legislation to a full-fledged (or at least attempting to become) land protection or terrestrial ecosystem code with implications on land tenure, both private and state owned (Soares-Filho et al. 2014).

A myriad of legal features were introduced in its many versions, some of which are now cornerstones of the BFC: APP (“Área de Proteção Permanente” – Permanently Protected Areas) and RL (“Reserva Legal” – Legal Reserve) (Sparovek et al. 2010, 2012). Both apply to *all non-urban land in the country with few exceptions*; APP and RL are binding provisions that were originally intended to conserve valuable timber and prevent soil and water degradation that mandated landowners to *permanently* set aside parts of rural properties for conservation or sustainable management. Key aspects of these legal features are the following:

1. APP encompass parts of the property to protect the soil and water resource and prevent degradation. APP are established according to certain critical terrain attributes and legally set without any input from the landowner. These include (a) riparian zones along rivers and other water bodies, (b) slopes $>45^\circ$, (c) most mountain and some hilltops, and (4) altitudes >1800 m. No productive activities are allowed, and these areas should be maintained with the original vegetation or restored if it was degraded.
2. RL establishes a fixed percentage of property area—from a maximum of 80% in the Amazon to 20% in other biomes such as the Atlantic forest—that is set aside by the owner and can be managed for production if core ecosystem structure and functions are not significantly altered. Examples of this would be sustainable harvest of forest products (e.g., Brazil nuts in the Amazon, cashew in the Cerrado), beekeeping, low-intensity cattle grazing in the savannas and grasslands, and other low-input low-impact activities. RL is additional to the established APP, except for small farms.

These features as well as additional aspects of the original BFC were hardly ever enforced for many reasons: lack of personnel and infrastructure and jurisdictional overlaps with state and municipal governments. Although praised in many aspects by conservationists and the scientific community in general, the “old” FCB never attained support from farmers, ranchers, and foresters. In fact, most of organizations representing these groups denounced the code as too restrictive and hostile to property rights and lacking technological and scientific basis. A vocal section of Brazilian agribusiness has routinely claimed that FCB implementation conflicts with agricultural production and would undermine Brazil’s expanding leadership in the global market of farm commodities. A substantial body of research indicates that most of these claims are unfounded (Ferreira et al. 2012).

However, extremely steep slopes and mountain tops above 1800 m (the latter affecting less than 0.1 % of Brazilian territory) have obvious limitations for intensive agriculture and even silviculture, and setting these areas aside to promote natural vegetation conservation or restoration should not be controversial. On the other hand, riparian environments have long been settled and farmed because of fertile soils and ease of access and are still under pressure in many regions.

36.2 Need for Supplemental Legislation

Several aspects of the BFC require supplemental legislation to be enacted by the Ministry of the Environment. Changes under implementation tried to resolve these original conflicts with new features and mechanisms that largely ease some of the most restrictive (and controversial) aspects. However, a new provision reclassified land with anthropic use until 2008 comprised a new legal feature called AC (“Área Consolidada” – Consolidated Areas). Depending on farm size, a fraction of the AC land that conflicts with the APP definition would have to undergo restoration to the original ecosystem. Other changes in BFC now allow small farmers to count APP areas as part of the RL of the property, significantly reducing the total protected areas outside national parks and preserves.

A crucial innovation that could have wide-ranging positive impacts for conservation in Brazil is the Environmental Reserve Quota (CRA – “Cota de Reserva Legal” in Portuguese), a negotiable instrument derived from “surplus” conserved areas (in excess of RL requirements). These CRA “credits” from a property, once underwritten by the Ministry of Environment, may be used to offset an LR deficit on another property within the same biome and same Brazilian state. Comprehensive implementation of CRA could create a trading market of protected land, reversing the notion held by farmers and their organizations that these carry high opportunity costs. Trade of CRA could become a cost-effective mechanism to promote compliance with the new code, while protecting high-conservation value ecosystem fragments which could otherwise be legally deforested, drained, or plowed under. Judicious use of CRA could benefit functional and ecological attributes of natural

landscapes such as habitat integrity (and thus biodiversity) and regulation and maintenance of biogeochemical cycles (Soares et al. 2014).

36.3 Implementation Issues

The effective implementation of the BFC depends on a new web-based geospatial database, the Rural Environmental Registry System (SICAR) (Cadastro Ambiental Rural (n.d.)). Once completed, this system should store boundaries of the existing five million farms and ranches in Brazil. SICAR could create the underlying “physical” framework for establishing a comprehensive system of payments of ecosystem services and a reliable market for CRA. For a practical standpoint, the success of CRA within SICAR would be highly welcome to offset restoration costs of degraded lands, particularly for small landowners.

Meanwhile, four of the 27 Brazilian states have introduced (or are discussing) supplementary legislation underpinning soil conservation and sustainable management of the land. It was recognized that the BFC did not address the soil resource with enough detail, although the word “solo” (soil) appears 40 times in the 82 articles that comprise BFC, in most instances associated with “protection” or “sustainable use.” These states (Paraná-PR, São Paulo-SP, Rio Grande de Sol-RS, and Espírito Santo-ES), which have extensive agricultural production and in the past faced severe soil degradation, especially erosion, have advanced supplemental legislation (known as *Leis do Solo* – “Soil Laws”) addressing specific conservation and management issues to safeguard this key resource for future generations.

36.4 Concluding Remarks

Brazilian soil science has much to contribute in the current scenario of evolving environmental legislation. The dramatic growth of agricultural research infrastructure of latter years has yielded a large body of locally produced knowledge about the soil resource. Many aspects of sustainable production remain as challenges, but the days of reliance on slashing-and-burning the country’s forests, the massive erosion events, and insidious contamination of soils and waters are more often than not things of the past. It is a matter of national pride that the current generation of Brazilian agronomist and soil scientist has had extensive training in soil conservation and management and land use planning and monitoring.

It remains to be seen how much direct involvement Brazilian soil scientists will have in the implementation of the abovementioned legislation. Most soil professionals have had limited participation because the focus of the environmental legislation debate to date has been on restoration biology, forest management, and biodiversity conservation. The importance of these aspects notwithstanding, there is ample opportunity for soil scientists to engage in this new legal context with specific

tools that could help in the management and monitoring of the legal land protection features established (APP and RL), such as land capability classifications, digital soil mapping, biogeocycle, and land use change modeling, all of which could easily fit and be incorporated in this grand effort to conserve natural resources and institutionalize sustainable land use in Brazil.

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