

April 2017

Public Conservation Policies on Private Land: A Case Study of the Brazilian Forest Code and Implications for the Agro-Industry Sector

Rayane Aguiar
raguiar.15@imperial.ac.uk

Jody M. Endres
University of Illinois College of Agricultural, Consumer, and Environmental Sciences

Caroline Taylor
University of California, Berkeley, cmtaylor@berkeley.edu

Samuel Evans
University of California, Berkeley, sgevans@berkeley.edu

Follow this and additional works at: <https://digitalcommons.pace.edu/pelr>



Part of the [Agriculture Law Commons](#), [Comparative and Foreign Law Commons](#), [Environmental Law Commons](#), [Food and Drug Law Commons](#), [Natural Resources Law Commons](#), and the [Water Law Commons](#)

Recommended Citation

Rayane Aguiar, Jody M. Endres, Caroline Taylor, and Samuel Evans, *Public Conservation Policies on Private Land: A Case Study of the Brazilian Forest Code and Implications for the Agro-Industry Sector*, 34 Pace Env'tl. L. Rev. 325 (2017)

DOI: <https://doi.org/10.58948/0738-6206.1805>

Available at: <https://digitalcommons.pace.edu/pelr/vol34/iss2/3>

This Article is brought to you for free and open access by the School of Law at DigitalCommons@Pace. It has been accepted for inclusion in Pace Environmental Law Review by an authorized administrator of DigitalCommons@Pace. For more information, please contact dheller2@law.pace.edu.

ARTICLE

Public Conservation Policies on Private Land: A Case Study of the Brazilian Forest Code and Implications for the Agro-Industry Sector

RAYANE AGUIAR*
JODY M. ENDRES**
CAROLINE TAYLOR***
SAMUEL EVANS****

I. INTRODUCTION

The growth of the agro-industry has played a major role in Brazil's development, and the country is now one of the largest producers of cattle, sugarcane, citrus, and soy in the world.¹

* Brazilian attorney specializing in Agro-Environmental Law and Energy Law and Policies. She is also a PhD researcher at the Imperial College London Centre for Environmental Policy. She is the corresponding author and can be reached at raguiar.15@imperial.ac.uk.

** Assistant Professor of Energy, Environmental and Natural Resources Law, at the University of Illinois College of Agricultural, Consumer and Environmental Sciences. Prof. Endres passed away before publication, and the authors would like to dedicate this article to her memory.

*** Visiting Scholar at the Department of Agricultural and Resource Economics at the University of California, Berkeley. She can be reached at cmtaylor@berkeley.edu.

**** Postdoctoral Researcher at the Department of Environmental Science, Policy, and Management, at the University of California, Berkeley. He can be reached at sgevans@berkeley.edu. Funding for this work was provided by the Energy Biosciences Institute.

1. According to the United Nations Food and Agriculture Organization Statistical Database (FAOSTAT), in 2013, Brazil ranked second, first, first, and second respectively in meat, sugarcane, citrus, and soy production worldwide. FAOSTAT, *FAO STATISTICAL YEARBOOK 2013: WORLD FOOD AND AGRICULTURE* (2013), <http://www.fao.org/docrep/018/i3107e/i3107e.PDF> [<https://perma.cc/8R69->

Ongoing expansion of intensive agricultural production, particularly over pristine ecosystems, has long concerned environmentalists and has been associated with several adverse environmental impacts such as biodiversity loss, water pollution, and soil degradation. Attention to the issue has contributed to the development of international sustainability standards and triggered important and innovative federal and state level conservation law and policies in Brazil.²

The two primary mechanisms for ecosystem conservation in Brazil include the Forest Code (FC),³ which applies to private lands, and the system of protected public lands through the National System of Conservation Units (*Sistema Nacional de Unidades de Conservação*, or SNUC).⁴ As of 2013, 62% (approximately 530 million hectares, Mha) of Brazil's territory consisted of native vegetation, which is scattered among the various biomes.⁵ 40% of natural vegetation is located on public lands protected as conservation units or indigenous land.⁶ The large majority of Brazil's remaining native vegetation (~60%) is found on private land subject to the FC or public lands not yet designated as SNUC units or as indigenous land.⁷

By requiring landowners to set-aside part of their land for conservation purposes, the FC provides essential protection to unique ecosystems. At the same time, it engenders heated philosophical debates about who in society should bear the responsibility for biodiversity preservation and the provision of

2FJS] [hereinafter FAO STATISTICAL YEARBOOK 2013] (for exact production figures).

2. See, e.g., Lei No.12.651, de 25 de Maio de 2012 (Braz.); Lei. No.11.428, de 22 de Dezembro de 2006 (Braz.).

3. CÓDIGO FLORESTAL [C.FLOR.] [FOREST CODE] Lei. No. 12.651, de 25 de Maio de 2012 (Braz.), <http://legis.senado.gov.br/legislacao/ListaTextoIntegral.action?id=245232&norma=264993> [<http://perma.cc/27YR-E4TB>].

4. Lei. No.9.985, de 9 de Julho de 2000 (Braz.).

5. See BRITALDO S. SOARES-FILHO, IMPACTO DA REVISÃO DO CÓDIGO FLORESTAL: COMO VIABILIZAR O GRANDE DESAFIO ADIANTE? [IMPACTS OF THE REVISION OF THE FOREST CODE: HOW WILL IT MAKE BIG CHALLENGES AHEAD?] 3 (2013), https://www.socioambiental.org/sites/blog.socioambiental.org/files/nsa/arquivos/artigo-codigo-florestal_britaldo_soares_sae_2013pdf.pdf [<https://perma.cc/BXL4-33VV>].

6. *Id.*

7. *Id.*

ecosystem services, in balance with economic activities such as agriculture and production of forestry.⁸ While environmental advocates and the scientific community see conservation policies as a great opportunity to change paradigms in Brazilian agriculture, conservative farmers' groups perceive them as institutional barriers to agricultural development.⁹ Although 32% (275Mha) of the total territory is currently used for agriculture and livestock production, only 65Mha are actually used to produce food, feed, and fiber.¹⁰ The large majority (210Mha) consists of low productivity pastureland under extensive cattle ranching (averaging 1.1 head/ha).¹¹ Furthermore, it is estimated that 61Mha of Brazil's agricultural land is found in different levels of degradation due to misuse.¹² Therefore, there is a great potential to improve productivity in livestock production and restore degraded areas across Brazilian farmland, which would free up land for agriculture and conservation. Together, these make it possible to reconcile increasing demand for agricultural production with environmental conservation as long as agricultural and environmental policies are properly integrated and enough institutional support is provided to farmers.

For many years, Brazilian farmers and conservationists have stood on opposite sides of the debate, and little effort has been made either to reach consensus or promote collaborations between these two groups. With environmental protection relying exclusively on legal instruments of command and control supported by an inefficient law enforcement system,¹³ there has been little incentive for landowners to support conservation goals

8. JOSÉ ANTONIO ALEIXO DA SILVA ET AL., *O CÓDIGO FLORESTAL E A CIÊNCIA: CONTRIBUIÇÕES PARA O DIÁLOGO* (Rute Maria Gonçalves de Andrade & Léa Gomes de Oliveira eds., 2nd ed. 2012).

9. *Id.*

10. INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA [IBGE], 2006 AGRICULTURE AND LIVESTOCK CENSUS (2006) [Hereinafter 2006 CENSUS]. These include major crops such as soybeans, sugarcane, corn, and eucalyptus.

11. *See* DA SILVA ET AL., *supra* note 8, at 50.

12. *Id.* at 142.

13. *See* Pedro H S Brancalion et al., *Análise crítica da Lei de Proteção da Vegetação Nativa (2012), que substituiu o antigo Código Florestal: atualizações e ações em curso*, 14 NATUREZA E CONSERVAÇÃO e1, e5 (2016). *See generally* Gerd Sparovek et al., *Brazilian Agriculture and Environmental Legislation: Status and Future Challenges*, 44 ENVTL. SCI. & TECH. 6046–53 (2010).

on private lands. Despite the strict land use restrictions for conservation purposes established under the Brazilian Forest Code, compliance levels have been generally low, leading policy-makers to place improvements in compliance at the forefront of the FC's new legal framework.¹⁴

After a long and contentious legislative process, the first large-scale revision of the FC since 1965 was approved in May 2012.¹⁵ The recent changes embody the tension between balancing the stringency of the law's private land conservation requirements with efforts to narrow historical gaps in compliance. In an effort to address demands from both farmers and environmentalists, the final rule provides broad exemptions to small landowners and facilitates compliance with set-aside requirements for all landowners while also establishing economic mechanisms to offset some of the costs of compliance. While the revisions significantly reduce the total amount of land requiring restoration (58% below 1965 levels according to a recent estimate¹⁶), it remains to be seen whether the new compliance and enforcement provisions and incentives will be enough to counteract this decline in environmental protection by making the law's actual requirements more attainable in practice.

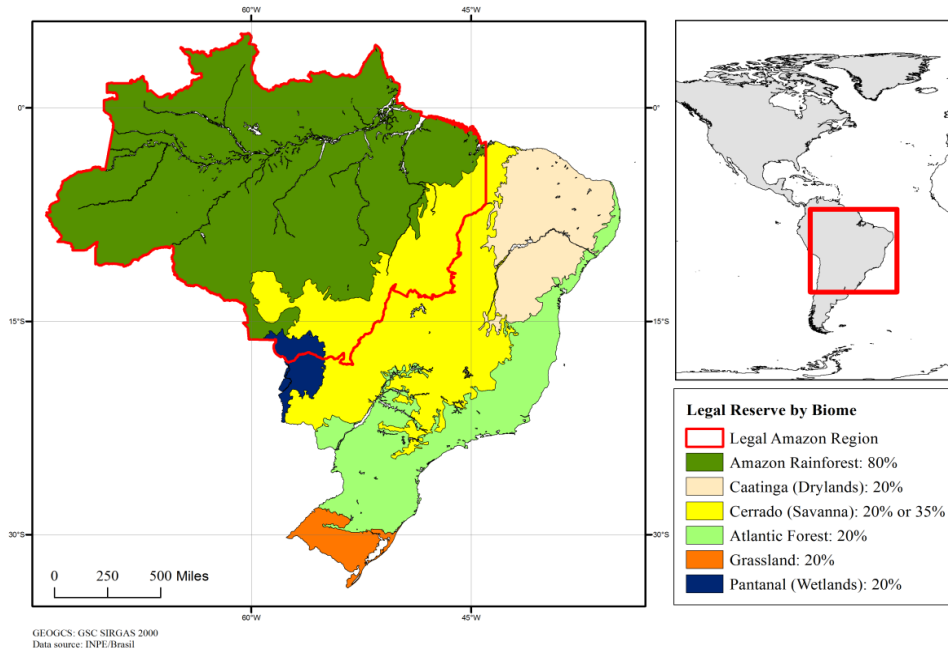
The objectives of this paper are to discuss (1) a brief history of the Forest Code; (2) key aspects of the 2012 FC revisions; (3) the status of implementation, including institutional and field-level challenges, as well as economic incentives to ease compliance; and (4) the importance of the FC for the Brazilian agro-industrial sector.

14. PARECER DO RELATOR DEPUTADO FEDERAL ALDO REBELO (PCDoB-SP) AO PROJETO DE LEI Nº 1876/99 E APENSADOS [OPINION OF RAPporteur FEDERAL DEPUTY ALDO REBELO (PCDoB-SP) TO BILL No. 1876/99] 270 (2010), http://www.abce.org.br/downloads/PL_1876_99.pdf [<https://perma.cc/EW6Y-4A7W>] [Hereinafter ALDO REBELO OPINION].

15. *See generally* C.FLOR.

16. *See* SOARES-FILHO, *supra* note 5, at 6.

Figure 1: Brazilian Biomes and Legal Reserve Requirements¹⁷



II. BACKGROUND

A. History of the Forest Code

The first Brazilian Forest Code was enacted in 1934, during the administration of then-president Getúlio Vargas, as a policy

17. The graph on Figure 1 was constructed using georeferenced data retrieved from the INSTITUTO NACIONAL DE PESQUISAS ESPACIAS (INPE) [BRAZILIAN INSTITUTE OF SPATIAL RESEARCH]. Note that the map is a general representation of the Brazilian biomes (ecoregions) based on their predominant ecological features. Therefore, it does not fully represent variations within each ecoregion, nor does it depict specific areas (Open Fields) within the Legal Amazon where lower LR requirements may apply (20%), instead of the general LR requirement of 80%. Because the FC uses the geographic delimitation of the Legal Amazon to define its requirements in the northern region of Brazil, for some portions of Cerrado (savanna) within the Legal Amazon the Legal Reserve requirement will be 35%, whereas for properties located within the Cerrado outside the Legal Amazon the general 20% requirement applies. See C.FLOR., art. 12.

response to claims by conservation groups that the nation's environmental laws were not equipped to address rapidly increasing development and uncontrolled logging activities in native forests.¹⁸ The government's aspiration to protect the country's natural resources and the willingness to pair its conservation measures to other nations', such as the U.S., are also considered driving forces of this federal conservation policy.¹⁹

The 1934 law was the first to establish the concept of Protected Forests, distinguishing them from forest areas that could be used primarily for economic activities (*floresta de rendimento*).²⁰ Protected Forests were intended to protect water resources, prevent soil degradation, serve as habitat for rare and endangered species, conserve pristine ecosystems, and create buffer zones to protect the country's territorial boundaries.²¹ They would later become what are currently referred to in the FC as Areas of Permanent Preservation, a central feature of today's Code.²² Whenever those Protected Forests were located on private lands and restoration was considered necessary, the area would be subject to expropriation and landowners entitled to compensatory payments.²³ Furthermore, landowners could only harvest trees in Protected Forests when authorized by the forest protection service, and the conversion of natural vegetation to agriculture was limited to up to 75% of the existing vegetation.²⁴

In the 1960s, the intensification of logging activities and territorial expansion of the agricultural frontier triggered greater concerns over the environmental impacts associated with the unsustainable use of natural resources.²⁵ As a policy response, in

18. See José L. A. Franco, *A Primeira Conferência Brasileira de Proteção à Natureza e a Questão da Identidade Nacional* [The First Brazilian Conference on Protection of Nature and the Theme of National Identity], 26 VARIA HISTÓRIA 77 (2002), for a historical background on the drivers of Brazilian forest laws and policies enacted in the 1930s, including the first FC.

19. See *id.* at 81-83.

20. Decreto No. 23.793, de 23 de Janeiro de 1934, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 31.12.1934, art. 3 cl. (d) (Braz.).

21. *Id.* art. 4.

22. C.FLOR, art. 3, cl. II.

23. See Decreto No. 23.793, de 23 de Janeiro de 1934, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 31.12.1934, art. 13 (Braz.).

24. *Id.* art. 23.

25. See *infra*, fig. 2.

1965, during Brazil's dictatorship, the environmental protection regime of 1934 was expanded to further enhance the defense of Brazil's forest remnants, when the new version of FC was enacted (referred here as the 1965 FC).²⁶ Among the innovations were the transformation of Protected Forest into the Areas of Permanent Preservation (APP) and the Legal Reserves (LR).²⁷ The 1965 version of the FC would serve as the legal foundation for all subsequent revisions and become the cornerstone of Brazil's current conservation policies. From 1965 to 2008, several amendments would be made to the 1965 legal framework in order to fill remaining gaps in the legislation and give law enforcement the legal means to implement the FC.²⁸

The first major change made to the FC was in 1986, when APP buffers were expanded to control illegal agricultural expansion over riverbanks, swamps, and lake margins.²⁹ The law was revised again in 1989, creating new categories of APP, including hilltops, steep terrain (slopes over forty-five degrees), riparian areas, and areas surrounding lakes, lagoons, springs, and other water bodies.³⁰ In order to control increasing deforestation, particularly evident in the agricultural frontier, another important regulation was enacted in 1989 establishing the precise amount of land that landowners should set aside as LRs and adding the requirement that these conserved areas should be registered in the property deed records.³¹

However, these implemented changes did not deliver the expected promises of curtailing deforestation in the Amazon forest. Contrarily, deforestation rates began to increase again in the early 1990s, leading to the approval of new changes in 1996, including the expansion of legal mechanisms to control forest

26. Lei No. 4.771, de 15 de Setembro de 1965, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 16.9.1965 (Braz.).

27. *Id.* art. 1, § 2(II)-(III).

28. See C.FLOR., arts. 29 (Cadastro Ambiental Rural), 44 (Cota de Reserva Ambiental), and 59 (Programa de Regularização Ambiental). These articles are amendments that were enacted to give law enforcement the legal means to implement the FC.

29. Lei No. 7.511, de 7 de Julho de 1986, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 8.7.1986 (Braz.).

30. Lei No. 7.803, de 18 de Julho de 1989, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 20.7.1989 (Braz.).

31. *Id.* art. 1(I).

clear cutting practices, the increase of LR requirements for private lands located in Legal Amazon's³² forest ecosystems, and the possibility to sustainably manage the LR for economic use, giving landowners an additional incentive to set them aside.³³ The full implementation of these revisions, however, was only made possible in 2001 when federal guidelines informing the administrative procedure towards compliance of LRs were set.³⁴

Furthermore, legal uncertainties regarding the real consequences of non-compliance remained until 2008, when a federal decree was enacted establishing the administrative procedure by which non-compliant landowners should be investigated and subject to particular criminal charges (including

32. Legal Amazon is an administrative unit that was established by Brazilian Federal Law No. 5.173, Lei No. 5.173, de 27 de Outubro de 1966, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 31.10.1966 (Braz.). Although named Legal Amazon (Amazônia Legal), the region encompasses three different biomes: all of the Amazon rainforest biome within Brazil's borders, 37% of the Cerrado biome, 40% of the Pantanal biome, as well as portions of Open Fields (Campos Limpos). Alicia Rolla & Fany P. Ricardo, *Amazônia Brasileira 2009* [Brazilian Amazon 2009], INSTITUTO SOCIOAMBIENTAL [SOCIOENVIRONMENTAL INSTITUTE] (2009), http://www.socioambiental.org/banco_imagens/pdfs/Amazonia2009_ISA_portuguesBaixa.pdf [<https://perma.cc/6RUG-MTF5>]. The Legal Amazon comprises the whole territory of eight states (Acre, Amapá, Amazonas, Mato Grosso, Pará, Rondônia, Roraima and Tocantins) and a portion of the State of Maranhão (west of the meridian 44° W), totaling an area of more than 5 million km². *O que é? Amazônia Legal*, INSTITUTO DE PESQUISA ECONÔMICA APLICADA (IPEA) [INSTITUTE OF APPLIED ECONOMICS] DESAFIOS DO DESENVOLVIMENTO (June 8, 2008), http://www.ipea.gov.br/desafios/index.php?option=com_content&id=2154:catid=28&Itemid=23 [<https://perma.cc/Y4VY-JFF5>].

33. The government issued a temporary measure, Medida Provisória No. 1.511, de 25 de Julho de 1996, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 26.7.1996 (Braz.), increasing the LR requirement from 50 to 80% and prohibiting new clearing on properties that already had *abandoned* or *underused* areas or areas that were being used *inappropriately* in terms of their soil capacity. See Claudia M. Stickler et al., *Defending Public Interests in Private Lands: Compliance, Costs and Potential Environmental Consequences of the Brazilian Forest Code in Mato Grosso*, 368 PHIL. TRANSACTIONS ROYAL SOC'Y B 1 (2013) (discussing "the use of spatial and temporal analysis of the Brazilian Forest Code to understand the patterns of regulatory compliance over time and across changes in the policy, and the implications of these compliance patterns for the perceived costs to landholders and environmental performance of agricultural landscapes in the southern Amazon state of Mato Grosso").

34. Medida Provisória No. 2.166-67, de 24 de Agosto de 2001, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 25.8.2001 (Braz.).

arrest,³⁵ fines and property embargoes).³⁶ With these new tools finally in place, law enforcement agencies were more equipped to enforce the FC and press charges against non-compliant landowners. As expected, this triggered an immediate reaction from the agro-business lobby, which started an intensive battle against the FC, challenging its constitutionality and pressuring the Brazilian Congress to approve substantial changes in the legislation.³⁷

Opposed by environmental advocates, negotiations on the new legal framework precipitated heated debates about the role of law and policy in limiting private land use rights to achieve conservation goals, and whether landowners should be entitled to compensation for the implementation and opportunity costs of compliance.³⁸ Given the inherent challenges in reaching consensus in a highly polarized legislative process, a special commission was created in 2009 to follow and mediate negotiations on the proposed revisions of the FC, which had been pending approval since the submission of a bill to Congress a decade earlier (Projeto de Lei No. 1876/1999).³⁹ The special commission's efforts resulted in a final approval in 2012, bringing to a close a highly contentious twelve-year legislative process.⁴⁰

35. Lei No. 9.605, de 12 de Fevereiro de 1998, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 13.2.1998, cl. (Braz.).

36. Decreto No. 6.514, de 22 de Julho de 2008, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 23.7.2008 (Braz.).

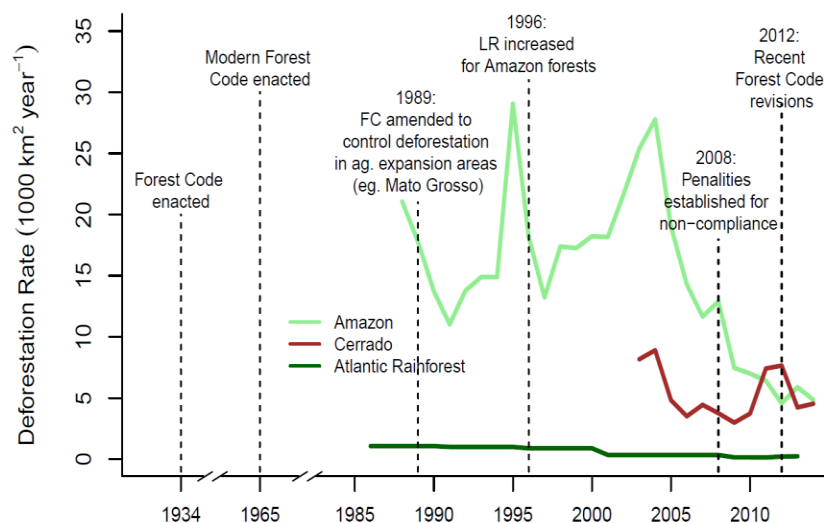
37. Davi A.S. de Lelis, *Entre o Discurso e a Norma: uma Análise sobre o Procedimento Legiferante em Torno do Novo Código Florestal* [Between the Discourse and the Standard: An Analysis of the Legitimate Procedure Around the New Forest Code] (Dec. 15, 2011) (unpublished Masters thesis, Universidade Federal de Viçosa) (on file with Biblioteca Central de Universidade Federal de Viçosa).

38. See generally ALDO REBELO OPINION, *supra* note 14.

39. *Id.*

40. *Id.*

Figure 2: Forest Code Timeline and Historical Deforestation Rates⁴¹



B. Importance and Structure

The FC divides Brazil's rural private lands into two categories: productive lands and lands set aside for conservation.⁴² Set-aside lands are further divided into APPs and LRs.⁴³ LRs consist of a proportion of the rural property that must be set aside to create areas of native vegetation to conserve broader ecosystem services and biodiversity.⁴⁴ APPs consist of

41. The graph on Figure 2 was constructed using deforestation data retrieved from the INSTITUTO NACIONAL DE PESQUISAS ESPACIAS (INPE) [BRAZILIAN INSTITUTE OF SPATIAL RESEARCH], PRODES PROJECT, http://www.obt.inpe.br/prodes/prodes_1988_2014.htm [<https://perma.cc/5Z2H-TRGE>]; *Alertas de Desmatamento* (Universidade Federal de Goiás) [Deforestation Alerts (Federal University of Goiás)], LABORATÓRIO DE PROCESSAMENTO DE IMAGENS E GEOPROCESSAMENTO (LAPIG) [LABORATORY OF IMAGE PROCESSING AND GEOPROCESSING, <http://www.lapig.iesa.ufg.br/lapig>] [<https://perma.cc/NS7T-AC8Y>]; and *Atlas da Mata Atlântica* [Map of Atlantic Woods], FUNDAÇÃO SOS MATA ATLÂNTICA (SOSMA) [SOS ATLANTIC FOREST FOUNDATION], www.sosma.org.br [<https://perma.cc/2STS-394V>].

42. C.FLOR. arts. 4, 12.

43. *Id.* arts. 4, 12.

44. *Id.* art. 3(III).

specific sensitive areas on a property that are directly related to the protection of water resources and soil erosion, such as riparian zones, buffers surrounding lakes and head waters, as well as high altitude areas and sloped lands.⁴⁵

LR requirements are most stringent in Brazil's most biodiverse areas. For example, properties located in the rainforest biome within the Legal Amazon⁴⁶ are required to set aside 80% of the land as LR, whereas LR requirements drop to 35% for properties located in the Cerrado (savannah) biome within the Legal Amazon.⁴⁷ LR requirements are set at 20% for all other properties in the country (including Cerrado outside of the Legal Amazon).⁴⁸ Less strict requirements may apply to small landholders in specific circumstances, as will be discussed in following sections.

The rationale behind these two conservation measures is clearly defined in Article 3, clauses II and III of the FC. Amongst the intended functions of the LR are the promotion of sustainable use of natural resources, the conservation and rehabilitation of ecological processes and biodiversity, and the provision of habitat to protect the native fauna and flora.⁴⁹ In order to incentivize broader compliance, the legislation allows for the sustainable management of LRs, which shall reconcile its economic use with the maximum provision of ecosystem services.⁵⁰ APPs, on the other hand, are exclusively meant to attain ecological functions, such as preserving water resources and the landscape, promote geological stability, conserve biodiversity, facilitate the gene flow of fauna and flora, protect the soil, and provide well-being to communities.⁵¹ Despite the fact that APPs and LRs are distinct categories of protected areas, they were established to fulfill

45. *Id.* art. 3(II). High altitude includes hilltops above 1800m. *Id.* art. 4(V). APP-protected sloped lands have grades above 45%. *Id.* art. 4(X).

46. *See supra* note 32 for a definition of the Legal Amazon.

47. C.FLOR. art. 12(I)(a)-(b).

48. *Id.* art. 12(I)(c).

49. ÉDIS MILARÉ, *DIREITO DO AMBIENTE: A GESTÃO AMBIENTAL EM FOCO* [RIGHT OF THE ENVIRONMENT: ENVIRONMENTAL MANAGEMENT IN FOCUS] 955 (2011).

50. C.FLOR. art. 17, § 1.

51. *See* DA SILVA ET AL, *supra* note 8, at 96.

complementary social and environmental functions.⁵² The imposition of such comprehensive and mandatory land use restrictions on private lands represents a unique approach to safeguarding wildlife habitats, water resources, soil, and other ecosystem services. By requiring landowners to maintain APPs and LR, the FC limits the economic use of private land in order to promote agricultural multi-functionality.⁵³

Brazil's approach to private land conservation contrasts with voluntary approaches adopted in other countries. In the U.S., for example, government subsidies are used to incentivize agricultural producers to participate in voluntary land conservation programs.⁵⁴ As part of the Conservation Reserve Program, farmers receive payments for retiring environmentally sensitive cropland from production.⁵⁵ With other federal programs, such as the Environmental Quality Incentives Program and the Conservation Stewardship Program, the government subsidizes a portion of the farmer's cost of implementing farmland conservation practices.⁵⁶ However, government budgets to support these programs have fallen short and farmer engagement has been limited.⁵⁷ The European Union's Common Agriculture Policy (CAP), on the other hand, has contained mandatory cross compliance requirements with environmental measures for over a decade, although farmers are not required to formally verify that compliance through certification, and small farmers are generally exempt from the recently approved greening measures.⁵⁸ Furthermore, implementation of voluntary environmental requirements

52. *Id.* at 73.

53. ORG. FOR ECON. CO-OPERATION & DEV. [OECD], MULTIFUNCTIONALITY: TOWARDS AN ANALYTICAL FRAMEWORK (2001), <https://www.oecd.org/tad/agricultural-policies/40782727.pdf> [<https://perma.cc/T4EC-V4J5>].

54. See generally Margaret R. Grossman, *Good Agricultural Practice in the United States: Conservation and Climate*, 13 ENVTL. L. REV. 296 (2011); *Conservation Reserve Program*, U.S. DEPT OF AGRIC., <https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index> [<https://perma.cc/NF2X-FHMN>].

55. Grossman, *supra* note 54, at 303.

56. *Id.* at 305, 306.

57. *Id.* at 308.

58. ALAN MATTHEWS, INST. OF INT'L & EUR. AFFAIRS, GREENING CAP PAYMENTS: A MISSED OPPORTUNITY? 4-5 (2013).

established under CAP Pillar 2 agro-environmental schemes have been limited by restricting member states' budgets.⁵⁹ Therefore, Brazil's Forest Code stands out as a unique case study on the use of federal policy to promote large-scale environmental protection and land conservation on private lands.

TABLE 1: MAJOR LEGAL RESERVE AND APPS REQUIREMENTS		
APP CATEGORY	REQUIREMENT	
RIPARIAN	<i>River width (x meters)</i>	<i>APP buffer (meters)</i>
	$x < 10$	30
	$10 \leq x < 50$	50
	$50 \leq x < 200$	100
	$200 \leq x < 600$	200
	$x \geq 600$	500
LAKE	<i>Lake Size (y)</i>	<i>APP buffer</i>
	$y < 20\text{ha}$	50
	$y \geq 20\text{ha}$	100
SPRING	<i>Spring Width</i>	<i>APP buffer</i>
	Any	100
SLOPE	Above 45 degrees	Whole area
HILLTOP	Above 1,800m	Whole area

59. *Id.* at 5-6. The CAP multi-annual financial framework (MFF) is divided into Pillar 1 and Pillar 2. *Id.* at 1. While Pillar 1 consists of the direct payments envelope, which supports the Basic Payment Scheme (BPS), Pillar 2 consists of the Rural Development agenda, which is supported jointly by CAP budget and EU Member States' money. *Id.* at 6. For more information, see ANDREAS STAAB, THE EUROPEAN UNION EXPLAINED: INSTITUTIONS, ACTORS AND GLOBAL IMPACT 114-25 (2d ed. 2011).

60. C.FLOR. art. 4.

III. OVERVIEW OF THE 2012 FOREST CODE REVISIONS

In May 2012, after more than a decade of contentious negotiations, Brazil's government completed a major overhaul of the Forest Code that included a number of provisions designed to improve compliance.⁶¹ While the FC consists of a very complex law which requires the understanding of many nuances, this paper focuses solely on the major revisions approved in 2012, including: (1) the creation of a unified Rural Environmental Registry (*Cadastro Ambiental Rural*, CAR), that will contain detailed information on individual properties to be used for legal enforcement; (2) the establishment of state-level Environmental Compliance Programs (*Programa de Regularização Ambiental*, PRA) that will provide landowners the necessary incentives and guidance to achieve compliance;⁶² (3) the establishment of the consolidation program, both for LRs and APPs; (4) an expansion of the LR offset program (*Cotas de Reservas Ambientais*, CRA), which allows landowners with LR deficits to purchase development rights from properties with an excess of LRs; (5) the counting of existing APPs to meet LR requirements; and finally, (6) the possibility to review LR requirements in municipalities and states within the Legal Amazon limits, where there is already a significant proportion of land protected under SNUC or indigenous land.

A. The Rural Environmental Registry (CAR)

While rural properties would already have been registered with the National Registry of Rural Properties (CNIR) to delineate land ownership,⁶³ the Rural Environmental Registry

61. See generally ALDO REBELO OPINION, *supra* note 14.

62. The federal guidelines for the state-level Environmental Compliance Programs (*Programa de Regularização Ambiental*, PRA) are established under Decreto No. 8.235, de 5 de Maio de 2014, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 05.05.2014 (Braz.).

63. The CNIR was created under Lei No. 5.868, art. 1, § 2, de 12 de Dezembro de 1972, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 14.2.1972 (Braz.). See Jacir A. Rambo & Luiz I. Rambo, *Implantação do Cadastro Territorial Multifinalitário no Brasil* [Implementation of the Multipurpose Territorial Register in Brazil], 1 REVISTA BRASILEIRA GEOMÁTICA., 48, 48 (2013) (Braz.).

(CAR) represents a first-of-its kind effort to augment the otherwise non-specific property registry with detailed information on the property's environmental characteristics. The CAR is intended to identify environmentally significant lands, gauge progress toward bringing lands into compliance with set-aside requirements, and to monitor land-use changes that would violate the FC.⁶⁴ More broadly, the CAR also can be used to design policies and actions that better recognize unique landscape features in the management of environmental systems.⁶⁵

Under the new FC, all landowners must register their properties with the CAR.⁶⁶ Municipal and state environmental agencies are in charge of administering implementation of the CAR with the support of the federal environmental protection agency, Institute for the Environment and Renewable Resources (IBAMA).⁶⁷ Registering with the CAR will function similarly to individual income tax return forms, and the registry will contain detailed environmental information provided by landowners that can be used for legal enforcement purposes.⁶⁸ The landowner must include property-specific information relevant to FC enforcement,⁶⁹ including the history of land use on the property, the location of remaining native vegetation, the georeferenced location of APPs and LR, the existence of "consolidated" APP or

(discussing weaknesses of the CNIR regulatory framework for land registry in Brazil, and the need for reforms given the current system's lack of capacity to prevent overlapping registries and land tenure conflicts). The CNIR is jointly managed by the Brazilian Institute of Colonization and Agrarian Reform (Instituto Brasileiro de Colonização e Reforma Agrária, INCRA) and the Internal Revenue Service (Secretaria da Receita Federal do Brasil). Lei No. 5.868/72, art. 1, §2. The CNIR, along with the Public Land Registry, the Landowners Registry, the Lessee and Sharecroppers Registry, and the National Registry of Public Forests, make up the National System of Rural Registration. *Id.* art. 1, cls. I-V.

64. C.FLOR. art. 29.

65. Decreto No. 7.830, art. 2, cl. II, de 17 de Outubro de 2012, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 18.10.2012 (Braz.).

66. *Id.*

67. *Id.* (establishing the general guidelines for the Cadastro Ambiental Rural, CAR).

68. See Luiz Amaral, *O primo verde do leão* [*The Green Cousin of the Lion*], REVISTA GLOBAL RURAL [GLOBAL RURAL MAGAZINE] (2014), http://www.cliptvnews.com.br/mma/amplia.php?id_noticia=94568 [<http://perma.cc/NB78-L6PE>].

69. C.FLOR. art. 45, § 1(V).

LR areas,⁷⁰ and existing areas identified as Areas of Restricted Use.⁷¹ Small landholders, on the other hand, are only required to provide limited information for their lands (a simplified CAR), including a simplified, non-georeferenced map (*croqui*) which should contain information on the total land area, existing APPs, remaining natural vegetation set aside as LR, and consolidated areas.⁷² The government unit responsible for the Registry then verifies the submitted information with satellite imagery.⁷³

The information gathered through the registration process will form the National Rural Environmental Registry System (*Sistema de Cadastro Ambiental Rural*, or SiCAR).⁷⁴ The large body of data to comprise the CAR will enable monitoring of implementation and, with the availability of such geographic specificity, is expected to change the way Brazilian enforcement agencies operate.⁷⁵ It will also support research and analysis on the impact of conservation and land use policies. Public access to data is regulated by Normative Instruction No. 3/MMA, which establishes the administrative procedure for such access,

70. See *infra* Part III(C).

71. Areas of Restricted Use include the wetlands (*pantaneais*), and plains of the Pantanal (*planícies pantaneiras*), as well as sloped lands between twenty-five and forty-five degrees. C.FLOR. arts. 10, 11. While the former areas are only to be used for conservation purposes under strict guidelines set by the environmental authority, steep terrain can be used for economic purposes as long as best management practices are implemented, although no clear definition exists in the Code for what would be considered best practices. *Id.* While the Areas of Restricted Use had already been protected under Brazilian law, for the first time, the FC amendments specifically recognized these areas for purposes of the CAR registration and protection. C.FLOR. art. 29, § 1(III).

72. Instrução Normativa [Normative Decree] No. 2/MMA, de 6 de Maio de 2014, art. 14(III) (Braz.), http://www.car.gov.br/leis/IN_CAR.pdf [<http://perma.cc/5TGH-FUSC>].

73. *Id.*

74. See Maurício Thuswohl, *Um ano após aprovação, Código Florestal teima em não sair do papel* [One Year After Approval, the Forest Code Insists on Not Leaving the Paper], REDE BRASIL ATUAL [CURRENT BRAZIL NETWORK] (May 21, 2013), <http://www.redebrasilatual.com.br/ambiente/um-ano-apos-aprovacao-codigo-florestal-teima-em-nao-sair-do-papel-7282.html> [<http://perma.cc/8ERC-TQQA>] (discussing interview with Volney Zanardi, Jr., the head of IBAMA, the federal environmental agency that is in charge of assisting state agencies implementing the Rural Environmental Registry (CAR), in which he stated that the agency is investing \$30 million in the satellite imaging program to support environmental agencies to best monitor landowners' compliance with the FC).

75. See Amaral, *supra* note 68.

including the protection of landowners' personal and business-confidential data.⁷⁶

Rural property owners initially had until May 2015 to register with the CAR.⁷⁷ However, given all the operational challenges local agencies have encountered, the federal government extended the deadline to December 2017, giving landowners two more years to submit their registration.⁷⁸ Registration is a pre-condition to participating in Environmental Compliance Programs⁷⁹ and is also required for landowners seeking permission to make changes in land use that would otherwise violate the FC.⁸⁰ Registration will also be necessary in order to access agricultural credit from 2017 onwards, as well as receive authorization to farm within consolidated APPs.⁸¹ Other factors are likely to drive adoption as well, including public and market responses to sustainable sourcing.

B. The Environmental Compliance Program (PRA)

In addition to the CAR, the 2012 FC also adds an innovative institutional mechanism, the Environmental Compliance Program (PRA), that will both guide and track landowners' progress towards compliance.⁸² Although engaging in PRAs is only mandatory for non-compliant landowners seeking consolidation of APP and LR areas, it can provide them an opportunity to integrate farm-level compliance strategies to landscape-level efforts developed by local and state governments.⁸³ The PRA is to be implemented through

76. Instrução Normativa [Normative Decree] No. 3, de 26 de Maio de 2003 (Braz.), http://www.mma.gov.br/estruturas/179/_arquivos/179_05122008034002.pdf [<https://perma.cc/Z8S6-H5XY>].

77. C.FLOR. art. 29, § 3.

78. Janary Júnior, *MP prorroga prazo de inscrição no Cadastro Ambiental Rural até maio de 2017*, CÂMARA DOS DEPUTADOS (May 5, 2016 6:34 PM), <http://www2.camara.leg.br/camaranoticias/noticias/MEIO-AMBIENTE/508254-MP-PRORROGA-PRAZO-DE-INSCRICAO-NO-CADASTRO-AMBIENTAL-RURAL-ATE-MAIO-DE-2017.html> [<https://perma.cc/7YF2-J9EG>].

79. C.FLOR. arts. 29, § 2, 59, § 2.

80. *Id.* art. 26.

81. *Id.* arts. 78-A, 61-A, § 9.

82. *Id.* art. 59.

83. *Id.* art. 61-A, §§ 11, 15.

cooperative federalism, with general guidelines set at the federal level and states in charge of establishing specific regulation to guide the process by which landowners can come into compliance with the FC requirements.⁸⁴

Participation in the PRA is required for landowners seeking consolidation of APP and LR areas (which is only available for areas out of compliance converted prior to July 2008).⁸⁵ As part of the process, the landowner signs a statement of commitment that contains the terms and conditions for maintenance, rehabilitation, and restoration of the amount of APP and LR land out of compliance.⁸⁶ Individual compliance plans must be submitted for approval to the responsible environmental agency (state or municipal, depending on where the property is located).⁸⁷ When designing their plans, small farmers can request assistance from local and state agencies, which are mandated to provide aid.⁸⁸

In order to optimize the costs and benefits of the restoration project, state and local environmental authorities must consider the land's unique characteristics such as climatic conditions, land use history, as well as cultural and socioeconomic factors when approving or designing the compliance plans.⁸⁹

Landowners have up to twenty years to complete their plans, although a minimum of ten percent of initial area requiring restoration must be achieved every two years.⁹⁰ During the implementation of the plan, any criminal charges and pending debts for previous violations of the FC will remain suspended, and the land that had been subject to embargo will be able to return to production.⁹¹ However, if the landowner fails to comply

84. *Id.* art. 59, § 1.

85. Decreto No. 7.830, de 17 de Outubro de 2012, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 18.10.2012, arts. 11, 12, 14 (Braz.).

86. Decreto No. 8.235, de 5 de Maio de 2014, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 5.5.2014, art. 5, cls. III-IV (Braz.).

87. C.FLOR, art. 59, §§ 2, 3.

88. *Id.* art. 54.

89. *Id.* art. 59, § 1.

90. *Id.* art. 66, § 2.

91. *Id.* art. 59, § 4.

with the terms of the statement of commitment, all suspensions are automatically voided and new sanctions imposed.⁹²

While the PRA can be implemented ahead of the CAR, it cannot be monitored until the CAR is fully implemented.⁹³ The monitoring capability and regular verification in PRA is intended to dramatically increase landowner adherence to their submitted statement of commitment. Thus, once in place, the PRA will be another valuable tool to promote landowner engagement and awareness concerning the benefits of compliance. It is also a necessary precursor to the Consolidation program.

C. Consolidation Program

The consolidation program, sometimes referred to as amnesty, was one of the more controversial revisions in the 2012 Forest Code. In essence, land eligible for consolidation is subject to less stringent LR and APP requirements, and in certain cases, consolidated properties are no longer required to undertake restoration efforts on land previously out of compliance with the FC.⁹⁴ A recent study estimated that this revision alone has reduced the total area to be restored to meet FC set-aside requirements from 50 ± 6 to 21 ± 1 Mha, of which 78% encompasses LRs and 22% RPAs.⁹⁵

The rationale behind the consolidation program reflects the impact of trends in land ownership concentration on the overall Forest Code revision process.⁹⁶ The new legal regime is designed to benefit the large majority of Brazilian family farmers, as well as increase overall compliance with the Code, while continuing to ensure that most private lands remain subject to the stricter

92. *Id.* art. 60, § 1; Decreto No. 8.235, de 5 de Maio de 2014, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 5.5.2014, art. 17 (Braz.).

93. C.FLOR. art. 59, § 2.

94. *See* C.FLOR, Seção II (Das Áreas Consolidadas em Área de Preservação Permanente), Seção III (Das Áreas Consolidadas em Área de Reserva Legal).

95. Britaldo Soares-Filho et al., *Cracking Brazil's Forest Code*, 344 SCI. 363, 363–364 (2014).

96. *See* BERNARDO M. FERNANDES ET AL., INT'L LAND COAL., LAND GOVERNANCE IN BRAZIL (2013), <http://www.landcoalition.org/sites/default/files/publication/1372/FramingtheDebateBrazil.pdf> [<http://perma.cc/GYF8-ALKG>].

requirements.⁹⁷ While 84% of rural properties are classified as smallholdings (predominantly family farmers),⁹⁸ they represent only 24% of the country's 330Mha of active arable land.⁹⁹ The threshold established to define *small farm* under the FC has been directly tied to the concept of family farming as determined in Article 3 of Federal Law No. 11,326.¹⁰⁰ Therefore, all family farms receive special treatment under the new FC and are now subject to less strict requirements in many aspects of the law.

Eligibility for consolidation is based on several criteria. First, the program only applies to lands converted to agriculture prior to July 22, 2008.¹⁰¹ Second, specific property size restrictions may apply; only smallholders will benefit from consolidation of LR areas, while all landholders irrespective of their property size can apply for consolidation of APPs.¹⁰² Importantly, the consolidation program is prohibited from triggering the conversion of new areas.¹⁰³ Thus, any illegal deforestation of land that should have been maintained as LR after July 2008, by any entity large or

97. See ANTONIO DE A. SODRÉ, NOVO CÓDIGO FLORESTAL COMENTADO [NEW FORESTRY CODE ANNOTATED] 94-95 (2013) (Luiz Henrique de Moura, head of the National Articulation of Agro-ecology (Articulação Nacional de Agroecologia, ANA), discussing how government institutions can effectively support family farmers to achieve full compliance with the code, stressing the need to promote appropriate technical assistance, financial aid, and guaranteed market pool).

98. According to the 2006 Agricultural Census, there are 5.2 million rural properties registered in the country, 84.4% (4.5 billion) of which are classified as smallholdings, usually family farms. 2006 CENSUS, *supra* note 10.

99. See generally Fernandes et al., *supra* note 96 (providing more details on Brazilian agrarian structure and land distribution policies).

100. Lei No. 11.326, de 24 de Julho de 2006, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 25.7.2006, art. 3 (Braz.). The FC defines family farm as any small or rural family property that is farmed by family members—including rural family settlements and land reform projects—that meets the requirements of Art. 3 of Federal Law 11.326: I – are not greater than 4 (four) fiscal modules; II – are mostly farmed by its own family members, with the possibility to hire one non-family worker during harvesting seasons; III – have a minimum percentage of family income generated from other economic activities, based on annual values established by the Executive Branch; IV – must be exclusively family managed. *Id.*

101. C.FLOR, arts. 61-A, 66.

102. *Id.*

103. *Id.* arts. 63, 66, § 9, 67.

small, must be brought to compliance irrespective of landowners' adherence to PRAs.¹⁰⁴

For environmental advocates and scientists, the consolidation program sends the wrong message to the landowners who have violated the law, rewarding their illegal activities, while indirectly punishing those who have behaved according to the law.¹⁰⁵ Furthermore, some fear that this flexibility may lead large landholders to fake sub-division of land property as a means to diminish restrictions on land use.¹⁰⁶ For the agro-business lobby, on the other hand, this revision provides an incentive for landowners to achieve compliance, thereby increasing the effectiveness of the law moving forward.¹⁰⁷

The consolidation strategy has divided opinions in both policy and scientific debates,¹⁰⁸ with several provisions of the new code being currently litigated in the Brazilian Federal Supreme Court.¹⁰⁹ Among them is an *Ação Direta de Inconstitucionalidade* (ADI 4902) that challenges the constitutionality of both APP and LR consolidation programs, arguing that they ignore core constitutional principles embedded in the environmental protection regime and violate the fundamental right to an ecologically balanced environment established in Art. 225 of the Constitution.¹¹⁰ Until a final or temporary decision is pronounced, however, enforcement agencies have remained active to promote full implementation of the new provisions for consolidation of APP or LRs.¹¹¹

104. *Id.* art. 66.

105. See Brancalion et al., *supra* note 13, at 9.

106. *Retrocesso Ambiental*, GREENPEACE BRASIL (June 8, 2015), <http://www.greenpeace.org/brasil/pt/Noticias/Retrocesso-ambiental-/?expandid=p669> [<http://perma.cc/5QLS-XRH4>].

107. See SODRÉ, *supra* note 97, at 368-376.

108. T. M. LEWINSOHN, J.P.W. METZGER, C.A. JOLY, & R.R. RODRIGUES, O CÓDIGO FLORESTAL BRASILEIRO DEVE SER MODIFICADO: O TIRO SAI PELA CULATRA [THE BRAZILIAN FOREST SHOULD NOT BE MODIFIED: THE SHOT BACKFIRES] (2010).

109. See, e.g., *Ação Direta de Inconstitucionalidade* [ADI] No. 4901 (Braz.); *Ação Direta de Inconstitucionalidade* No. 4902 (Braz.); *Ação Direta de Inconstitucionalidade* No. 4903 (Braz.).

110. R.T.J., *Petition, Ação Direta de Inconstitucionalidade* No. 4902, Relator: Min. Luiz Fux, 18.1.2013 (Braz.), <http://redir.stf.jus.br/estfvisualizadorpub/jsp/consultarprocessoeletronico/ConsultarProcessoEletronico.jsf?seqobjetoincidente=4355128> [<https://perma.cc/3X38-3DHH>].

111. See Brancalion et al., *supra* note 13, at 14.

1. The Consolidation of APPs

The APP consolidation program sets less strict requirements for APP areas that have been converted prior to July 22, 2008. For the non-consolidated areas, the APP requirements remain unchanged from pre-2012 levels.¹¹² Eligible landowners that participate in the consolidation program are generally not required to restore the entire amount of out-of-compliance land to the pre-2012 FC levels.¹¹³ Instead, landowners are only required to restore APP buffers according to the less strict guidelines outlined in the new FC.¹¹⁴

The new consolidated APP guidelines differ according to the size of the property and the size/width of the waterbody (unlike the pre-2012 FC which defined APP buffers exclusively on the size/width of the water body).¹¹⁵ The metric for property size is referred to in the FC as a fiscal module (*módulo fiscal*), which can range from 5-110 hectares depending on the municipality.¹¹⁶ In more developed areas, including metropolitan areas, the size of a fiscal module is usually much lower than in regions further away from large urban centers.¹¹⁷

112. C.FLOR, art. 4.

113. C.FLOR, art. 61-A.

114. *Id.*; see *infra*, tbl.2.

115. *Id.*

116. Since 1979, Brazil has used the agrarian measurement, Módulo fiscal, which is expressed in hectares and varies across municipalities. See Decreto No. 84.685, de 6 de Maio de 1980, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 7.5.1980, art. 4 (Braz.); Lei No. 6.746, de 10 de dezembro de 1979, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 11.12.1976 (Braz.). The Brazilian Institute for Colonization and Agrarian Reform (Instituto Nacional de Colonização e Reforma Agrária, or INCRA) is the government institution in charge of listing the size of a Fiscal Module for each municipality via Special Instruction, which takes into consideration: a) the predominant farming activity in the municipality, whether it is: I – fruits, herbs and vegetables; II - permanent crops; III - annual crops; IV - livestock; or V - forestry; b) income earned from the predominant type of operation; c) other existing farming activities in the city which, although not predominant, are relevant depending on income generated or on the amount of land allocated; and d) the concept of “family farming” as defined in Lei No. 11.326, Decreto No. 84.685, de 6 de Maio de 1980, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 7.5.1980, art. 4 (Braz.); Lei No. 11.326, de 24 de Julho de 2006, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 25.7.2006, art. 3 (Braz.).

117. Decreto No. 84.685, de 6 de Maio de 1980, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 7.5.1980, art. 4 (Braz.).

Comparing Tables 1 and 2 demonstrates how the APP consolidation program significantly reduces the amount of buffer zones the landowner is obligated to restore compared to the APP area required by the 1965 FC.¹¹⁸ The program also means that it will be possible to have APP riparian zones with different sizes along the same river depending on the property size and the existence of consolidated APPs in a given micro-basin. According to recent estimates, this amendment alone corresponds to almost a third (approximately 8Mha) of the overall reduction of protected areas, land that is no longer required to be in riparian buffers that otherwise would have been under the “old” FC.¹¹⁹

For the consolidated APP areas that need to be restored observing the new APP requirements, landowners must follow specific provisions established under the consolidation program. To summarize, a landowner has four options to restore APP lands under the “consolidated” program. He or she can: (1) allow the land to naturally regenerate; (2) plant with native species; (3) combine methods of natural regeneration and planting of native species; or, exclusively for small subsistence farmers, (4) opt to interplant the area with native and up to 50% of exotic woody or perennial species to be used for their own subsistence.¹²⁰

118. Although the initial proposal had established a minimum requirement of 30m buffer zones for riparian areas, the final legislation set buffer zones as low as 5m, 8m, and 15m, depending on the property size, which is significantly below the minimum recommended by the literature based on existing methods of forest restoration. M. Brian C. Hickey & Bruce Doran, *A Review of the Efficiency of Buffer Strips for the Maintenance and Enhancement of Riparian Ecosystems*, 39 WATER QUALITY RES. J. CAN. 311 (2004). The challenge for researchers and planners now is to develop new and cost-efficient methods of forest restoration for riparian areas with buffer zones of less than 30m, while still creating resilient and sustainable APPs for the consolidated areas. Researchers from the Laboratory of Ecology and Forest Restoration [LERF] at the University of São Paulo [Esalq/USP], a group that has extensive experience in developing forest restoration projects in Brazil, have been working on developing new techniques that can be used on the implementation of FC compliance programs. RICARDO R. RODRIGUES, PEDRO H. S. BRANCALION & INGO ISERNHAGEN, LABORATÓRIO DE ECOLOGIA E RESTAURAÇÃO FLORESTAL, PACTO PELA RESTAURAÇÃO DA MATA ATLÂNTICA: REFERENCIAL DOS CONCEITOS E AÇÕES DE RESTAURAÇÃO FLORESTAL (2010).

119. SOARES-FILHO, *supra* note 5, at 6.

120. C.FLOR, art. 61-A, § 13. This provision was particularly questioned in terms of its compatibility with the rationale of the APPs, but it was ultimately approved in the final rule. Yet, the sustainable management of exotic woody or

The first three options, natural regeneration, active restoration, and both combined, entail an opportunity cost equal to the lost revenue that the landowner was receiving by using the land for economic purposes.¹²¹ If the land is actively restored, then additional planting costs could also accrue.¹²² The fourth provision (4) allows for sustainable management of APPs for subsistence consumption, exclusively on family farms¹²³ and may not, at any rate, lead to increased soil erosion or otherwise degrade water quality.¹²⁴ Also, in cases where authorities deem a watershed of critical importance, they can establish, after consulting with the watershed committee and the state environmental council, special guidelines that landowners must follow for APP restoration.¹²⁵

perennial species in consolidated APP areas may not at any rate lead to increased soil erosion or otherwise degrade water quality. *Id.*, art. 61-A, § 14.

121. Cristina Banks-Leite et al., *Using Ecological Thresholds to Evaluate the Costs and Benefits of Set-Asides in a Biodiversity Hotspot*, 345 SCI. 1041, 1042 (2014).

122. See RODRIGUES, BRANCALION & ISERNHAGEN, *supra* note 118, at 178.

123. See *supra* note 100 (providing a legal definition of family farms).

124. C.FLOR. art. 63. The responsible environmental authority will determine when mitigation strategies should be adopted in order to prevent further soil erosion and floods after consulting the State Environmental Council. *Id.*, art. 63, §2.

125. *Id.* art. 61-A, § 17.

TABLE 2: APP REQUIREMENTS FOR CONSOLIDATED AREAS ¹²⁶		
PROPERTY SIZE (X in fiscal module)	APP CATEGORY	REQUIREMENT (buffer) ¹²⁷
$x \leq 1$	Riparian	5m
$1 < x \leq 2$	Riparian	8m
$2 < x \leq 4$	Riparian	15m
$x > 4$	Riparian	20 to 100m (established by the PRA)
$x \leq 1$	Lakes	5m
$1 < x \leq 2$	Lakes	8m
$2 < x \leq 4$	Lakes	15m
$x > 4$	Lakes	30m
<i>any size</i>	Spring	15m

2. The Consolidation of LR

The 2012 amendments provide for a somewhat similar “consolidation” of LR as with APPs but restricted to small landholdings.¹²⁸ Properties of up to four fiscal modules¹²⁹ can now measure their LR obligations against their LR holdings as of July 22, 2008.¹³⁰ This means that small landholders that, in July 2008, had LR below 1965 FC levels or no set-aside land as LR will no longer be obligated to restore those areas. Although the total land area of the properties that qualify for “consolidated” LR¹³¹ is

126. *Id.* art. 61-A, §§ 6, 7.

127. The total amount of consolidated APP areas that shall be restored within a property may not exceed 10% of the property size for properties up to two fiscal modules, and 20% of its size for properties larger than two and up to four fiscal modules.

128. *Id.*, art. 66.

129. *See supra* Part III(C)(1). For a legal definition of fiscal modules, see also Decreto No. 84.685, de 6 de Maio de 1980, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 7.5.1980, art. 4 (Braz.), and the text accompanying *supra* note 116.

130. C.FLOR. art. 67.

131. SOARES-FILHO, *supra* note 5, at 17. In order to estimate the approximate proportion of land that falls into the category of *up to 4 fiscal modules*, Soares-Filho used disaggregated data and took into consideration the specific measure of a fiscal module (in hectares) in each municipality. *Id.* at 23-24. The 2006 Census, on the other hand, only provides aggregated data of all properties that fall within a certain size range (in hectares) irrespective of their

proportionally small (24% of total farmland in the country, as discussed earlier), estimates show that this consolidation will result in approximately 17Mha¹³² being exempt from restoring LR set aside requirements.¹³³

For other properties that are not eligible for LR consolidation (i.e. larger than 4FM) and that do not have sufficient native vegetation in LR as of July 22, 2008, the landowner may choose among the following strategies to bring the land into compliance:¹³⁴ (1) allow the land to naturally regenerate; (2) actively restore the LR by planting new trees; or (3) compensate LR deficits via purchasing or leasing environmental reserve quotas (CRA)¹³⁵ within the same biome (and ideally within the same state) through a national trading system.¹³⁶

classification in terms of fiscal modules for the purpose of FC compliance. *See* 2006 CENSUS, *supra* note 10. However, the Census data provides a good notion of land concentration in Brazil, whereas Soares-Filho's figures provide useful information on the proportion of lands that are eligible for the consolidation programs (properties up to four fiscal modules). 2006 CENSUS, *supra* note 10; SOARES-FILHO, *supra* note 5, at 17.

132. Estimates can range depending on the methodology applied and the granularity and quality of the data used. *See* Emanuel J.S. Nunes, *Consolidação do Uso Agro-pecuário em Área de Reserva Legal: Uma Proposta Metodológica de Aplicação do Art.68 do Código Florestal - Lei n. 12.651/2012* [Consolidation Using Agro-Livestock in a Legal Reserve Área: A Proposed Implementation Methodology] (2014) (unpublished Master thesis, Escola Superior de Agricultura Luiz de Queiroz) (on file with Divisão de Biblioteca – DIBD/ESALQ/USP). Nunes estimated a reduction of 11.9 Mha of LR due to the consolidation of LR areas converted prior July 2008 in small properties. *Id.* Soares-Filho on the other hand, pointed to a reduction of 17 Mha of LR due to consolidation. SOARES-FILHO, *supra* note 5, at 6. Estimates also vary with regard to the provision that allows for revision of LR requirements in the Legal Amazon area. *See supra* Part III(D). While Nunes estimated a potential reduction of 9.26 Mha of LR, Soares-Filho points to a 1 Mha reduction of LR. Nunes, *supra* note 132; SOARES-FILHO, *supra* note 5, at 17.

133. SOARES-FILHO, *supra* note 5, at 17.

134. Landowners, small or large, are not required to engage in PRA to follow any combination of these compliance strategies. They must engage in PRA only if they are seeking consolidation of APP or LR, which will exempt them from any incurred criminal and civil charges from non-compliance. C.FLOR. art. 66.

135. The CRA acts as a “stock market” for trading areas of native vegetation. BOLSA VERDE DO RIO DE JANEIRO, RIO DE JANEIRO ENVIRONMENTAL EXCHANGE: OPERATIONAL REPORT 2011-2013 (2013), http://wp.bvrio.org/wp-content/uploads/2015/11/relatorio2013_ing_04.pdf [<https://perma.cc/3BEC-BBHA>]. The state of Rio de Janeiro has such a system, the Bolsa Verde do Rio de Janeiro, which has been used by over 1,600 landowners from fifteen states

The first and second compliance strategies (1 and 2), natural regeneration or active restoration, entail an opportunity cost equal to the lost revenue that the landowner was receiving by using the land for economic purposes.¹³⁷ If the land is actively restored, then additional planting costs could also accrue. The majority of the landowners have opted to simply abandon the land and let it naturally regenerate.¹³⁸ However, such a strategy may not be the most efficient technique for properties located within highly fragmented and disturbed areas if the goal of the FC is to achieve maximum ecosystem function through planning.¹³⁹ Experiments in forest restoration have shown that the reconstruction of permanent forest reserves with high diversity is feasible, but it depends on the strategies applied and on the surrounding landscape.¹⁴⁰ In Brazil, the large majority of the APP and LR areas out of compliance are expected to be restored with simply isolation to allow natural succession while only a small portion will actually require active restoration.¹⁴¹ In those areas, the challenge remains in developing cost-efficient restoration techniques.

Exploring the economic advantages of sustainably managing the LR with the establishment of high value forestry products, especially native species, may provide a means to offset some of the costs of restoration. Landowners can opt to sustainably manage their LR for economic use, which the FC allows

across the country, comprising more than 1.5 Mha of tradable forest reserves. *Id.* at 14.

136. C.FLOR. art. 66(III).

137. See BANKS-LEITE ET AL., *supra* note 121, at 1042.

138. ROGÉRIO ALESSANDRE DE OLIVEIRA CASTRO, SETOR SUCROENERGÉTICO E SUA ADEQUADA REGULAÇÃO: SUSTANTABILIDADE VS. VIABILIDADE ECONÔMICA 103 (José Ernani de Carvalho Pacheco ed., 2012).

139. See Peter M. Attiwill, *The Disturbance of Forest Ecosystems: The Ecological Basis for Conservative Management*, 63 FOREST ECOLOGY & MGMT. 247, 249-50 (1994) (suggesting that the greater the ecosystem disturbance the lower is the probability that succession after abandonment will affect the recovery of diversity and productivity).

140. Ricardo R. Rodrigues et al., *On the Restoration of High Diversity Forests: 30 Years of Experience in the Brazilian Atlantic Forest*, 142 BIOLOGICAL CONSERVATION 1242, 1243, 1245, 1247, 1249 (2009).

141. Ricardo R. Rodrigues, *Mensagem de Ricardo Rodrigues aos Senadores*, YOUTUBE (Oct. 25, 2011), <https://www.youtube.com/watch?v=vnli1qvvz0c> [https://perma.cc/RUM2-Q4QB].

conditional on the observation of certain guidelines.¹⁴² The FC specifically refers to an option to interplant regionally native species with up to 50% of exotic species using agro-forestry practices that promote the rehabilitation of ecosystem services.¹⁴³ The use of exotic species must follow specific sustainable management strategies and may (i) not compromise the conservation of native vegetation; (ii) ensure the maintenance of species diversity; and (iii) be managed in a way that supports the regeneration of native species.¹⁴⁴ This means that no clear cutting is allowed, and the placement of LR must be approved by the responsible environmental authority.¹⁴⁵ For the small farmers who wish to manage their LR for their own subsistence, no special permit is required.¹⁴⁶

Successful methods of sustainable management of LRs have been implemented across Brazilian farmlands with especially surprising results observed from the unprecedented application of silviculturist strategies in restoration models for native species.¹⁴⁷ The management of native species of high commercial value (fruits and timber) in LR was shown to be an economically viable alternative for landowners.¹⁴⁸ Additionally, landowners who opt to actively manage their LRs can apply for Payments for

142. C.FLOR. art. 66, § 4.

143. *Id.* art. 66, § 3.

144. *Id.* art. 22.

145. *Id.*

146. *Id.* art. 23.

147. Several experiments have been developed around the country to test different methods of restoration and management of LRs, with some of them published in peer-review journals. See Elaine A. Ball et al., *Multi-scalar Governance for Restoring the Brazilian Atlantic Forest: A Case Study on Small Landholdings in Protected Areas of Sustainable Development*, 5 *FORESTS* 599, 602, 610, 612, 614–15 (2014); Ricardo R. Rodrigues et al., *Large-scale Ecological Restoration of High-Diversity Tropical Forests in SE Brazil*, 261 *FOREST ECOLOGY & MGMT.* 1605, 1610–11 (2011). An on-going public-private initiative, the Projeto Biomas [Biomes Project], is being developed in partnership between the Brazilian Confederation of Agriculture and Livestock (CNA) and Embrapa, with the aim of identifying sustainable and cost-efficient ways to enable agricultural production and FC compliance across Brazilian farmlands by exploring the management of high value timber in LRs. *O que é o Projeto Biomas*, PROJETO BIOMAS, <http://www.projetobiomas.com.br/projeto> [<https://perma.cc/4WJA-NHGC>]. Experiments are being developed across all Brazilian biomes and have been supported by SEBRAE, Monsanto, and John Deere. *Id.*

148. See RODRIGUES, BRANCALION & ISERNHAGEN, *supra* note 118, at 162-79.

Ecosystem Services (PES).¹⁴⁹ The new FC explicitly grants such landowners the right to PES when their conservation efforts contribute to (i) the maintenance or increase of the amount of carbon stocks retained in the area, (ii) the conservation of the natural ecosystem beauty, (iii) the conservation of biodiversity, (iv) the protection of water resources, (v) the regulation of the climate, (vi) the promotion of cultural values and traditional knowledge of ecosystems, (vii) the conservation of soils, and (viii) the protection of APPs, LRs, and Areas of Restricted Use.¹⁵⁰

A recent study measured the economic impacts of LR compliance on predominant cropping systems in the Mogi Guaçu and Pardo water-basin, a traditional agricultural region in the state of São Paulo.¹⁵¹ It compared two different strategies of LR compliance in small farms and citrus farms: (i) the active restoration and sustainable management of LR with native species (timber) for commercial use, and (ii) the isolation of the LR area to allow natural succession.¹⁵² The results point to an annualized net present value of R\$ 428.52/ha (US\$ 158.12/ha) for managed LRs in citrus farms, and R\$ 416.84/ha (US\$ 153.81/ha) for managed LRs in low productive small farms.¹⁵³ They also show positive gross margins in the whole period for the small farms, indicating that compliance of LR in site can be economically feasible in this group.¹⁵⁴ For the citrus farms, on the other hand, the compensation of LR off-site seems to be the best option given the high opportunity cost of taking land out of production.¹⁵⁵

149. C.FLOR. art. 41, § 4.

150. C.FLOR. art. 41(I)(a)-(h).

151. Maria do C.R. Fasiaben et al., *Impacto Econômico da Reserva Legal sobre Diferentes Tipos de Unidades de Produção Agropecuária* [Economic Impact of Legal Reserve on Different Types of Agricultural Production Units], 49 REVISTA DE ECONOMIA E SOCIOLOGIA RURAL [J. ECON. & RURAL SOC.] 1051, 1053 (2011).

152. *Id.* at 1067. In the Mogi Guaçu and Pardo water-basin, citrus production represents the main land use system, occupying 32% (17,581 ha) of the total arable land in the region. *Id.* at 1057–58.

153. *Id.* at 1071, 1079 (applying an exchange rate of R\$ 2.71 for each unit of dollar).

154. *Id.* at 1082.

155. *Id.* at 1076.

The possibility to compensate deficits in LR offsite (where other landowners may have surplus of LR) by purchasing shares of a CRA or leasing lands already preserved or in the process of being rehabilitated is the third compliance strategy available to landowners).¹⁵⁶ While this option was also available under earlier versions of the FC, the available areas that could be subject to trading have been expanded to allow for trading within the same biome rather than within the same micro-basin (watershed level).¹⁵⁷ However, compensation should preferably take place in the same state.¹⁵⁸ If necessary to look outside of the state, the compensatory land must be within the areas identified as priority for conservation.¹⁵⁹ Furthermore, the CRA must be registered in the CAR, and the environmental authority must approve the compensatory mitigation as promoting connectivity of native vegetation so that corridors for wildlife and biodiversity are maintained.¹⁶⁰

In agriculturally intense areas where the opportunity costs to take land out of production to set-aside as LR may be prohibitive, the possibility to offset deficits in LR elsewhere can be an attractive alternative for producers seeking compliance. Expanding the trading zone is expected to create more robust offset markets, offering farmers an opportunity to implement cost-efficient compliance strategies while maintaining protected large portions of natural vegetation.¹⁶¹ For example, in the Cerrado biome—Brazil’s new agriculture frontier—a large number of properties have surpluses of native vegetation.¹⁶² While these areas (estimated at approximately 40Mha) could still

156. C.FLOR. arts. 66(III); 66, § 5.

157. C.FLOR. art. 48, § 2.

158. C.FLOR. art. 66, § 5(IV). The new FC allows for compensation of LR in the “same biome,” replacing the “same watershed” requirement established in the 1965 FC. CÓDIGO FLORESTAL [C.FLOR.] [FOREST CODE], Lei No. 4.771, de 15 de Setembro de 1965, art. 44(III) (Braz.), http://www.planalto.gov.br/ccivil_03/leis/L4771.htm [<https://perma.cc/Z8RW-JR7Z>].

159. C.FLOR. art. 66, § 6(III). Priority areas are identified as those that promote the recovery of deforested watersheds, the creation of wildlife corridors, the conservation of large protected areas, and restoration of habitats for endangered species. *Id.* art. 66, § 7.

160. *Id.* art. 44, § 1.

161. See SOARES-FILHO, *supra* note 5, at 11–12.

162. *Id.* at 3.

be legally deforested, they can now be traded to compensate LR deficit in properties with high opportunity costs to set aside in site,¹⁶³ which creates value in their preservation. To put this in perspective, recent estimates suggest that if the FC trading system is successfully implemented, over 16Mha of CRAs could be traded across the country, reducing the total current deficit in LR by 55%.¹⁶⁴

These provisions, thus, clearly give landowners an additional economic incentive to comply with LR requirements. However, they also raise concerns over how the trading system will deal with tradeoffs between improving the efficient allocation of agricultural land and reducing potential ecological benefits of maintaining a fragmented agricultural production.¹⁶⁵ The economic use of LR, on the other hand, can be questionable depending on the management strategies applied and their potential negative impacts on surrounding ecosystems. Therefore, it remains to be seen whether these two mechanisms will be able to broadly deliver the expected ecological functions and become an effective and widespread means of conserving natural ecosystems across Brazilian farmlands.¹⁶⁶

163. *Id.*

164. *Id.* at 12.

165. See Kenneth M. Chomitz, *Transferable Development Rights and Forest Protection: an Exploratory Analysis*, 27 INT. REGIONAL SCI. REV. 348, 350, 370 (2004) (the study develops a simple, geographically explicit simulation model to examine the economic and environmental impact of a hypothetical transferable development rights program under alternative implementation scenarios. Using data on land cover and land productivity from the Brazilian state of Minas Gerais, the model shows substantial reductions in conservation cost from widening the geographical scope of trading. Also, when restricting the program only to large landholders, transactions costs are drastically reduced, while the amount of forest placed under protection is only mildly reduced); see also Claudia M. Stickler et al., *Defending Public Interests in Private Lands: Compliance, Costs and Potential Environmental Consequences of the Brazilian Forest Code in Mato Grosso*, 368 PHIL. TRANSACTIONS OF ROYAL SOC. B 1619, 1620 (2013) (a spatial and temporal analysis of the Brazilian Forest Code to understand the patterns of regulatory compliance over time and across changes in the policy, and the implications of these compliance patterns for the perceived costs to landholders and environmental performance of agricultural landscapes in the southern Amazon state of Mato Grosso).

166. Rodrigues et al., *supra* note 140.

D. Other Important Revisions

Several other consequential revisions were made in the 2012 Forest Code. One important change allows landowners to count APPs towards making up LR deficits.¹⁶⁷ This change only applies so long as (i) the substitution does not result in deforestation; (ii) the area under APP protection must be currently restored or under ongoing restoration program; and (iii) the property must still be registered with the CAR.¹⁶⁸ This is an indicator of the mismatch in interpretation and implementation of APPs and LR, and has been highly criticized by Brazilian scientists and environmental activists to whom replacing LR with APP makes no sense in biological terms.¹⁶⁹ This allows, for example, that if a given rural property in the Cerrado biome¹⁷⁰ has at least 20% of that land under APPs, then the landowner does not need to set aside land as Legal Reserve even though they do not fulfill the same functions.¹⁷¹ It is worth noting, however, that this provision, like most of the new amendments, was intended to facilitate compliance of landholdings with shortfall on LR and therefore, may not trigger new conversion of land already protected under LR.¹⁷²

The new code has also opened the possibility for revisions of the LR requirement in states and municipalities within the Legal Amazon where there is a large amount of land protected under SNUC or indigenous reserves.¹⁷³ If the state has an approved ecological-economic zoning plan and more than 65% of its territory already protected under SNUC or indigenous land, the LR obligation can be reduced from 80% to as low as 50%.¹⁷⁴ The

167. C.FLOR. art. 15.

168. *Id.* art. 15, cl. I-III.

169. DA SILVA ET AL., *supra* note 5, at 73.

170. In the Cerrado biome, the Legal Reserve requirement is 20%. C.FLOR. art. 12(I)(c).

171. C.FLOR. art. 15(I)-(III).

172. *Id.* art. 15(I).

173. *Id.* art. 12(I)(a).

174. *Id.* art. 14, §§ 4–5. This was the alternative the legislator found to not undermine agricultural activities and economic development within regions that are already widely protected under the conservation units system. For instance, in the state of Rondônia, in the northern region of Brazil, the reduction of LR requirement has been voted on in Congress. On February 4th, 2014, the Bill

same condition applies to municipalities that have more than 50% of its territory under these two types of protected areas.¹⁷⁵

IV. IMPLEMENTATION AND COMPLIANCE

Implementing a land conservation policy of this scale and complexity is an inherently challenging and controversial process. Historically, compliance with the FC has been low, particularly for the LR obligation.¹⁷⁶ In part, this is because some landowners have failed to register their LR.¹⁷⁷ However, wide-spread resistance to the LR obligation among landowners persists with many refusing to take sufficient land out of production.¹⁷⁸ There is a general perception in the agricultural sector that the environmental restrictions on private farmland are too strict and prevent agricultural development, and also that conservation of natural vegetation should take place mainly on public lands. Some producers have even refused to sign agreements with the State Public Prosecutor Office (*Ministério Público Estadual*) to bring their properties into compliance.¹⁷⁹ Within intense agricultural production regions, it is generally difficult to find commercial farms that maintain sufficient LR set-asides.¹⁸⁰

Even though the new FC provisions substantially reduce the set-aside acreage requirements, large compliance deficits remain throughout several regions of the country.¹⁸¹ Early estimates put the amount of land out of compliance at about 20Mha of LR and APPs on Brazilian farmlands.¹⁸² In the Central-South region, where most agricultural expansion has taken place, compliance

390/2013 [PLS 390/2013] proposed by Senator Acir Gurgacz, was initially approved at the lower house of the Brazilian Senate (Commission of Agriculture and Agrarian Reform). Projeto de Lei do Senado No. 390, de 2013, PLS 390/2013 (Braz.). If this bill is ultimately approved on both houses, it will reduce the LR requirements in the state of Rondônia from the current 80% to 50% for all properties located within forested areas. *Id.*

175. C.FLOR. art. 12, § 4.

176. See Sparovek et al., *supra* note 13, at 6047.

177. See CASTRO, *supra* note 138, at 103.

178. *Id.*

179. *Id.*

180. *Id.*

181. SOARES-FILHO, *supra* note 5, at 5 fig.2.

182. *Id.* at 3.

rates are especially low.¹⁸³ Applying the old code requirements, estimates for the state of São Paulo show a Legal Reserve deficit of about 2.6Mha.¹⁸⁴ Applying the new FC requirements, more recent estimates suggest a current LR deficit of 1.5Mha.¹⁸⁵ Therefore, the FC 2012 revisions come with a promise to improve Brazil's Environmental Protection System (SISNAMA) and to increase the general level of compliance.¹⁸⁶

A. Implementation Status

Historically, implementation of the FC has been restricted by bureaucratic tie-ups, weak public and private governance structures, and a general lack of economic incentives and institutional assistance to landowners.¹⁸⁷ This round of revisions is no different. More than two years since Congress approved the 2012 FC, delays in implementation have led environmental groups to question the government's capacity to fully implement the new revisions.¹⁸⁸

Central to implementation are the ruling of federal guidelines to inform the process of registration with the CAR and

183. Sparovek et al., *supra* note 13, at 6050.

184. *Id.*

185. SOARES-FILHO, *supra* note 5, at 10 (supplemental material).

186. SISNAMA (*Sistema Nacional do Meio Ambiente*, National System for Environmental Protection) was established under the Brazilian Environmental Policy Act, Lei No. 6.938, consisting of federal, state, and local level environmental protection agencies, as well as of public foundations established by the government, responsible for the protection and promotion of environmental quality. Lei No. 6.938, de 31 de Agosto de 1981, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 2.9.1981, art. 6 (Braz.). The SISNAMA is administered by the following entities: (i) Superior Agency: Government Council (*Conselho de Governo*); (ii) Consulting Agency: CONAMA - National Environmental Council (*Conselho Nacional do Meio Ambiente*); (iii) Central Agency: MMA - Ministry of Environment (*Ministério do Meio Ambiente*); and (iv) Executive Agency: IBAMA - Brazilian Institute of Environment and Renewable Natural Resources (*Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis*). *Id.* art. 6(I)-(IV). For more information on SISNAMA, see MINISTÉRIO DO MEIO AMBIENTE [MINISTRY OF ENVIRONMENT], <http://www.mma.gov.br> [<https://perma.cc/WP2M-L4V7>].

187. Sparovek et al., *supra* note 13, at 6047.

188. OBSERVATÓRIO DO CÓDIGO FLORESTAL, <http://www.observatorioflorestal.org.br> [<https://perma.cc/7BVD-SSS5>]. This is an independent network created by civil society organizations with the aim of monitoring the implementation of the new Forest Code.

the operationalization of property PRAs as well as the establishment of economic incentives and technical assistance to support landowners' strategies towards compliance. Progress was made in 2014 when the federal government issued Decree No. 8.235 and Normative Instruction MMA No. 2, which established the process by which PRA and CAR programs, respectively, are to be implemented.¹⁸⁹ However, implementation of the CAR has lagged behind, and important regulation, including state-level guidelines for their environmental compliance programs, is still pending approval, as are regulations for economic incentives to encourage compliance.¹⁹⁰ Because state PRAs cannot be monitored until the CAR is fully implemented, many states have not yet passed legislation defining specific guidelines for state PRAs.¹⁹¹ Thus, it will be some time before it can be determined whether initial promises of broader implementation can be achieved.¹⁹²

All government efforts as yet have been devoted to developing the technological, intellectual, and institutional capacity to implement the CAR, but so far the rollout of the CAR at the state and municipal levels has varied considerably.¹⁹³ Launching and populating the registry is progressing with nearly all rural properties already registered.¹⁹⁴ The northern and southeastern regions are slightly further along than others in implementing CAR. Progress towards full registration was aided by more advanced environmental governance infrastructures developed over the years in some states, particularly Pará and Mato Grosso.¹⁹⁵ The environmental registry is not a new

189. Decreto No. 8.235, de 5 de Maio de 2014 (Braz.); Instrução Normativa No. 2/MMA, de 6 de Maio de 2014 (Braz.).

190. See Brancalion et al., *supra* note 13, at 9.

191. *Id.* at 15.

192. C.FLOR. art. 41, § 4.

193. As of February 2017, there were already 3.99 million rural properties registered with the CAR, which make up 402,782,597 ha of land—more than the total area subject to the CAR. *Números do Cadastro Ambiental Rural*, SERVIÇO FLORESTAL BRASILEIRO [BRAZ. FORESTRY SERV.], <http://www.florestal.gov.br/numeros-do-car> [https://perma.cc/R2FE-FJYB].

194. *Id.*

195. RODRIGO MEDEIROS ET AL., A IMPLEMENTAÇÃO DO CADASTRO AMBIENTAL RURAL (CAR) E DO PROGRAMA DE REGULARIZAÇÃO AMBIENTAL (PRA) NOS ESTADOS BRASILEIROS: III RELATÓRIO DE ACOMPANHAMENTO 10 (2016), <http://www.>

instrument of environmental law enforcement in these states.¹⁹⁶ Both Pará and Mato Grosso have already been using the Integrated System for Environmental Monitoring and Permitting (*Sistema Integrado de Monitoramento e Licenciamento Ambiental*, SIMLAM) to monitor compliance with the FC and other environmental regulations.¹⁹⁷ SIMLAM was developed by a private company, which uses CAR information to inform environmental permitting processes and other conservation policies in these two states.¹⁹⁸ New registrations for the CAR have been in the new system.¹⁹⁹ As of 2017, approximately 280,000 properties (more than 100%) had been registered in the new CAR in the state of Pará and about 179,538 (94.21%) in the state of Mato Grosso.²⁰⁰

Registration is a complex process using detailed field-level information that must be submitted electronically. This results in three key bottlenecks: (i) infrastructure; (ii) owner knowledge and assistance; and (iii) data validation. A number of programs and services are being developed to aid in the process. The federal government has allocated millions of dollars to support states on implementing their CARs, but technological and institutional challenges remain.²⁰¹ For example, states that already had a registration system in place are facing some difficulties trying to connect their systems to the federal SiCAR.²⁰² As part of its efforts to implement the new FC revisions, IBAMA established

inovacar.org.br/wp-content/uploads/2016/11/III-Relato%CC%81rio-de-Acompanhamento-do-CAR-e-PRA-Amazonia-Legal-marco-2016.pdf [https://perma.cc/JL4M-7QDN].

196. *Id.*

197. *Id.*

198. MAURO OLIVEIRA PIRES & VALMIR GABRIEL ORTEGA, O CADASTRO AMBIENTAL RURAL NA AMAZÔNIA 12 (2013), <http://www.inovacar.org.br/wp-content/uploads/2016/11/Cadastro-Ambiental-Rural-na-Amazonia.pdf> [https://perma.cc/E5JS-MUKP].

199. MEDEIROS ET AL., *supra* note 195, at 10. Currently, compatibility and integration issues are contributing to discussions about whether to continue to develop the SIMLAM system and link with CAR, or import its data, or use another connected approach. *Id.*

200. SERVIÇO FLORESTAL BRASILEIRO, CAR – BOLETIM INFORMATIVO 9, 27 (2017), <http://www.florestal.gov.br/documentos/car/boletim-do-car/2603-boletim-informativo-car-fevereiro-de-2017/file> [https://perma.cc/ZS89-SHV6].

201. *Id.*

202. MEDEIROS ET AL., *supra* note 195, at 10.

cooperative agreements with state agencies to share technical expertise and other information related to helping landowners identify land-use and land-use changes.²⁰³

The complex data requirements are often a barrier for rural landowners, as it can be quite challenging to compile all the information required to register their properties in the CAR, even with the simplified form available to the smallest landowners. Although government agencies are tasked with providing technical assistance to small landholders, many are overwhelmed and voluntary public and private initiatives have emerged around the country to help producers and landowners understand the registry and the process.²⁰⁴ Checking all the data submitted for registration is an additional challenge. The administering authority is responsible for the time-consuming validation of the landowner-submitted data.²⁰⁵

The new structure of the CAR, which includes georeferenced data mapping capacities, will largely change the way enforcement agencies operate in Brazil and will give farmers a clear incentive to seek compliance. Moreover, it will allow civil society to monitor legal compliance, as well as researchers to develop more robust and detailed quantitative analysis on the effects of public conservation and land use policies such as the Forest Code.²⁰⁶ Realizing these benefits will depend largely on the extent of participation. The effort and costs of registration and compliance, coupled with the opportunity costs associated with setting aside

203. See *Governo Federal e Estados se une para Consolidar o CAR*, MINISTÉRIO DO MEIO AMBIENTE (Feb. 5, 2015), <http://www.mma.gov.br/index.php/comunicacao/agencia-informma?view=blog&id=730> [<https://perma.cc/N5MQ-H47J>].

204. The Federal University of Paraná, for example, launched the Portal do CAR project, which offered free technical assistance to producers and landowners who were finding difficulties in registering their properties in the CAR. See PROJETO PORTAL DO CAR, www.portaldocar.com.br [<https://perma.cc/2525-9KVD>].

205. C.FLOR. art. 29, § 1.

206. See *Governo divulga (quase) todos os dados do Cadastro Ambiental Rural*, INSTITUTO SOCIOAMBIENTAL (Dec. 2, 2016), <https://www.socioambiental.org/pt-br/noticias-socioambientais/governo-divulga-quase-todos-os-dados-do-cadastro-ambiental-rural> [<https://perma.cc/9VBG-TMYR>]. Future studies of policy implementation will largely benefit from the open access to more detailed and georeferenced data gathered from all properties registered with the CAR.

potentially productive land, make institutional and economic incentives crucial to the program's success.

B. Overview of Other Economic incentives for Compliance

Ensuring that producers opt-in is challenging, and the amended FC addresses the importance of economic incentives to improve compliance and facilitate broader implementation of the legislation's requirements.²⁰⁷ A set of incentives bills, initiated before the revisions, are currently working their way through Congress and were recently aggregated into a single bill to expedite the legislative process.²⁰⁸ The incentives could compensate landowners for some of the foregone income and costs incurred in setting aside land and registering to the CAR, thus providing economic incentives to comply with the FC. These incentives generally fall into three categories: tax incentives, rural financing incentives, and payment for ecosystem service (PES) transfers.²⁰⁹

As proposed in the aggregated bill, legal reserves may become eligible for tax credits that are provided for environmental and reforestation projects. Acreage categorized as legal reserves and/or APP could be exempt from Brazil's rural property tax (*Imposto Territorial Rural*, ITR), or registered landowners could pay lower income taxes.²¹⁰ Additionally,

207. See Brancalion et al., *supra* note 13, at 14.

208. Projeto de Lei do Senado No. 131, de 2007 (Braz.). The aggregated bills include Projeto de Lei do Senado No. 142, de 2007 (Braz.) (proposing compensatory measures for the provision of ecosystems services related to water quality and quantity); Projeto de lei do Senado No. 304, de 2007 (Braz.) (proposing property tax (ITR) exemptions for LRs that exceed the minimum requirement); Projeto de Lei do Senado No. 34, de 2008 (Braz.) (proposing mechanisms to offset the costs of setting aside LRs through direct payment or debt amortization); Projeto de Lei do Senado No. 64, de 2008 (Braz.) (proposing compensation payments for LRs and other set-aside lands); Projeto de Lei do Senado No. 65, de 2008 (Braz.) (proposing favorable credit terms for compliant landowners); Projeto de lei do Senado No. 78, de 2008 (Braz.) (proposing tax and credit incentives to be approved annually in the federal government budget); and Projeto de Lei do Senado No. 483, de 2009 (Braz.) (proposing payments for ecosystems services to farmers who have set aside LRs).

209. *Id.*

210. Projeto de Lei do Senado No. 304, de 2007 (Braz.).

landowners that are in compliance with the FC could be eligible for more favorable terms on rural credit and a price premium when selling produce to the government.²¹¹ The former may include reduced interest rates or debt payments on existing loans or low-interest loans to help offset costs of LR and APP restoration, whereas the latter will consist of a price premium payment to all compliant landowners as a way to award them for the provided ecosystem services.²¹² As discussed in the consolidation program section, PES transfer schemes may provide an additional source of funding for bringing reserve lands back into compliance.²¹³ Furthermore, revenues from existing PES conservation programs, such as under the Water Resources Act, would also be allowed to help producers offset their restoration costs or income foregone from decreased production.²¹⁴ Funding to support PES schemes is also expected to come from other sources, including federal, state, and local governments' budgets, the State Water Resources and Environmental Fund (FEHIDRO), the National Environmental Fund (FNMA), international donors (e.g. NGOs, GEF, BIRD, etc.), contributions from private companies that benefit from ecosystem services, and Clean Development Mechanisms (CDM) developed under the UN Framework Convention on Climate Change. Exploring these funding sources, the National Water Agency (ANA) has developed a program to transfer PES to compliant landowners who are promoting the protection of APP areas and contributing to the provision of water resources in water basins with critical levels of degradation across the country (Programa Produtor de Água –

211. Projeto de Lei do Senado No. 65, de 2008 (Braz.). There have also been proposals from environmental groups (Instituto Socioambiental) to link FC compliance to existing government support schemes for family farmers, which includes the payment of a price premium to FC compliant farmers for any produce sold to the government through existing support schemes (e.g. PAA [Programa de Aquisição de Alimentos], PNAE [Programa Nacional de Alimentação Escolar], and PGPM [Programa de Garantia de Preço Mínimo]). See FLÁVIA CAMARGO DE ARAÚJO & RAUL SILVA TELLES DO VALLE, INSTITUTO SOCIOAMBIENTAL, *A POLÍTICA AGRÍCOLA COMO VETOR PARA A CONSERVAÇÃO AMBIENTAL NO CAMPO* (2013), http://www.socioambiental.org/sites/blog.socioambiental.org/files/publicacoes/pol_agricola.pdf [<https://perma.cc/XA3U-749E>].

212. *Id.*

213. *See supra* Part III(C).

214. Lei Federal No. 9.433, de 8 de Janeiro 1997, art. 22, § 2 (Braz.).

Water Producer Program).²¹⁵ ANA has recognized compliant landowners' right to PES transfer applying the same legal argument used under the Water Resources Act to justify water users' obligation to pay for their use of water.²¹⁶ Currently, twenty Water Producer Programs are being developed across the country with the participation of around 1,200 landowners and the financial support of several local communities' stakeholders.²¹⁷

In addition to these incentive schemes, the new FC also provides an array of different compliance strategies landowners can follow, including compensatory measures off-site and LR management.²¹⁸ How these compliance mechanisms will be implemented moving forward will largely depend on multiple socioeconomic factors driving landowners' decisions. In this process, landowners should explore the economics and trade-offs of LR compensation mechanisms and the possibility to sustainably manage the LR using high commercial value products. These two strategies have shown to be profitable alternatives for some landowners—particularly for extensive farmers—and can always be combined to allow more cost-efficient compliance plans.²¹⁹

Voluntary certification schemes are also expected to drive implementation of FC requirements, as has happened in some forestry (FSC) and agricultural (Sustainable Agriculture Network) sectors.²²⁰ With end-users, retailers, and wholesalers (e.g., McDonald's, Unilever, and Mars) increasingly demanding sustainable sourcing, third-party sustainability standards and certification bodies have become important players in the process of setting standards and verifying operators' compliance with

215. *Programa Produtor de Água*, AGÊNCIA NACIONAL DE ÁGUA [ANA], <http://produtordeagua.ana.gov.br> [<https://perma.cc/89Z4-3WE9>].

216. *Id.*

217. *Id.*

218. C.FLOR. arts. 48, 66(III), 66, § 4.

219. See Fasiaben et al., *supra* note 151, at 1068–82; RODRIGUES, BRANCALION & ISERNHAGEN, *supra* note 118, at 162.

220. LUIS FERNANDO GUEDES PINTO ET AL., IMAFLORA, INCENTIVOS PARA A CONSERVAÇÃO DE FLORESTAS: A EXPERIÊNCIA DA CERTIFICAÇÃO NO BRASIL [INCENTIVES FOR FOREST CONSERVATION: THE EXPERIENCE OF CERTIFICATION IN BRAZIL] (2014), http://www.imaflora.org/downloads/biblioteca/53dc06bcbf461_Sustentabilidade_em_debate_vol1_01_08_14.pdf [<https://perma.cc/6GNH-X2Y3>].

both voluntary and regulatory standards.²²¹ A recent study developed by the NGO Imaflora, comparing groups of certified operators to non-certified producers in their surrounding regions found that overall certified producers presented higher levels of FC compliance and maintained greater areas of native vegetation than non-certified operators, indicating that certification has played a role in shifting compliance and promoting continuous improvement.²²² Lessons learned in certification and standards implementation processes should inform adaptive management on future private and government led efforts to promote broader FC compliance in the forestry and agro-industry sectors.

V. IMPLICATIONS FOR THE BRAZILIAN AGRO-INDUSTRY SECTOR AND BIOETHANOL

Over the past three decades, Brazil has become a leading exporter of agricultural commodities²²³ and the world's second largest producer of ethanol.²²⁴ In 2013, the country was also responsible for over 25% of the global ethanol supply,²²⁵ and in 2014 its agricultural exports were more than US\$ 96.7 billion.²²⁶ In the same year, its agricultural sector produced 193 million Mg (megagrams) of cereals (including 86 million Mg of soybeans), 24 million Mg of meat, and 658 million Mg of sugarcane.²²⁷ This makes Brazil the world's largest sugarcane producer and the second largest soybean producer.²²⁸

221. Council Directive 2009/28/EC, 2009 O.J. (L 140) 16.

222. PINTO ET AL., *supra* note 220.

223. FAO STATISTICAL YEARBOOK 2013, *supra* note 1.

224. REN21, RENEWABLES 2014: GLOBAL STATUS REPORT (2014), http://www.ren21.net/Portals/0/documents/Resources/GSR/2014/GSR2014_full%20report_low%20res.pdf [<https://perma.cc/DK8D-UDTX>].

225. *Id.*

226. *Quadro de Suprimentos e Comércio Exterior*, CONAB/MAPA [NATIONAL FOOD SUPPLY COMPANY/BRAZILIAN MINISTRY OF AGRIC. AND FOOD SUPPLY], <http://www.conab.gov.br/conteudos.php?a=1538&+t=2> [<http://perma.cc/75PU-NU5M>].

227. *Pesquisa de Safras e Informações Geográficas da Agricultura Brasileira*, CONAB/MAPA [NATIONAL FOOD SUPPLY COMPANY/BRAZILIAN MINISTRY OF AGRIC. AND FOOD SUPPLY], <http://www.conab.gov.br/conteudos.php?a=1534&t=2> [<http://perma.cc/GW29-7BZ7>].

228. *See* FAO STATISTICAL YEARBOOK 2013, *supra* note 1.

While large-scale agro-industry has been a key driver of economic development in Brazil, it has come with some environmental costs. Agricultural expansion has been identified as a major contributor to the clearing of vast areas of native vegetation.²²⁹ While the expansion of cattle and soybeans production in the Legal Amazon region has been associated with deforestation of the rainforest, recent expansion of sugarcane has occurred primarily on pasture and cropland in the Cerrado and Atlantic forest biomes that were converted to agriculture many decades ago.²³⁰ In the State of São Paulo, one of Brazil's major agricultural producing regions, native forests cover less than 18% (4.3Mha) of the state's territory, and most of it (79%) is located on private lands subject to FC requirements.²³¹ Despite government efforts to improve the state's environmental protection system,

229. Sparovek et al., *supra* note 13, at 6046.

230. Bernardo F.T. Rudorff et al., *Studies on the Rapid Expansion of Sugarcane for Ethanol Production in São Paulo State (Brazil) Using Landsat Data*, 2 REMOTE SENSING 1057 (2010). Despite the general consensus that recent sugarcane expansion has taken place predominantly on pasture and cropland, a recent study developed by Picoli et al. indicates that there has actually been a significant conversion of environmentally sensitive areas to produce sugarcane in the state of São Paulo. See Picoli et al., *Sugarcane Expansion into Environmental Relevant Areas in São Paulo State* (Oct. 20-24, 2014) (Working Paper presented at the 2nd Brazilian Bioenergy Science and Technology [BBEST] Conference). Using (i) remote sensing images from 2003 to 2011 (images provided by CANASAT project); (ii) deforestation maps for the Atlantic Forest and Cerrado biomes from 2002-2008 and 2008-2009 (before and after a federal law was enacted to control deforestation in the Atlantic Forest biome) (data provided by the Ministry of Environment – MMA, 2013); and (iii) maps of environmentally relevant areas also produced by the Ministry of Environment (MMA, 2007), and considering the BIOTA-FAPESP classification for priority areas for biodiversity conservation, Picoli et al. found that recent sugarcane expansion is responsible for the conversion of about 324,037 ha of environmentally sensitive areas, out of which: (a) 21,862 ha of areas considered of high importance for biodiversity conservation, (b) 105,168 ha were of areas considered of very high importance for conservation, and (c) 197,007 ha of areas of extremely high importance for conservation. *Id.* This study also found that between 2002 and 2008, sugarcane expanded over 16,221 ha of native Cerrado vegetation and over 442 ha of native Atlantic Forest. *Id.*

231. *Sugarcane Crop Monitoring in Brazil*, CANASAT/INPE [SUGARCANE CROP MONITORING PROGRAM/NATIONAL INSTITUTE OF SPATIAL RESEARCH], <http://www.dsr.inpe.br/laf/canasat/en/tables.html> [https://perma.cc/WV48-H9XL]. According to data from the Sugarcane Crop Monitoring Program (CANASAT), in the 2012-2013 harvesting season, there were about 5.5 Mha of farmland under sugarcane crop in the state of São Paulo. *Id.*

soil degradation, water pollution, and biodiversity loss represent a continuing challenge posed by agricultural production in the region.²³² State-wide, an estimated 149 Mg of fertile soil are lost every year, 80% of the total farmland has observed high levels of soil erosion,²³³ and 850,000 Mg of fertilizers are discharged annually into the streams and rivers.²³⁴ Similar environmental issues are also observed across agricultural landscapes in other states and regions.²³⁵ The FC thus provides strategic legal instruments of environmental protection that have been used by local, states, and federal governments to revert the status of environmental degradation in rural landscapes and protect the country's pristine natural ecosystems. Although historically successful implementation of the FC has varied considerably across the country, more recently improvements have proven effective in particular agro-industries, such as the sugarcane and cattle sectors.²³⁶

Driven by domestic demand for ethanol as well as growing demand from international markets due to ethanol consumption mandates, rapid expansion of sugarcane has raised sustainability concerns, with certification being increasingly required for

232. See Wagner L. Soares & Marcelo F. Porto, *Atividade Agrícola e Externalidade Ambiental: uma Análise a partir do Uso de Agrotóxicos no Cerrado Brasileiro*, 132 CIÊNCIA & SAÚDE COLETIVA 137 (2007) (a quantitative analysis of the environmental impacts of large-scale agriculture on water and soil contamination due to massive use of agrochemicals on farmland across the Cerrado biome). For more details on soil erosion from agriculture practices in Brazil, see Luis. C. Hernani et al., *A Erosão e seu Impacto no Brasil*, in *USO AGRÍCOLA DOS SOLOS BRASILEIROS* 47 (2002). See also DA SILVA, *supra* note 8, at 64–67 (a literature review on environmental impacts of agriculture expansion on soil and water quality and quantity on the central-south of Brazil).

233. D. BERTOLINI, *MANUAL TÉCNICO DE MANEJO E CONSERVAÇÃO DO SOLO E AÇUGUA EMBASAMENTO TÉCNICO DO PROGRAMA EETADUAL DE MICROBACIAS HIDROGRÁFICAS* 15 (1993).

234. *Id.*

235. See, e.g., GOVERNO DO ESTADO DE SÃO PAULO, *MEIO AMBIENTE PAULISTA: RELATÓRIO DE QUALIDADE DO MEIO AMBIENTE* (2012), http://arquivos.ambiente.sp.gov.br/cpla/2013/01/RQA_2012.pdf [<https://perma.cc/5VCN-UP5U>].

236. Pedro H.S. Brancalion & Ricardo R. Rodrigues, *Implicações do Cumprimento do Código Florestal Vigente na Redução de Áreas Agrícolas: Um Estudo de Caso da Produção Canavieira no Estado de São Paulo*, 10 BIOTA NEOTROPICA 63 (2010).

market access.²³⁷ Therefore, in addition to government land-use regulations such as the FC, sustainability standards and certification have been important forces shaping the sugarcane sector.

In response to market demand, São Paulo's sugarcane sector has moved forward in promoting implementation of compliance programs to observe FC requirements.²³⁸ As part of their efforts, both the industry and growers have committed to restore more than 265,000 hectares of APP riparian areas on sugarcane fields.²³⁹ Restoration efforts have taken place primarily on lands owned or contracted by sugarcane mills but have also been extended to lands owned and managed by independent suppliers.²⁴⁰ Although the statutory responsibility of environmental obligations fall exclusively on landowners, the sugarcane industry has voluntarily established environmental partnerships with sharecroppers and lessees to restore APP and LR areas on contracted lands and on some independent suppliers' land.²⁴¹ As part of the agreement, the industry has committed to

237. See, e.g., Council Directive 2009/28/EC, 2009 O.J. (L 140) 16-62; Decreto No. 6.961, de 17 de Setembro de 2009 (Braz.); *Projeto Etanol Verde*, GOVERNO DO ESTADO DE SÃO PAULO, <http://www.ambiente.sp.gov.br/etanolverde> [<https://perma.cc/74EP-GQRA>]. From 2003 to 2013, total cropland devoted to sugarcane almost doubled in the state, from 2.8Mha to 5.4Mha. *Área Plantada com cana-de-açúcar, 2003-2013*, UNICA [BRAZILIAN SUGARCANE INDUSTRY ASS'N], <http://www.unicadata.com.br/historico-de-area-ibge.php?idMn=33&tipoHistorico=5&acao=visualizar&idTabela=1792&produto=%C3%81rea+Plantada&anoIni=2003&anoFim=2013&estado=SP> [<https://perma.cc/V55A-BGDZ>].

238. GOVERNO DO ESTADO DE SÃO PAULO, *supra* note 235.

239. *Id.*

240. *Id.* at 208. The majority of the land used to produce sugarcane in the state of São Paulo is either owned or managed by sugarcane mills (77%), while the remaining 23% are owned or managed by independent suppliers. *Id.*

241. See UNICA, 2010 RELATÓRIO DE SUSTENTABILIDADE 111 (2010), [<https://perma.cc/7C8M-NBYZ>]. See generally Rodrigues et al., *supra* note 147. Generally, as part of the agreement mills are in charge of providing the material inputs and technical assistance farmers need to implement FC compliance programs. *Id.* Yet, landowners have usually to pay back the costs of restoration based on the terms established in the sharecropping/leasing contract. *Id.* Since the law governing these contracts (Land Statute) recognizes the landowner's exclusive liability with respect to environmental obligations, agro-industries such as sugarcane mills can voluntarily decide whether to assist their sharecroppers and lessees. C.FLOR, art. 2, § 2. This is an example of an outdated law that although had an original intent of protecting the powerless land-operators in a period where those were represented by rural workers, more recently it has been

donate 100,000 native plants annually to sharecroppers, lessees, and suppliers, a key component in restoration projects.²⁴²

The state government has also made some efforts to promote sustainability and improve FC compliance among São Paulo's sugarcane producers. Among these initiatives are the design of the state Sugarcane Agro-environmental Zoning (ZEA-Cana) and the voluntary Green Ethanol Program (Programa Etanol Verde), which establish, respectively, areas that are off-limits for sugarcane expansion and sustainability requirements for the sugarcane industry and growers.²⁴³ São Paulo also has one of the most effective environmental monitoring systems in Brazil, which has played an important role in the process of promoting broader implementation of environmental legislation.²⁴⁴ A study measuring compliance levels of 1,961 sugarcane landholdings in the state (using the 1965 FC requirements) found that, on average, 10.4% of the farm's total area were classified as APP and only 21.2% of them were illegally occupied by some kind of agricultural production.²⁴⁵ The same study found that, on average, there was a 6.4% deficit in LR compliance (compared to

used to exempt large-scale agro-industry operators, such as sugarcane mills, from environmental and social obligations attached to the land they contract. Although a large portion of land continues to be concentrated on the hands of traditional rural elites (*latifúndios*, which are, by definition, large non-productive landholdings), medium and small landholdings have multiplied around the country, creating new paradigms for land-use policies in Brazil. Maria de N. B. Wanderley, *A Valorização da Agricultura Familiar e a Reivindicação da Ruralidade no Brasil*, DESENVOLVIMENTO E MEIO AMBIENTE 29 (2000). Small and medium farmers have become important actors in the Brazilian rural economy. *Id.* These changes in land distribution and tenure systems over the past decades have created some loopholes in the law, which requires urgent reform to adapt it to the new realities and avoid legal uncertainty. Therefore, the establishment of a joint liability from land related social, economic, and environmental obligations to both land-owners and land-operators seems to be more appropriate for Brazil's new agrarian context.

242. *Id.*

243. *Zoneamento Agroambiental para o Setor Sucroalcooleiro*, SMA [SECRETARIA DO MEIO AMBIENTE DE SÃO PAULO] [SÃO PAULO SECRETARY OF ENV'T], <http://www.ambiente.sp.gov.br/etanolverde/zoneamento-agroambiental/> [<http://perma.cc/T2S3-NY8L>].

244. Paulo C.V. Guimarães et al., *Fiscalização do Meio Ambiente no Estado de São Paulo*, 31 REVISTA DE ADMINISTRAÇÃO PÚBLICA 96 (1997).

245. RODRIGUES, BRANCALION & ISERNHAGEN, *supra* note 118, at 63.

the 20% level set in the FC).²⁴⁶ These results indicate that full implementation of the FC requirements in sugarcane landholdings is achievable without major impacts on production, particularly after the 2012 revisions, which facilitate even more compliance.²⁴⁷ Furthermore, considering that most sugarcane producing areas are within the same biome (Cerrado), great potential exists for producers to compensate deficits in LR through the CRA trading system and improve their level of compliance with the FC even more.²⁴⁸

Examples of successful implementation of the FC can also be found in the cattle and meat sector. In the State of Pará, one of the hotspots of Amazon deforestation, the municipality of Paragominas has established public-private partnerships to promote implementation of the FC, and is changing paradigms in cattle ranching systems in Brazil.²⁴⁹ Paragominas is a traditional cattle production region in Pará, which used to report one of the highest rates of rainforest deforestation in the country (more than 50km²/year).²⁵⁰ In 2008, together with more than 30 other municipalities, Paragominas was listed in the deforestation blacklist created by the Ministry of Environment (MMA).²⁵¹ As a result, many cattle ranchers had their land embargoed by IBAMA, were banned from accessing credit lines, and had their contracts with major meat retailers terminated.²⁵² Following these events, cattle ranchers, processors, and large retailers operating in the region signed an agreement (*Termo de Ajuste de Conduta*) with the State Public Prosecutor, committing to reverse

246. *Id.*

247. *Id.*

248. *Id.*

249. See *Paragominas, no PA, Vira Exemplo de Desenvolvimento Sustentável*, GLOBO RURAL (Sept. 9, 2012), <http://g1.globo.com/economia/agronegocios/noticia/2012/09/paragominas-no-pa-vira-exemplo-de-desenvolvimento-sustentavel.html> [https://perma.cc/9GJ9-5BG3].

250. *Id.*

251. *Id.* According to data from the Secretary of Environment of the State of Pará, 105 municipalities are currently participating in the Programa Município Verde in the state. For more information, see GOVERNO DO PARÁ, PROGRAMA MUNICÍPIOS VERDES: LIÇÕES APRENDIDAS E DESAFIOS PARA 2013/2014, <https://docs.google.com/file/d/0B4LOtiMjnDenV2pFdVhzdUpKekU> [https://perma.cc/A2MA-R5KM] [hereinafter PROGRAMA MUNICÍPIOS VERDES].

252. *Id.* at 8.

the levels of deforestation and bring their lands into compliance with the FC, which included the obligation to register their properties in the CAR.²⁵³ In order to meet these requirements, in 2009, the local government launched the Green County Project (Programa Município Verde) in partnership with the Local Farmers Union (Sindicato de Produtores Rurais de Paragominas, SPRP) and NGOs.²⁵⁴ The successful implementation of the Green County Project resulted in Paragominas becoming the first municipality to be taken off of the MMA blacklist in March 2010.²⁵⁵ The municipality has also achieved one of the highest levels of registration with the CAR with more than 80% of the local landholdings registered.²⁵⁶ This inspired the local government to launch the Green Livestock Project in 2011, an initiative that combines improvements in productivity with the implementation of best management practices in order to boost the economic and environmental performances of local cattle ranchers.²⁵⁷ The Green Livestock Project has been implemented by the local farmers union in partnership with the NGOs Imazon and The Nature Conservancy, and with the support and expertise of researchers and practitioners from Esalq/USP (Luiz de Querioz College of Agriculture/University of São Paulo) and UNESP (Universidade Estadual Paulista).²⁵⁸

These are only few examples of on-going efforts to promote FC implementation across the country. Despite progress in implementation observed in some sectors and regions, the promotion of conservation goals along the agricultural frontier, where natural lands are mostly under pressure, remains a

253. *Id.* at 7.

254. *Id.*

255. *Id.* at 22. Deforestation rates by municipality reported by INPE/PRODES showed a 43% reduction in 2008, and 83% in 2009. *Desmatamento nos Municípios*, DIVISÃO DE PROCESSAMENTO DE IMAGENS, <http://www.dpi.inpe.br/prodesdigital/prodesmunicipal.php> [<https://perma.cc/D86Z-WD9J>].

256. MAURO O. PIRES & VALMIR G. ORTEGA, CONSERVAÇÃO INTERNACIONAL, O CADASTRO AMBIENTAL RURAL NA AMAZÔNIA 25 (2013), <http://inovacar.org.br/uploads/documents/O%20Cadastro%20Ambiental%20Rural%20na%20Amazonia.pdf> [<https://perma.cc/S86V-FU4M>].

257. PROGRAMA MUNICÍPIOS VERDES, *supra* note 251.

258. *Id.* at 19.

challenge for the government.²⁵⁹ In the state of São Paulo, for example, as of 2013 only 65,530 hectares of private land had been set aside and registered as LR, according to an Environmental Quality Report issued by the State Secretary of Environment.²⁶⁰ Therefore, in agriculture intensive areas where the general mechanisms of compliance may not provide sufficient incentives for landowners, other public and private initiatives may enable cost-efficient FC implementation. Among these efforts are the restoration of degraded pastureland under the Brazilian Low Carbon Agriculture Plan (Plano Setorial de Mitigação e de Adaptação às Mudanças Climáticas para a Consolidação de uma Economia de Baixa Emissão de Carbono na Agricultura, hereinafter *Plano ABC*), improvements in productivity in the livestock and meat sector, the identification of areas with low suitability for agriculture that should be preferably devoted to FC compliance,²⁶¹ and the process of mechanization in the sugarcane sector.

Launched in 2010, the *Plano ABC* aims to promote the adoption of low-carbon intensive and sustainable practices in the agricultural sector in order to help Brazil achieve its GHG emissions reduction targets.²⁶² As one of its program strategies, *Plano ABC* has set an initial goal to restore 15Mha of degraded pasture that can be devoted to meet increasing demand for land in the agricultural and bioenergy sectors while reducing pressure over pristine lands.²⁶³ Other strategies in the Plano ABC include

259. Sparovek et al., *supra* note 13, at 6046.

260. GOVERNO DO ESTADO DE SÃO PAULO, RELATÓRIO DE QUALIDADE AMBIENTAL – 2014 172 (2014), http://arquivos.ambiente.sp.gov.br/cpla/2014/06/RQA_2014.pdf. Proportionally, this is less than 1% of the total land area under private ownership in the State of São Paulo (16.9 Mha). 2006 CENSUS, *supra* note 10.

261. Areas with low suitability for agriculture are, by definition, slope terrains of between 13 to 45 degrees of inclination, mostly identified as low productivity pastureland. LAURO CHARLET PEREIRA & FRANCISCO LOMBARDI NETO, AVALIAÇÃO DA APTIDÃO AGRÍCOLA DAS TERRAS: PROPOSTA METODOLÓGICA 26 (2004).

262. Decreto No. 7.390, de 9 de Dezembro de 2010, art. 3 (Braz.).

263. ANTÔNIO EUSTÁQUIO ANDRADE FERREIRA & GILBERTO JOSÉ SPIER VARGAS, PLANO SETORIAL DE MITIGAÇÃO E DE ADAPTAÇÃO ÀS MUDANÇAS CLIMÁTICAS PARA A CONSOLIDAÇÃO DE UMA ECONOMIA DE BAIXA EMISSÃO DE CARBONO NA AGRICULTURA: PLANO ABC (AGRICULTURA DE BAIXA EMISSÃO DE CARBONO) 19 (2012).

(1) the establishment of crop-livestock-forest integration systems and agro-forestry systems; (2) the dissemination of no-tillage practices; (3) the promotion of biological fixation of nitrogen; (4) the expansion of planted forests; (5) the efficient treatment of animal waste; and (6) climate change adaptation strategies. Improvements in productivity are also expected to mitigate the challenges in implementing the FC, increasing production without increasing the demand for land.²⁶⁴ Compared to international standards, cattle stocking rates are particularly low in Brazil with an average of 1.11 head/ha.²⁶⁵ If the current level of productivity is maintained, the Brazilian cattle sector would need 207 Mha of pasture land to meet the global demand for meat by 2030.²⁶⁶ Alternatively, if investments in productivity are made, only 138Mha of the total land currently devoted to livestock production in the country would be required to meet global demand by 2030.²⁶⁷ Therefore, there is huge potential for converting low-productivity pastureland to agriculture and other productive land use systems, land that could also be used to meet FC compliance.²⁶⁸

264. See DA SILVA ET AL., *supra* note 8, at 36. Three strategies can be used to increase productivity in the livestock sector: (a) restoration of degraded pastureland; (b) implementation of management strategies that lead to improvements in stocking rates; (c) promote the implementation of integrated crop-livestock production systems. *Id.* These strategies combined would lead to a reduction in the projected amount of land demanded for livestock by 2030 from 207 Mha (business as usual) to approximately 138Mha (high productivity and low carbon emission scenario) *Id.*

265. 2006 CENSUS, *supra* note 10.

266. See DA SILVA ET AL., *supra* note 8, at 36.

267. *Id.*

268. Alberto G.O.P. Barreto et al., *Agricultural Intensification in Brazil and its Effects on Land-use Patterns: an Analysis of the 1975-2006 Period*, 19 GCB BIOENERGY 1804 (2013) (this study suggests that the combination of productivity improvements and public policy interventions to curb conversion of native vegetation to agriculture has led to a contraction or stability of total farmland in the Central-South, and significant reduction in deforestation in recent years, despite of rising food commodity prices in the international market. From 1975 to 2010, the area used for grains increased by 45.6%, but the production increased 268%, almost six times more than the planted area. In the same period, however, the study revealed an expansion and gradual movement of the agricultural frontier towards the interior, center-western Cerrado of Brazil, where no economic incentives and institutional support exist to help producers improve their productivity, and the level of governance and law enforcement is too low, which contributes to the scenario, although changes

It is estimated that 76% of Brazil's suitable land for agriculture presents some kind of restriction due to soil limitation or terrain inclination, a condition that requires appropriate land-use planning and the adoption of conservation management strategies.²⁶⁹ Cost-efficient land-use planning may take into consideration variations on land productive potential, actual status of degradation, and the environmental and socioeconomic dimensions of patterns in land-use, characterized regionally by different forms of land-use pressure. Following this approach, areas with the lowest suitability for agriculture should be preferably taken out of production and be devoted to more cost-efficient land-uses, which may include FC conservation measures. Currently, areas with low suitability for agriculture generate, on average, an annual gross income of R\$ 150/ha (US\$ 55/ha).²⁷⁰ Recent estimates suggest that if these areas were set aside and managed as LR with the use of high commercial value timber, they would generate R\$ 188.59/ha (US\$ 69) in the first year.²⁷¹ This revenue would triple by the seventh year to total R\$ 416.84/ha (US\$ 153.81/ha), all while using less work force.²⁷² Considering that these estimates only measure the economic returns from timber products, additional revenue may accrue if the LR management plan also combines the production of non-timber products (e.g., fruits and honey). Moreover, the landowner may also be entitled to PES transfers from the ecosystem services provided by the forest reserve and can also participate in CRA trading systems if he or she opts to set aside land beyond FC requirements. Different land-use strategies can take place at the individual farm level depending on a multitude of factors. Hence, in order to assist Brazilian farmers in transitioning to a more

have been made more recently); Lywood et al., *The Relative Contributions of Changes in Yield and Land Area to Increasing Crop Output*, 1 GCB BIOENERGY 360 (2009); ICONE [INSTITUTO DE ESTUDOS DO COMÉRCIO E NEGOCIAÇÕES INTERNACIONAIS] [INSTITUTE FOR INT'L TRADE NEGOTIATIONS], SIMULATING LAND USE AND AGRICULTURE EXPANSION IN BRAZIL: FOOD, ENERGY, AGROINDUSTRIAL AND ENVIRONMENTAL IMPACTS (2011), http://www.iconebrasil.com.br/datafiles/publicacoes/artigos/2002/simulating_land_use_and_agriculture_expansion_in_brazil_0902.pdf [<https://perma.cc/A3HE-F448>].

269. DA SILVA ET AL., *supra* note 8, at 143.

270. Fasiaben, *supra* note 151, at 1079.

271. *Id.* at 1079.

272. *Id.*

profitable and sustainable agriculture, appropriate institutional and technical capacity must be developed and provided to landowners to promote a widespread adoption of multifunctional land-use planning and best management practices.

In the sugarcane sector, policy efforts to phase-out pre-harvest burning practices and promote mechanization is estimated to shift sugarcane from non-mechanizable areas.²⁷³ Estimates suggest that around 45% of the land used to produce sugarcane is not suitable for the use of commercially available harvesting machine designed to operate in terrains of up to 12 degrees of inclination.²⁷⁴ Although parts of these lands are expected to continue producing sugarcane—given current investments in technology to develop new harvesters compatible with slop terrains²⁷⁵—some sugarcane producers have considered shifting these areas to alternative land-uses. These include uses that do not require mechanization such as forestry plantations and may also accommodate FC conservationist measures.²⁷⁶ However, it remains too early to determine whether and how much of those lands will actually be used for agricultural expansion and FC compliance programs.

On top of legal requirements, market forces are also expected to drive FC implementation as well as wide adoption of the CAR,

273. O. Braunbeck et al., *Prospects for Green Cane Harvesting and Cane Residue Use in Brazil*, 17 BIOMASS & BIONENERGY 495, 499 (1999).

274. *Id.*; see also OLIVEIRA & BRAUNBECK, DEMANDA DA FORÇA DE TRABALHO NA CANA-DE-AÇÚCAR SEGUNDO DIFERENTES SISTEMAS DE COLHEITA, CONGRESSO BRASILEIRO DE ENGENHARIA AGRÍCOLA 33 (2004).

275. *Mechanical Processes for Agricultural Operations*, CTBE [BRAZ. BIOETHANOL SCIENCE AND TECH. LABORATORY] <http://ctbe.cnpem.br/en/research/mechanical-processes-agricultural-operations/> [<https://perma.cc/63JP-8AFA>]. A group of scientists led by Prof. Oscar Braunbeck from CTBE, a government funded research institute, in partnership with Agricef (a private agricultural technology company) and the University of Campinas (Unicamp), have designed a Controlled Traffic Structure (ETC) with the goal of reducing soil compaction, increase productivity and save transport fuel during the harvesting process of sugarcane fields. *Id.* The ETC machine is adapted to harvest sugarcane and other crops on slop terrains of up to 19% inclination, and it was also designed to carry-on other crop management operations such as preparing the soil prior cropping, as well as planting and applying fertilizers. *Id.* The ETC is currently being tested on the field and is expected to become commercially available by 2018. *Id.*

276. See generally Pedro H.S. Brancalion et al., *Finding the Money for Tropical Forest Restoration*, 63 UNASYLVA 41–50 (2012).

as has happened with wood products.²⁷⁷ For example, many companies might opt to only buy products from farmers that are registered with the CAR, potentially hampering sales from non-compliant farmers. Moreover, access to international markets are increasingly relying on certification of sustainable practices and products. In Brazil, sustainability concerns have stood in the way of agricultural exporters, particularly sugarcane ethanol producers, who have been required to observe specific environmental standards, including the assessment of their carbon footprint and no use of high conservation value land for biofuels feedstock production.²⁷⁸ The European Union, for example, requires formal verification of compliance by a third-party certification scheme.²⁷⁹ Bonsucro, RSB, and ISCC are voluntary certification schemes recognized under the E.U. Renewable Energy Directive to verify Brazilian ethanol producers' compliance with the E.U. standards.²⁸⁰ Forty six ethanol refineries and mills are currently certified by Bonsucro in the country.²⁸¹

Furthermore, because producers are also required, as a baseline condition, to demonstrate full-compliance with all national, state, and local legislation, verification of compliance with the FC is directly relevant to these certification schemes' efforts and may shift compliance. Such forces may also shape how a growing production of biodiesel evolves. However, even though conservation policies are an important piece in the process of achieving broader sustainability goals on the ground, certification bodies' interaction with local government institutions in charge of FC implementation has been limited despite an increasing recognition of the important role of third-party certification in

277. *Id.*

278. See Council Directive 2009/28/EC, 2009 O.J. (L 140) 17.

279. *List of Approved Voluntary Schemes*, EUR. COMMISSION, <https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/voluntary-schemes> [<https://perma.cc/AV3C-KY3W>].

280. *Certified Mills*, BONSUCRO, <https://www.bonsucro.com/en/certified-businesses/> [<https://perma.cc/WD7K-NZWB>].

281. *Bonsucro in Numbers*, BONSUCRO, <http://bonsucro.com/site/in-numbers/> [<https://perma.cc/J93A-JFHQ>].

promoting implementation of both statutory and voluntary standard requirements.²⁸²

VI. CONCLUSION

Although environmental advocates have strongly criticized the 2012 revisions, arguing that they largely reduce the FC's level of environmental protection when compared to voluntary approaches taken in the U.S. and the E.U., the Brazilian Forest Code is a unique example of the use of federal policy to promote large-scale environmental protection and land conservation on private lands. However, implementing a land conservation policy of this scale and complexity is an inherently challenging and controversial process, which continues to trigger heated debates about the role of law and policy in limiting private land use rights to achieve conservation goals.

Despite historical disagreements between agro-industry and environmental lobbyist groups, the government has great expectations that the 2012 revisions and emerging incentive schemes will yield broader compliance with the Code. By lowering the set-aside requirements and extending the compensation possibilities, the new Brazilian Forest Code may provide a more feasible approach to improving the levels of compliance, although additional mechanisms are likely to be required to achieve the nation's conservation goals in areas where natural land is presently under highest pressure from agriculture expansion. In such areas, the FC may couple with increases in productivity and growing market pressures for sustainable production.

Many producers have moved to take land out of production to set-aside as APPs and LR. That is not to say, however, that compliance programs have not come at a great cost, which small farmers find particularly difficult to bear. Nevertheless, efforts made by more proactive producers, such as the sugarcane and the livestock sectors, could influence and inform other landowners when implementing FC's Environmental Compliance Programs to promote cost-efficient restoration projects that achieve real ecological improvements on the ground. Public-private

282. L.K. McAllister, *Regulation by Third-Party Verification*, 53 B.C. L. REV. 1 (2012).

partnerships are also crucial in this process, and large agro-industry players can play an important role in developing contractual partnerships with their feedstock providers for the restoration of FC set-asides. On the other hand, clear economic incentives also need to be established to promote landowners' engagement in compliance efforts.

Furthermore, if successfully implemented, the CAR will generate big data that will help government agencies monitor implementation of the FC. Enforcement agencies in Brazil will be able to draw on large-scale geographic information systems and georeferenced data mapping properties across the country, changing their ability to monitor and penalize, which will provide a clear incentive for landowners to seek compliance. Moreover, it will allow researchers to develop more robust and detailed quantitative analysis on the effects of public conservation and land use policies such as the Forest Code. However, with important regulation still pending approval, including states guidelines for their environmental compliance programs and economic incentives for compliance, it remains to be seen if initial promises of broader implementation will ultimately become a reality.