



**CHALLENGES AND OPPORTUNITIES**

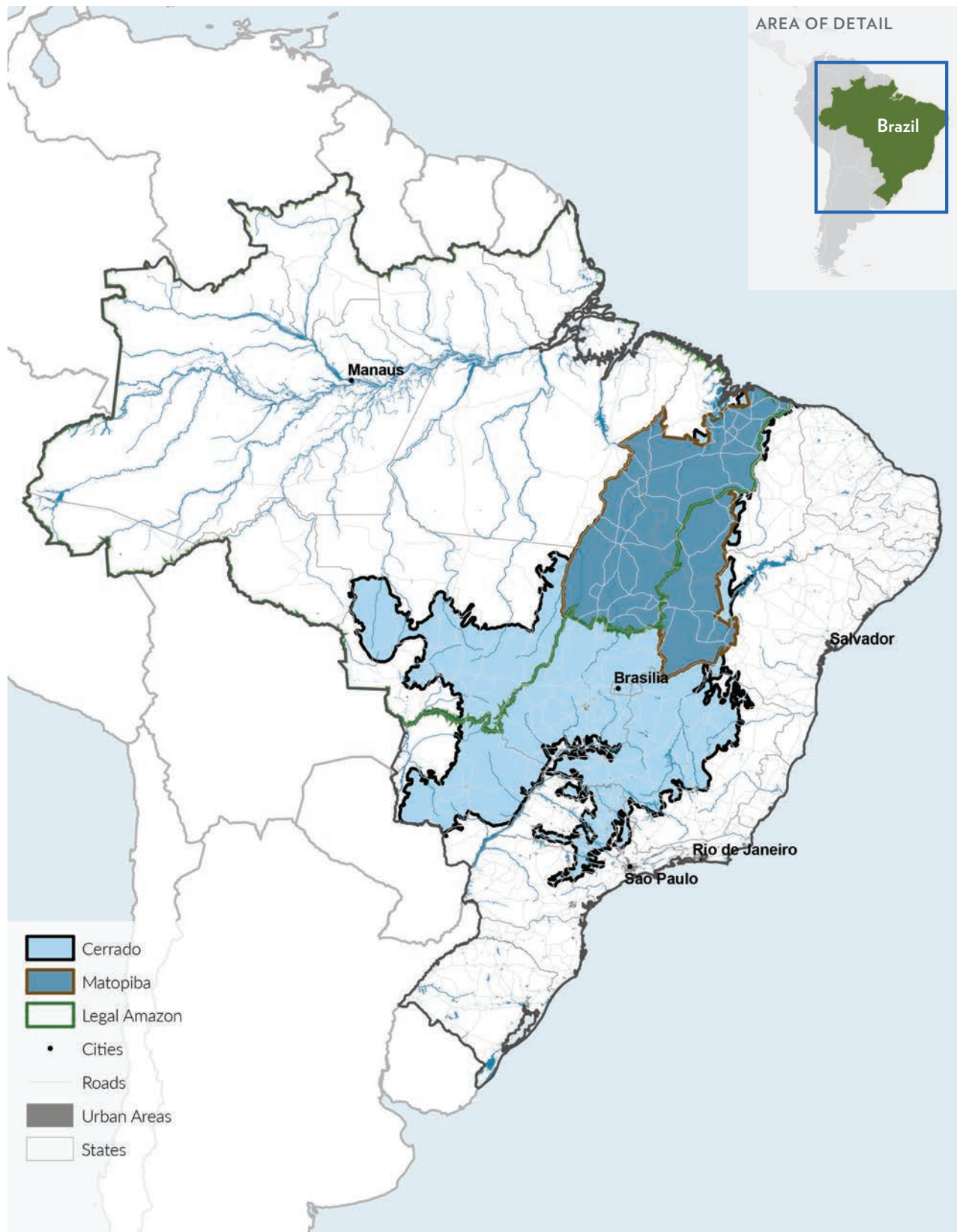
**FOR CONSERVATION, AGRICULTURAL PRODUCTION,  
AND SOCIAL INCLUSION IN THE**

# **CERRADO BIOME**

An assessment developed for  
the Climate and Land Use Alliance by CEA Consulting

August 2016

MAP 1: BRAZIL'S CERRADO BIOME



Sources:

Reference layers: <http://www.naturalearthdata.com/>

Matopiba: [http://www.ibge.gov.br/english/geociencias/default\\_prod.shtm](http://www.ibge.gov.br/english/geociencias/default_prod.shtm)

Cerrado Biome: <http://maps.lapig.iesa.ufg.br/lapig.html>



Photo: CEA

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# ABOUT THIS REPORT

**This document outlines a set of opportunities that can contribute to conservation of biodiversity and ecosystems, growth in agricultural production, and support for social inclusion and traditional livelihoods in Brazil's Cerrado biome for the future of the region. It was prepared by CEA Consulting at the request of the Climate and Land Use Alliance (CLUA), a philanthropic collaborative of the ClimateWorks Foundation, the Ford Foundation, the Gordon and Betty Moore Foundation, and the David and Lucile Packard Foundation. It was supported by the Gordon and Betty Moore Foundation and the ClimateWorks Foundation. The intended audience for this report is the full range of stakeholders working in the Cerrado biome; the recommendations included here are not designed for any particular actor and in fact would necessarily need to be undertaken by many different actors.**

This report was developed through an extended research and consultation process, lasting from early 2015 to mid-2016. We reviewed dozens of publications, drew from a broad set of data sources, conducted roughly one hundred expert interviews, consulted with approximately fifty stakeholders through three separate review workshops, and conducted site visits. The authors are solely responsible for the report's content, including any errors. However, the report would not have been possible without the many people who contributed to this project, and we extend our warmest gratitude for their help.

This document is accompanied by several supporting documents that the authors hope will provide a repository of information on the Cerrado biome. These materials specifically address and include:

- Biodiversity
- Hydrology
- Trends in deforestation and associated carbon emissions
- Social and political contexts
- Trends in the agricultural sector
- Funding sources
- Corporate deforestation commitments
- Maps of the region

These materials can be found at:  
[www.climateandlandusealliance.org/reports/cerrado/](http://www.climateandlandusealliance.org/reports/cerrado/)

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## EXECUTIVE SUMMARY

**The Cerrado biome is a dynamic, mosaic landscape that spans the center of Brazil. It is one of the largest and most biologically diverse tropical savannas in the world, has a rich social and cultural history, is home to a wide variety of indigenous peoples and traditional communities, and is an important region for the provisioning of freshwater across Brazil.**

Since the 1970s, agribusiness has been steadily expanding across the Cerrado biome, contributing to Brazil's emergence as a global leader in agricultural commodity production. As a result, nearly half the biome has been deforested.<sup>1</sup> Continued agricultural productivity within the Cerrado that supports economic development and also works in harmony with thriving traditional livelihoods and conservation of native habitat is important for the long-term health and prosperity of the biome. Achievement of these multiple objectives will be challenging and will require a significant increase in resources, attention, and political will devoted to the region; however, the tools and frameworks exist to achieve this vision. The health and prosperity of the Cerrado biome is a matter of national importance. Given the central role that the Cerrado plays in food and water security and the region's rich social diversity and cultural heritage, the Cerrado agenda cannot be separated from the national agenda.

Today, Matopiba—the northern portion of the Cerrado where the majority of the biome's intact native habitat is found—is one of the primary agricultural frontiers in Brazil.<sup>2</sup> This landscape is the last great expanse of the Cerrado biome that has not been converted to large-scale mechanized agriculture. The Ministry of Agriculture (MAPA) is actively supporting the growth of the agriculture

and livestock sectors in the region through the Agricultural Development Plan Matopiba (PDA-MATOPIBA) (Decree 8447, May 2015). Although the details of this plan have not yet been formalized, it clearly aims to spur growth in large-scale agriculture in the region, primarily through expansion of transportation infrastructure. It has been heavily criticized by civil society organizations for being formulated with limited consultation and transparency and for not including social and environmental representation on its governing body.<sup>3</sup> (See callout box on next page.)



Photo: CEA

1. Rene Beuchle et al., "Land Cover Changes in the Brazilian Cerrado and Caatinga Biomes from 1990 to 2010 Based on a Systemic Remote Sensing Sampling Approach," *Applied Geography* 58 (2015): 116–127.

2. Matopiba is named for the initial letters of the states that compose the region: Maranhão, Tocantins, Piauí, and Bahia.

3. Talise Rocha, "Plano para Desenvolvimento Agropecuário no Matopiba e Questionado," *Observatorio ABC*, October 2015.

4. Critical Ecosystem Partnership Fund (CEPF), "Ecosystem Profile: Cerrado Biodiversity Hotspot," April 2016.

5. Agroecology is the integrative study of the ecology of the entire food system, encompassing ecological, economic, and social dimensions. Charles Francis et al., "Agroecology: the Ecology of Food Systems," *Journal of Sustainable Agriculture* 22, no. 3 (2003): 99–118.

PDA-MATOPIBA aims to boost the trend seen over the last several years of large-scale agribusinesses advancing into the region to produce soy and other agricultural commodities for export. At the same time, another vision for this landscape is being championed by the traditional cultures and historical communities of the Matopiba region (e.g., indigenous people, quilombolas, extractivists, geraizeiros, ribeirinhos, and family farmers). This vision is for the continued development and economic flourishing of a wide diversity of agricultural systems across the landscape. Most of these systems are small in scale, have been practiced in the region for generations, operate in accordance with the principles of agroecological production,<sup>5</sup> and coexist well with natural habitat in complex mosaics. These communities, their lands, and their way of life are threatened by PDA-MATOPIBA and by the expansion of large-scale agriculture generally.

To build toward a future Cerrado that maintains ecological integrity, biodiversity, carbon stores, and a diversified set of agricultural systems, the expansion of large-scale agriculture needs to be both constrained and guided to areas where it will displace the least biologically and socially valuable resources. Careful planning for the region should allow for large-scale agriculture to grow and contribute to rural economic development in a way that harmonizes with other uses of the landscape and other economic development pathways.

This report outlines five high-level strategies that, if implemented together, can support multiple uses of the land. These strategies require:

- compliance with existing environmental and community rights laws;
- reconciliation of long-standing land claims and disputes;
- official recognition of traditional people's and rural communities' claims over lands and territories;
- secure land tenure for both private owners and communities;
- improved management of existing conservation units (including sustainable use and full protection);
- robust implementation of agribusiness commitments to zero- or zero-net-deforestation supply chains;
- support for traditional agriculture and agroecological practices and markets;
- expansion of low-carbon agricultural practices and sustainable intensification of pasturelands; and
- continuous improvements to monitoring and mapping of natural resources in the Cerrado (including forests, native vegetation, soils, biodiversity, and water).

Effective implementation of these strategies depends upon leadership, collaboration, and commitment—across a range of government, private sector, community, and civil society stakeholders. It will not be easy, especially given the current instability in Brazil's political and economic climate. Yet together, the strategies have the potential to create a resilient landscape that balances social and environmental needs with the economic potential of the region.

## Geographic focus of these recommendations

Because of the current acute vulnerability of the Matopiba region, we recommend prioritizing conservation and social inclusion investments there and have focused much of this report on that region. However, all of the strategies included in this report can be applied to the entire Cerrado biome. Of the strategies highlighted in this report, the most relevant for the non-Matopiba portions of the Cerrado are 1) strong implementation of the Forest Code, 2) improved sustainability and productivity of existing agricultural lands and pasturelands, and 3) building the case for biodiversity and landscape conservation. Because the southern and western portions of the Cerrado have such significant legal reserve debts (see definition on page 18), compliance with the Forest Code will be a major driver for restoration. Restoration in these areas will produce very

significant benefits for biodiversity, water protection, carbon sequestration, and agroextractivist communities. Restoration in the southern part of the biome is an important adaptation strategy since species' ranges are expected to shift to the south and east as a result of climate change.<sup>4</sup> Because the southern and western parts of the Cerrado also have so much land in agricultural production already, efforts to improve sustainable management of these lands (e.g., through pasture intensification and adoption of low-carbon or agroecological practices) will be more widely applicable than in Matopiba. Finally, because the Cerrado plays such an important role in the provisioning of water across the biome, the fifth strategy covered in this report must be undertaken at a biome scale, not just in Matopiba.

## PRIORITY 1

# Strong implementation of the Forest Code

## *Ensuring the legal protection of natural ecosystems on private lands*

Brazil's new Forest Code (Law 12.651/2012) is the leading environmental policy in Brazil, governing management of native habitat and land use on all land holdings. Although the new Forest Code reduced the previous restoration requirement, providing amnesty to many producers, it also introduced new mechanisms for better compliance and for trading of legal reserves. Even with the reduced requirements, compliance with the law will restore 21 million hectares (Mha) of previously cleared land and provide greenhouse gas (GHG) mitigation of between 7 and 11 Gt of carbon dioxide equivalent (CO<sub>2</sub>e).<sup>6</sup>

## **Complete, timely, and equitable implementation of the Rural Environmental Cadaster (CAR) is essential for successful enforcement of the Forest Code.**

The CAR, a database that will hold information about the environmental characteristics of individual properties, is the first step in Forest Code implementation. It is the top priority for a number of federal, state, and local agencies, led by the Ministry of the Environment (MMA), as well as the main sources of international funding to the Cerrado (e.g., the World Bank's Forest Investment Program (FIP)). As of May 2016, roughly 91 percent of all rural areas were registered in the CAR.<sup>7</sup> Although this represents good progress, more time is needed to complete registrations, especially for smallholders. Many small-scale producers don't have the resources to complete their registration, and there are technical challenges with registering rural settlements and other types of communally owned land in the CAR. Two recent provisional measures have extended the deadline. In May 2016, a provisional measure (PM No. 724) extended the registration deadline for smallholders to May 5, 2017 and in June 2016, a provisional measure (PM No. 733) extended the deadline for all rural properties to December 2017.<sup>8</sup> Although

6. Britaldo Soares-Filho et al., "Cracking Brazil's Forest Code," *Science* 344 (April 2014).

7. Serviço Florestal Brasileiro, "Cadastro Ambiental Rural: Boletim Informativo," May 2015.

8. Canal Rural, "CAR is extended to all producers," June 15, 2016 and Serviço Florestal Brasileiro, "Pequenos Poderão Fazer CAR Até Maio de 2017," May 5, 2016.



Photo: CEA

these extensions are necessary to ensure that small landholders are included in the CAR, delays also pose a risk of paralysis.

## **Effective CAR validation and development of sound restoration and compensation platforms is necessary.**

The validation of CAR registries and the resolution of conflicts within the CAR are critically important steps that need to be undertaken before further compliance actions are taken. Given that these responsibilities will fall to state-level agencies that often have limited capacity, the validation process could also stymie implementation of the Forest Code. Technical support to the relevant state agencies from the federal government and international donors is essential. At the same time, continued groundwork must be laid and momentum built to ensure effective compliance with the Forest Code once the roster of legal reserve debts and surpluses is documented and validated. To that end, the guidelines and regulations that will shape restoration and compensation activities require careful design to deliver conservation outcomes while being economically viable for producers.

## **Launch of the satellite monitoring systems for the Cerrado is essential.**

The PRODES and DETER systems that provide satellite monitoring for the Amazon have been essential to the rapid reduction in deforestation in that biome over the last decade. Comparable satellite monitoring systems that provide both annual deforestation data and deforestation monitoring on a month-to-month timescale have been pledged for the Cerrado, with support coming from the FIP. This level of monitoring, along with CAR registrations, will provide the information needed to track Forest Code compliance in the Cerrado. However, the monitoring systems are now several years overdue; timely completion and launch is important to the success of the Forest Code.

## PRIORITY 2

# Protection and management of community and conservation lands

*Recognition and titling of traditional peoples' lands and territories and improved stewardship of native habitat within all types of conservation areas*

The Matopiba landscape is a mosaic of different types of peoples and land uses: family farmers, large-scale agriculture, indigenous lands, quilombola lands, agroextractivists, and other kinds of traditional communities. The Cerrado biome is often thought to be an open and empty land that is ripe for agricultural development, but in fact much of the land is in use, either inhabited or harvested and managed by one of the numerous traditional communities in the region. Many of these communities do not have secure tenure to their land. Family farmers may lack legal title to their parcels even if their families have ties to the land going back generations. Communally managed territory (e.g., rural settlement, quilombola territories, extractive reserves) may lack regularized or formal recognition from the government, even when their rights to their lands and territories are protected by the Brazilian constitution.

**Helping communities and family farmers secure their claims and legal rights to the land is a key step** in preventing unforeseen environmental and social risks from large-scale agricultural expansion in the region. It is in this context of tenuous protections for their lands that the traditional communities across Matopiba face new pressure from expanding agricultural crops and the PDA-MATOPIBA development plan. Support for CAR registrations for traditional communities and family farmers and renewed political will on the



Photo: Peter Caton/ISPN

part of federal and state governments (including public prosecutors) to resolve land disputes and recognize community lands are important points of engagement.

**Protected areas that are devoted to conservation and biodiversity need to be expanded and require better long-term funding and management.** Currently, protected areas in the Cerrado cover roughly 8 percent of the landscape, less than half the target established by the UN Convention on Biodiversity (17 percent); 6.2 Mha (3.1 percent of the biome) lie in strict protected areas and 11.1 Mha (5.5 percent of the biome) are in Sustainable Use areas.<sup>9</sup> Expansion of this network is of key importance to the future of the Cerrado. The MMA and several conservation organizations have called for better support for existing protected areas and additions to the protected area network, in line with existing analyses of priority conservation areas published by the government and leading NGOs.<sup>10</sup> Additionally, expanded support for better management of protected areas should be a priority for the conservation and social agendas in the coming years. Currently, sustainable use protected areas are suffering from inadequate management, with deforestation persisting at rates comparable to areas not under protection.<sup>11</sup>

9. Renata D. Françoso et al., "Habitat Loss and the Effectiveness of Protected Areas in the Cerrado Biodiversity Hotspot," *Nature and Conservation* 13, no. 1 (2015): 35–40; MMA, "Unidas de Conservação por Bioma," February 26, 2016.

10. MMA, "Priority Areas for the Conservation, Sustainable

Use and Benefit Sharing of Brazilian Biological Diversity. Update: MMA Administrative Ruling No 9," (Brasília: January 2007); Mario Barroso et al., "Áreas Prioritárias para e Conservação do Cerrado e Pantanal," *WWF Brasil* (2013); CEPF, 2016.

11. Françoso et al., 2015.



## PRIORITY 3

### Incentives for conservation

#### *Ensuring sufficient incentives from public and private sources for the conservation of surplus natural habitats on private and communally managed lands*

The Cerrado landscape has great economic value as agricultural land. Prioritizing conservation requirements on both private and communally managed lands beyond the 20 percent legal reserve requirement of the Forest Code (35 percent for the sections of the Cerrado that fall within the Legal Amazon) will be costly and will require financial incentives.

**Credit is one of the most important tools for creating incentives for producers.** Credit could be used to strategically guide expansion of crops in the Matopiba area so that expansion avoids priority biodiversity areas and important areas for communities and is guided to areas that are best suited for crop productivity. This concept has been successfully employed in Brazil already with the sugarcane agroecological zoning (ZAE Cana) program, which was established by an inter-ministerial group.<sup>12</sup> Additionally or alternatively, public and private banks could offer preferential access to loans or lower interest rates for property holders that hold more land in conservation areas than required by the Forest Code or that adopt low-carbon agricultural practices. These incentives could be provided through broad integration of conservation priorities into the government's agricultural credit programs, such as the Agriculture and Livestock Plan, commonly called the Harvest Plan.

**The private sector also has a role to play in providing incentives for farmers and ranchers across the Cerrado to both reduce deforestation and protect land rights for traditional communities.** Successful implementation of sector-wide deforestation and rights commitments, which are proliferating among large, international agribusiness companies, could prove hugely important in reducing deforestation rates

and protecting community rights in the Cerrado. Buyers of agricultural goods from the Cerrado should demand compliance with the Forest Code and other laws (e.g., regarding labor and safe use of agrochemicals). Buyers should also demand that producers avoid areas with high biological or social importance—if not fully commit to zero deforestation—and areas with social conflicts (e.g., areas with land tenure disputes or high levels of violence). Preferential or expanded market access for producers that comply with such commitments or policies is one incentive associated with this type of approach. Alternatively, corporate agribusiness leaders could engage with individual municipalities to help them develop robust instruments for reducing deforestation and/or embrace certifications as a way to provide incentives to producers for better practices.

#### **Payment for Ecosystem Services (PES) programs merit further development.**

For example, the Forest Code's compensation mechanism, the Environmental Reserve Quota (CRA), could be expanded to help capture voluntary funding for intact habitat in the Cerrado (e.g., from corporate social responsibility campaigns or downstream municipalities). This concept, tentatively termed "X-CRA," has been suggested by Brazilian academics who have studied the CRA market extensively.<sup>13</sup> Additionally, the Water Producer Program managed by Brazil's National Water Agency (ANA), an existing PES scheme, should be expanded and targeted at those areas of greatest hydrological importance, and PES legislation that has been introduced to Congress should be considered.

**Other means of building demand for intact Cerrado vegetation should also be explored and supported.** For example, support for agroecological production and agroextractivists' products helps to promote sustainable use of the landscape; these topics are covered in Priority 4 (*See next page.*). Finally, strengthening the Cerrado as a tourism/eco-tourism destination could help provide incentives for protection of native habitat and traditional cultures.

12. Government-subsidized credit lines were established through BNDES for entities wishing to expand sugarcane production, as long as they follow the ZAE Cana guidelines. "Sugarcane Agro-Ecological Zoning: Greening the Expansion of Ethanol," Evidence and Lessons from Latin America.

13. Raoni Rajão and Britaldo Soares-Filho, "Cotas de Reserva Ambiental (CRA): Potencial e Viabilidade Econômica do Mercado no Brasil" (Belo Horizonte: Ed. IGC/UFMG, 2015).

#### PRIORITY 4

## Improved sustainability and productivity of existing agricultural lands and pasturelands

*Encouraging sustainable intensification of pasturelands, mainstreaming low-carbon agricultural practices, expanding adoption of other sustainable practices, and supporting traditional agricultural products*

Agriculture and livestock production are vital to Brazil's economy, accounting for over 35 percent of the country's export value and 21.5 percent of GDP.<sup>14</sup> The Cerrado has the largest area of farm and ranch land in Brazil, accounting for 88 Mha, or 44 percent, of the total agricultural area.<sup>15</sup> It produces about 40 percent of Brazil's beef, 84 percent of its cotton, 60 percent of its soybeans, and 44 percent of its corn.<sup>16</sup> Agriculture will likely continue to be an important driver of economic growth of the Cerrado in the coming years.

Photo: CEA



**Making better use of already cleared land through sustainable intensification of pasturelands is one of the best ways to reconcile agricultural development with conservation.**

According to a recent study, Brazil could meet demands for increased crop acreage through 2040 without any further conversion of native habitat through intensification of pastureland and shifting crop cultivation onto the freed-up land.<sup>17</sup> This is an important strategy for the Cerrado, which has about 40 percent (almost 20 Mha) of the country's potential for pasture restoration.<sup>18</sup> Government, private sector, and civil society actors should collaborate to provide the necessary training and incentives to catalyze a shift from expansion to intensification in both the ranching and farming sectors. Mainstreaming and targeting credits from Brazil's Low Carbon Agriculture Plan (ABC Plan) or other credits for restoration of pasturelands, providing technical assistance and training, and studying and promoting successful pilots are all important elements of an intensification effort.

Any effort to support intensification would be most effective if done in a way that ensures social and ecological sustainability and is coupled with complementary instruments such as environmental compliance, land regularization, and supply chain governance as a way of mitigating the rebound effect. (See definition on page 40.)

The nearly 20 Mha of cropland in the Cerrado could also be managed more sustainably through broader adoption of low-carbon agricultural practices and other ecologically and socially sound production methods, including those typically employed in traditional agricultural systems.<sup>19</sup>

14. Aron Belinky, "Green Growth in Action – Overview of Innovative Country Strategies: Case Study from Brazil: Plano ABC," Centro de Estudos em Sustentabilidade da EAESP (London: October 28, 2014); The Center for Applied Economy, University of São Paulo.

15. CEPF, 2016.

16. Ibid.

17. Bernardo B.N. Strassburg et al., "When Enough Should Be Enough: Improving the Use of Current Agricultural Lands Could Meet Production Demands and Spare Natural Habitats in Brazil," *Global Environmental Change* 28 (2014): 84–97.

18. Another 10 percent (5.6 Mha) is found in the transitional areas between the Amazon and the Cerrado and between the Caatinga and the Cerrado. Ibid.

19. MMA, *PROBIO Land Cover Map* (Brazil, 2002).

20. MAPA, *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)* (Brasília: MAPA/ACS, 2012).

21. Note that the area covered by the Cerrado states is larger than that of the Cerrado biome, so these statistics overstate the allocation of ABC credits to the Cerrado biome. "Analysis of Resources of the ABC Program: Investment Purposes," *ABC Plan Observatory Report 3 – Year 2*, December 2014.



Photo: CEA

**Continued and expanded support for the full range of low-carbon agriculture practices promoted by the ABC Plan** will be important for the long-term health and resilience of the agricultural sector and could help Brazil meet its greenhouse gas (GHG) reduction targets by contributing up to 166 million tonnes (Mt) of CO<sub>2</sub>e by 2020.<sup>20</sup> The ABC Plan provides the most significant set of public incentives for the adoption of low-carbon agriculture practices, in the form of dedicated agricultural credits (R\$4.5 billion). In the first quarter of the 2014/2015 crop year, roughly 80 percent of the nationally available ABC credits were issued in Cerrado states, roughly 20 percent of them in Matopiba states.<sup>21</sup> Support for the adoption of sustainable agriculture practices in line with the ABC Plan is a priority for international funding programs in the region, most notably the FIP. Still, a number of improvements to the ABC Plan could enhance its effectiveness, including expanded support for technical assistance, better training for the banks issuing the loans, and establishment of a monitoring program. It is also important to note that while low-carbon practices are generally positive, they are not always wholly environmentally sound.

**Beyond its GHG emissions profile, Brazil's agricultural sector has much room for improvement in terms of the overall sustainability of its practices.** There is much that government agencies, supply chain actors, and civil society can do to encourage more environmentally and socially sustainable practices across the agricultural sector, particularly with respect to the use of agrochemicals, farm labor, pollution of waterways, protection of water springs, crop diversity, and conflict with rural communities. Broad efforts should be made to reduce the negative environmental and social impacts of industrial-scale agriculture through better enforcement of laws governing pesticide use and labor standards, and through promotion of best practices for protecting water springs and waterways. Additionally, assistance for agroecological practices, small-scale production, and biodiversity and agro-extractive products is needed. Specifically, traditional and small-scale producers require expanded technical assistance, targeted credit lines, and support for market access. These forms of agriculture can help sustain native habitat and are consistent with conservation, social, and cultural priorities. Support for integrated crop-livestock-forest production, which is part of the ABC program, should also be expanded.

## PRIORITY 5

# Building the case for biodiversity and landscape conservation

*Highlighting and enhancing scientific research on the importance of water and its relationship with native vegetation, and on the impacts of climate variability in the Cerrado*

There is mounting evidence that preservation of native vegetation plays a beneficial role in maintaining the freshwater flows and water springs that agricultural producers, hydropower producers, and municipalities all depend upon.

**Developing a more comprehensive body of research about the relationship between hydrological systems and land cover would be invaluable for planning efforts across the Cerrado.**

Such a research agenda should focus on questions of thresholds of native vegetation necessary for healthy ecosystem function, impacts on neighboring biomes, and the economic effects of changes in precipitation patterns. Specific questions include:

- Is there a point at which the relationship between land cover, weather patterns, and hydrological function will see a step-change?
- Could deforestation in the Cerrado dry out the Amazon?
- What would a ten-day delay to the rainy season mean for soy yields?
- What would a 40 percent drop in river flows mean for hydropower generation?

These questions have received some attention from scientists and government agencies, but a more coordinated approach to synthesize and build upon the current state of the science would help many actors across the Cerrado.

**Adopting land use plans and agricultural practices that can help the region mitigate and adapt to the effects of global climate change** should be an important component of agricultural development and expansion of protected areas in the biome. The Cerrado biome is expected



Photo: alarico/Shutterstock

to experience productivity disruptions due to global climate change. These global pressures will amplify those felt from local land use change. Both will have a warming and drying effect. A 2003 study that modeled the effects of climate change on Cerrado flora predicted that between 10 and 32 percent of the 162 analyzed tree species could end up without habitable areas in the Cerrado region or go extinct by 2055.<sup>22</sup> Additionally, over half of the species were projected to decline by more than 90 percent in the Cerrado, with major range shifts to the south and east.<sup>23</sup> Such range shifts should be considered in future plans for restoration and protected area management and expansion.<sup>24</sup>

## Conclusion

The Cerrado is a vitally important region to Brazil's economy, traditional communities, biodiversity, hydrological resources, and climate mitigation and adaptation capacity. Agricultural expansion and related infrastructure development in the region, left largely unchecked, have the potential to threaten many human populations and ecosystem functions. Thus, it is essential to adopt a balanced approach to development in the Cerrado, one that recognizes the value of agricultural production, ecosystem function, and thriving agricultural systems and economies for traditional communities. The opportunities covered in this report are those that, based on our assessment, have the highest potential to support an integrated conservation, agricultural production, and social inclusion agenda.

22. CEPF, 2016.

23. Ibid.

24. Ibid.

# Challenges and Opportunities for Conservation, Agricultural Production, and Social Inclusion in the Cerrado Biome

INTERVENTION	STRATEGY	SUBSTRATEGY
<b>1. Strong implementation of the Forest Code</b>	Timely, equitable, robust, and transparent implementation of the CAR	<ul style="list-style-type: none"> <li>• Support smallholders and indigenous and traditional communities in the CAR registration process and in resolving conflicts</li> <li>• Capacity building for state-level agencies responsible for registrations and verification</li> </ul>
	Development of a strong post-CAR agenda	<ul style="list-style-type: none"> <li>• Develop restoration guidelines and policies that balance economic viability and ecological integrity</li> <li>• Design CRA markets that promote transparency, additionality, low transaction costs, and “smart compensation” (See definition on page 23.)</li> </ul>
	Effective compliance and enforcement	<ul style="list-style-type: none"> <li>• Launch satellite monitoring systems</li> <li>• Make CAR a precondition of agricultural credits (public and private)</li> <li>• Technical support for state-level agencies responsible for compliance</li> </ul>
<b>2. Protection and management of community and conservation lands</b>	Land regularization	<ul style="list-style-type: none"> <li>• Support smallholders and indigenous and traditional communities in the CAR registration process and in resolving conflicts</li> <li>• Capacity building and legal training to support family farmers in securing title to their land</li> <li>• Engagement of public prosecutors in resolving land conflicts</li> </ul>
	Support for indigenous and quilombola lands and other communally managed lands	<ul style="list-style-type: none"> <li>• Recognition and titling of indigenous lands</li> <li>• Recognition and titling of quilombola lands</li> <li>• Support laws that protect agroextractivists’ access to land</li> <li>• Map community lands</li> <li>• Support sustainable land management planning and practices on indigenous, quilombola, and other traditional community lands</li> </ul>
	Expanded and well-maintained protected area network	<ul style="list-style-type: none"> <li>• Support better management of existing protected areas</li> <li>• Integrate Priority Conservation Areas and Key Biodiversity Areas mapping into CRA market design, corporate commitments, and agricultural credits to guide agricultural expansion away from these areas</li> </ul>
<b>3. Incentives for conservation</b>	Use credits and other government programs to guide agricultural expansion in the Matopiba region	<ul style="list-style-type: none"> <li>• Use existing agricultural credit lines (e.g., ABC Plan, Harvest Plan) or new credit lines to encourage development in areas that are already open or degraded, or that are highly productive, and to discourage expansion into areas of biological or social importance</li> <li>• Use this same kind of “zoning” approach in the development of the PDA-MATOPIBA plan and development of CRA markets</li> </ul>
	Corporate commitments and supply chain incentives	<ul style="list-style-type: none"> <li>• Determine an appropriate target for deforestation in the Cerrado that all parties can agree to (e.g., zero deforestation by a certain date, go/no-go zones based on social and biological criteria)</li> <li>• Increased use of certifications</li> </ul>
	Payment for ecosystem services	<ul style="list-style-type: none"> <li>• Expand ANA’s Water Producer Program</li> <li>• Develop the “X-CRA” concept</li> </ul>

INTERVENTION	STRATEGY	SUBSTRATEGY
<b>3. Incentives for conservation</b> <i>(continued)</i>	Strengthen the Cerrado's tourism industry	<ul style="list-style-type: none"> <li>• Development grants and credits for eco-tourism</li> </ul>
<b>4. Improved sustainability and productivity of existing agricultural and pasturelands</b>	Sustainable intensification of pasturelands	<ul style="list-style-type: none"> <li>• Study the economics of expanding onto degraded pastures for producers of soy and other crops</li> <li>• Technical assistance and training for ranchers</li> <li>• Expand availability of credits for pasture intensification and target credits to areas best suited for restoration</li> <li>• Expansion of low-carbon agriculture practices</li> <li>• Push for improvements in the ABC Plan, including: <ul style="list-style-type: none"> <li>• establishment of a monitoring system</li> <li>• better training for banks that are issuing the loans</li> <li>• increasing technical assistance allocation of credits</li> <li>• better targeting of loans</li> </ul> </li> </ul>
	Support for sustainable agriculture and traditional agriculture	<ul style="list-style-type: none"> <li>• Better enforcement of pesticide and labor laws</li> <li>• Support agroecological practices through better implementation of the national plans and policies on agroecology and organics (PNAPO, PLANAPO)</li> <li>• Promote markets and supply chains for sociobiodiversity products (e.g., pequi fruit, babaçu fruit, and native honey) (e.g., through better implementation of the National Plan for Promotion of Socio-Biodiversity Value Chains)</li> <li>• Support sustainable management of these products (e.g., through better implementation of the Food Acquisition Program and the National Program for School Meals)</li> <li>• Generally increase technical and financial assistance to smallholders</li> </ul>
<b>5. Building the case for biodiversity and landscape conservation</b>	Consolidate existing science on the relationship between forest cover and water, and support new research	<ul style="list-style-type: none"> <li>• Coordinate between government agencies, academics, and NGOs</li> </ul>
	Harness existing incentive systems to help protect water resources and support adaptation to climate change (cross-referenced to other strategies)	<ul style="list-style-type: none"> <li>• Increase support for PES programs (e.g., ANA's Water Producer Program)</li> <li>• Target CRA trading to places of hydrological importance</li> <li>• Tie agricultural credits to better water practices</li> <li>• Include water conservation practices in purchasing standards of agricultural commodity buyers</li> </ul>

# INTRODUCTION

The Cerrado is a tropical, woody savanna located in the geographic heart of Brazil and linking most of the country's biomes. It is characterized by a mosaic landscape that includes scrubland, grasslands, and open- and closed-canopy forests. It is the second largest biome in Brazil, behind the Amazon, occupying approximately 200 Mha, nearly one fourth of the country. It is rich in endemism and is considered to be the most biologically diverse savanna in the world.<sup>25</sup> Rural inhabitants include indigenous people, quilombolas, extractivists, *geraizeiros*, and *ribeirinhos*, as well as many family farmers. The Cerrado contains the headwaters of three of Brazil's major river systems, the São Francisco, Tocantins, and Paraná and it plays an instrumental role in providing freshwater throughout the country and even across the continent.

Despite its significant social diversity, cultural heritage, and biodiversity, the biome has not generally been seen as ecologically valuable or charismatic. While the Amazon, Atlantic Forest, and Pantanal all have legal standing as national heritage biomes, the Cerrado does not. Only 8.3 percent of its 2 million square kilometers are in designated conservation units, compared with 26 percent of the Amazon.<sup>26</sup>

Beginning in the mid-1970s, the Cerrado transitioned from a region considered "closed" and unfit for agriculture into one of the most productive agricultural regions in the world, producing large volumes of soy, sugarcane, corn, cotton, and beef. Large-scale national investment in the agricultural sector, international cooperation, and development of transportation infrastructure led to a regional transformation so profound it is known as the "Cerrado miracle."<sup>27</sup> The value of Brazil's agricultural exports increased ten-fold between 1991 and 2011, from USD\$7.9 billion to USD\$79 billion.<sup>28</sup> Much of that growth is due to agricultural

expansion within the Cerrado. Agricultural production continues to grow across the biome. Cultivated acreage of soybean, corn, and cotton in the Cerrado increased by roughly 85 percent between the crop years of 2000/2001 (9.33 Mha) and 2013/2014 (17.43 Mha).<sup>29</sup> Most of this expansion was driven by soybeans, which represented 90 percent of the total cultivated area of these three crops in the Cerrado in 2013/2014.<sup>30</sup> (See Map 2 and figures on the following pages.)



Photo: Peter Caton/ISPN

25. Ibid..

26. Françaço et al., 2015; Nepstad et al., "The End of Deforestation in the Brazilian Amazon," *Science* 326, no. 5958 (2009): 1350–1351.

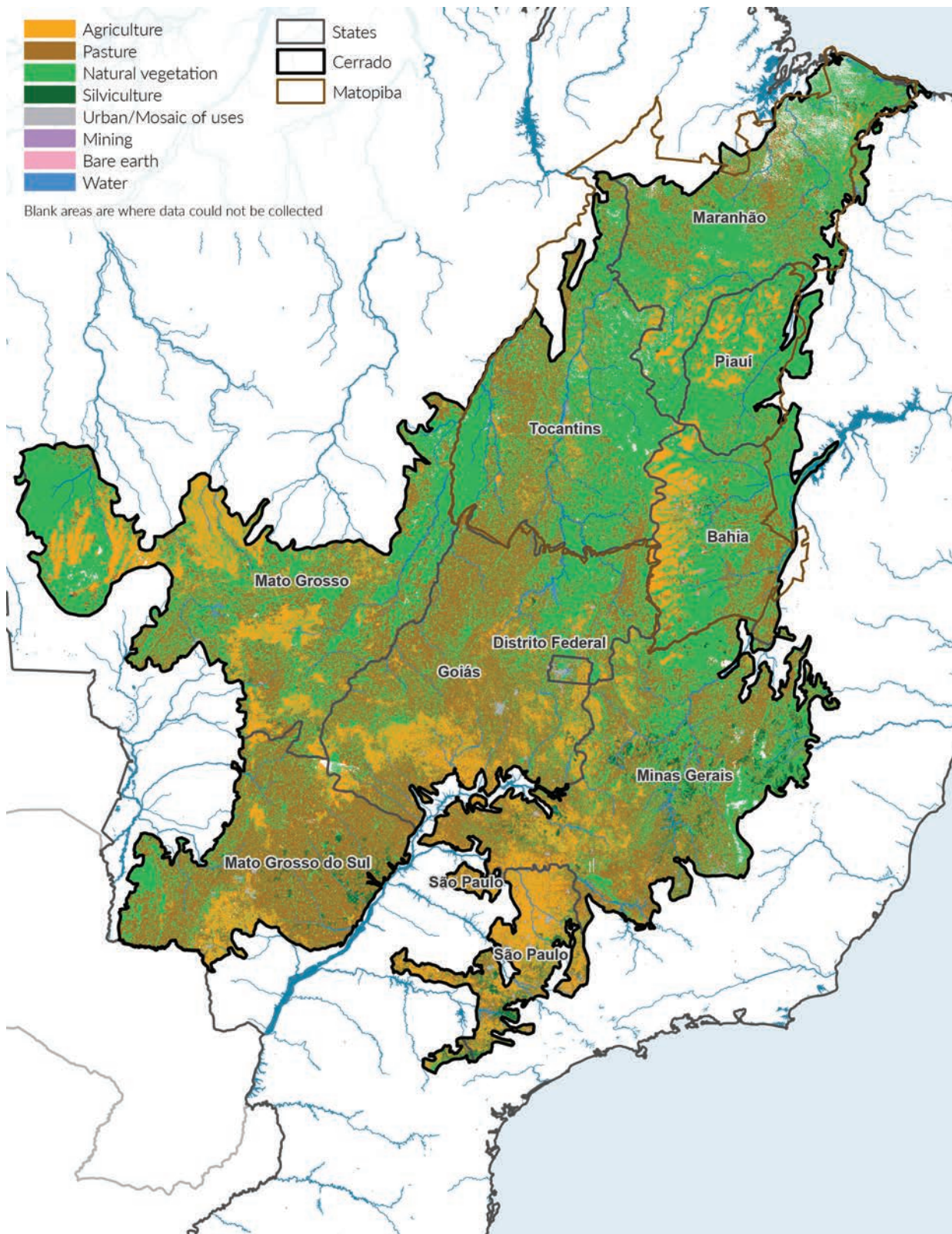
27. Akio Hosono, "Industrial Strategy and Economic Transformation: Lessons of Five Outstanding Cases" (working paper prepared for JICA/IPD Africa Task Force Meeting, Yokohama, Japan, April 2013).

28. Food and Agriculture Organization of the United Nations (FAO), 2015.

29. Rudorff et al., 2015.

30. Ibid.

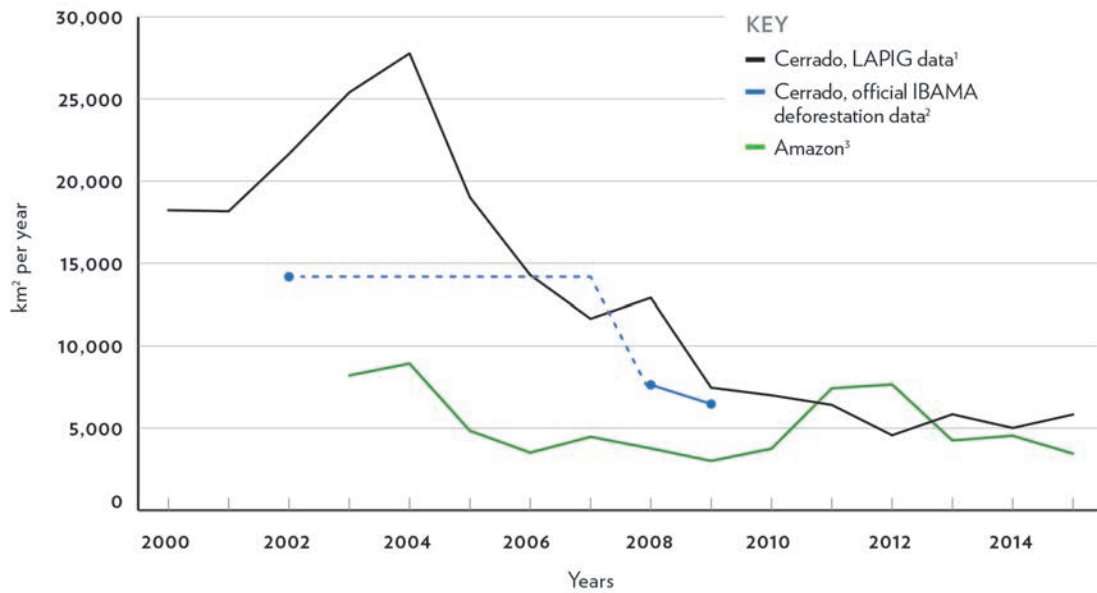
MAP 2: BRAZIL'S CERRADO, LAND COVER (2013)



Sources:  
Reference layers: <http://www.naturearthdata.com/>  
Matopiba: [http://www.ibge.gov.br/english/geociencias/default\\_prod.shtm](http://www.ibge.gov.br/english/geociencias/default_prod.shtm)  
Cerrado: <http://maps.lapig.iesa.ufg.br/lapig.html>  
Land Cover: <http://www.dpi.inpe.br/tccerrado/>  
field work in August 2005; Successional habitat translation not final



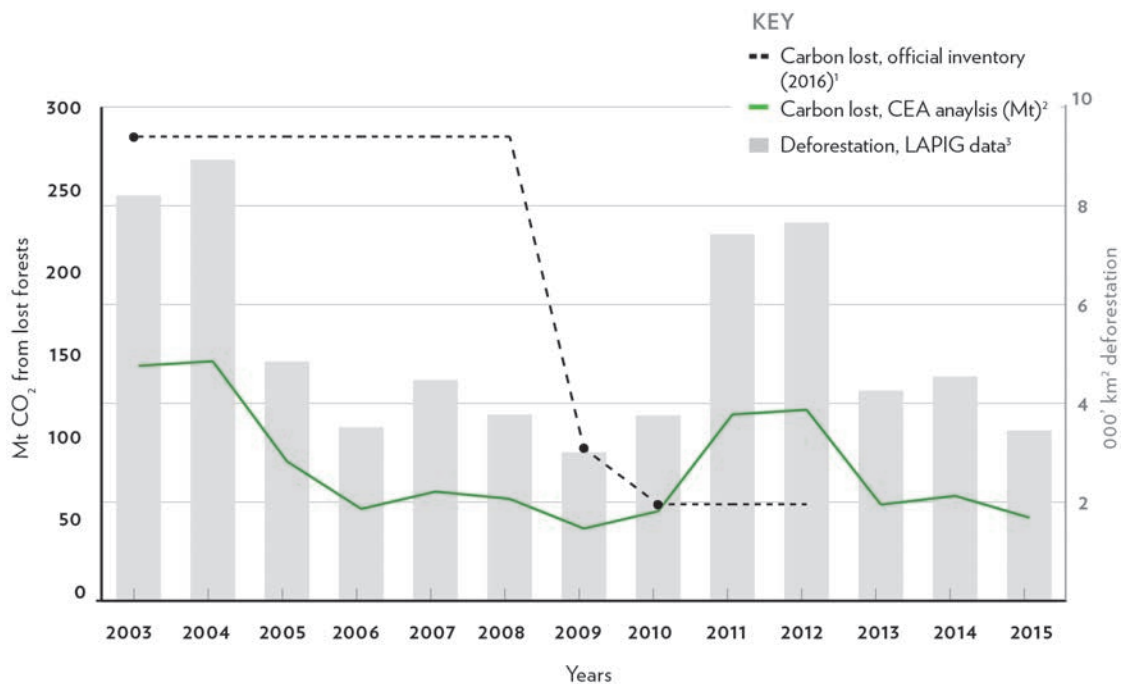
FIGURE 1: DEFORESTATION IN BRAZILIAN BIOMES, 2000–2015 (km<sup>2</sup> per year)



Sources: 1) INPE. 2) MMA-IBAMA 2009, 2011; dotted line indicates interpolation between 2002 and 2008 data points. 3) LAPIG Maps.

FIGURE 2: CERRADO DEFORESTATION AND LAND USE CHANGE EMISSIONS, 2002 – 2015

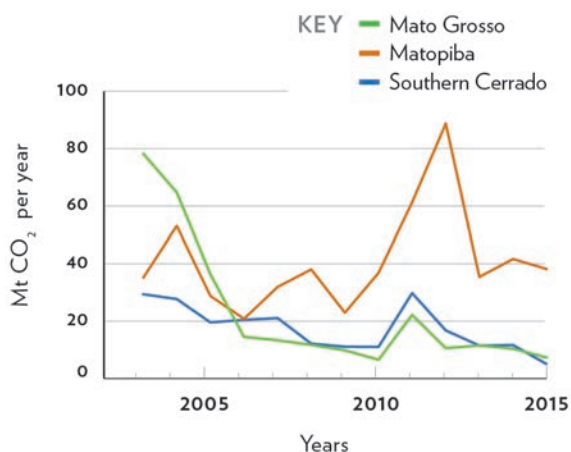
CEA attempted to estimate carbon from land use change from deforestation using LAPIG deforestation data and a simplified form of the Brazilian inventory methodology. The official inventory includes carbon lost from soil erosion and carbon gained from vegetation regrowth, whereas CEA's analysis is based simply on loss of above and below-ground forest carbon.



Sources: 1) MCTI 2016. 2) CEA/Greeninfo Network analysis using data from LAPIG and Saatchi et al., 2011. 3) LAPIG Maps.

Methodology: CEA developed a carbon map using the PROBIO land cover map and the carbon stock data used in the official Brazilian inventory (c.f. Table 8, Fundacao de Ciencia Aplicoes e Tecnologia Espacias (FUNCATE). 2010. "Segundo inventario Brasileiro de emissoes e remocoes antropicas de gases de efeito estufa: relatorios de referencia: emissoes de dióxido de carbono no setor uso da terra, mudanca, do uso da terra e florestas."). This was intersected with LAPIG deforestation data to obtain carbon loss, in terms of CO<sub>2</sub>e. It was conservatively assumed that 10t C/ha remained in cropland or pasture upon conversion (estimates of carbon stocks in pasture or annual crop areas vary from 5 to 9.2 t C/ha).

FIGURE 3: CERRADO DEFORESTATION AND LAND USE CHANGE EMISSIONS BY SUB-REGION, 2003–2015 (Mt CO<sub>2</sub> per year)



Source: CEA/Greeninfo Network analysis using data from LAPIG and NASA.

Roughly half of the native vegetation in the Cerrado has already been converted to agricultural or urban uses, primarily in the southern part of the biome.<sup>31</sup> According to data from the Laboratório de Processamento de Imagens e Geoprocessamento (LAPIG) at the Federal University of Goiás, deforestation rates in the Cerrado from 2010 through 2015 have averaged just over 0.5 Mha (5,000 km<sup>2</sup>) per year, roughly four times the size of the city of São Paulo.<sup>32</sup> This corresponds to average GHG emissions of more than 80 Mt CO<sub>2</sub>e per year.<sup>33</sup> These deforestation rates are roughly at parity with those in the Amazon in the last few years. Note that even the Third National Inventory, which was published in May 2016, does not report emissions from land use change after 2010, so academic data is the best source of information for the 2010 to 2015 period. While the Cerrado is generally not as carbon dense as the Amazon, it still has very significant stores of carbon in both above-ground and below-ground biomass, as well as in its soils. Unfortunately, data on the below-ground and soil carbon stocks is limited, so emissions estimates for land use change in the Cerrado are particularly uncertain.

31. Beuchle et al., 2015.

32. LAPIG, SIAD-Cerrado. Map analyzed by GreenInfo Network, 2015, <http://maps.lapig.iesa.ufg.br/lapig.html>.

33. GreenInfo Network analysis based on LAPIG deforestation data, PROBIO land cover map, and carbon stock data from the Ministry of Science and Technology (MCT), *Second National Communication of Brazil to the United Nations Framework Convention on Climate Change* (Brasília: General-Coordination on Global Climate Change, 2010).

Most of the remaining native vegetation in the Cerrado is in the northern part of the biome, commonly called “Matopiba,” a 73-Mha region named for the initial letters of the states that compose it: Maranhão, Tocantins, Piauí, and Bahia.<sup>34</sup> In recent years, Matopiba has become a major frontier of agricultural expansion, accounting for three quarters of Cerrado deforestation in 2015.<sup>35</sup> Soybeans are a leading driver of land conversion, having expanded by over 250 percent (or by 2.45 Mha) in Matopiba between the crop years of 2000/2001 and 2013/2014.<sup>36</sup> The majority of this expansion was onto areas with native vegetation or where native vegetation was recently cleared.<sup>37</sup>

The region is slated for further development. In May 2015, MAPA announced PDA-MATOPIBA, the new high-level, cross-ministry plan for agriculture and livestock development in Matopiba. Its stated objective is to promote sustainable economic development based on agricultural and livestock activities, resulting in improved livelihoods. Over a year after the plan was announced, its details have not yet been published. The governing body that guides it lacks representation from the environmental and social sectors, and the plan has been critiqued for lacking transparency and opportunities for consultation.<sup>38</sup>

Government policies focusing on environmental objectives in the region have been implemented unevenly, at best. The government established an Action Plan for the Prevention/Control of Deforestation and Forest Fires (PPCerrado) in 2010 in support of the National Climate Change Policy (PNMC). This plan aimed to reduce deforestation rates in the Cerrado by 40 percent, support the creation of a deforestation monitoring system, increase the number of conservation units, recognize and title additional indigenous lands, reduce illegal deforestation within conservation units and indigenous territories, reduce and control forest fires, and support sustainable production.<sup>39</sup> Unfortunately, implementation of the PPCerrado has not been well documented, and there are several indications that it has not been successful in meeting its objectives.

34. Embrapa Strategic Intelligence Group (GITE), <https://www.embrapa.br/en/tema-matopiba/perguntas-e-respostas>.

35. GreenInfo Network analysis based on LAPIG deforestation data.

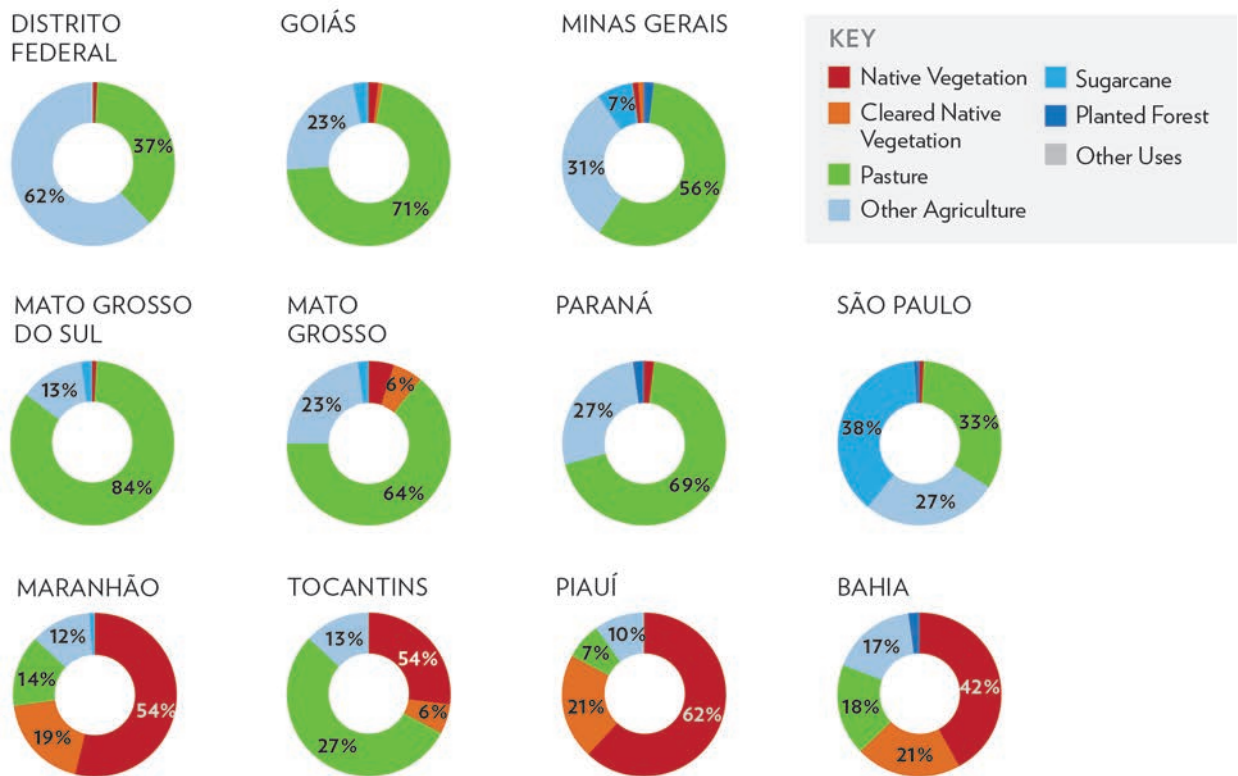
36. Rudorff et al., 2015.

37. Ibid.

38. Rocha, 2015.

39. MMA, *Plano de Ação para Prevenção e Controle do Desmatamento e das Queimadas no Cerrado* (Brasília: September 2010).

FIGURE 4: PRIOR LAND-USE IN AREAS OF RECENT AGRICULTURAL EXPANSION (FROM CROP YEAR 2006/2007 TO 2013/2014)



Source: “Geospatial Analysis of the Annual Crops Dynamic in the Brazilian Cerrado Biome: 2000 to 2014.” Rudorff, B.; Risso, J. et al., 2015.

For example, the satellite monitoring system for the Cerrado that was promised for 2011 has not yet been launched. The MMA is currently in the process of updating the plan for the coming years. The new version of the PPCerrado should attempt to address the shortcomings of the initial plan and provide means for better reporting, cross-links with PDA-MATOPIBA, and improved coordination with other key ministries and plans (e.g., ABC Plan, the FIP, ANA, the National Institute for Colonization and Agrarian Reform (INCRA), and MAPA).

The current economic and political climate in Brazil is not favorable to the conservation agenda. Brazil’s economy is weak. Its GDP contracted by 3.8 percent in 2015, the largest drop in 25 years; agriculture is the only sector that grew in 2015.<sup>40</sup> Inflation and unemployment are rising, and the Brazilian Congress is facing serious budget deficits.<sup>41</sup> Confidence in the government is at an all-time low. President Dilma Rousseff has been removed from office and will face impeachment

trials, and scores of government leaders have been mired in a corruption scandal involving the state-owned oil company, Petrobras. Still, international momentum to address climate change and deforestation is strong, buoyed by the December 2015 United Nations Framework on Climate Change Paris Climate Agreement and commitments on the part of private companies to make their supply chains deforestation-free. Yet to date, international attention paid to climate and forests has generated only limited support for communities and ecosystems in the Cerrado.

Although advancing an integrated agenda that supports various forms of agricultural production, ecosystem conservation, and social inclusion in the Cerrado is a challenging proposition at present because of the current economic and political turmoil in Brazil and because of the pressure for agricultural expansion into the Matopiba region, it is possible. In the next section, we propose several opportunities that, implemented together, could help to achieve these objectives.

40. Nielmar de Oliveira, “IBGE: PIB Fecha 2015 com Queda de 3,8%,” *Agência Brasil*, March 3, 2016.

41. “All Fall Down,” *The Economist*, September 5–11, 2015.

# PROPOSED PRIORITIES

We have identified a set of five potential opportunities to advance an integrated agenda that supports various forms of agricultural production, ecosystem conservation, and social inclusion in the Cerrado. Each of these is described in detail in the following pages.

1. Strong implementation of the Forest Code
2. Protection and management of community and conservation lands
3. Incentives for conservation
4. Improved sustainability and productivity of existing agricultural lands and pasturelands
5. Building the case for biodiversity and landscape conservation

## PRIORITY 1

### Strong implementation of the Forest Code

#### *Ensuring legal protection of natural ecosystems on private lands*

Nearly half the Cerrado remains in native vegetation—a mix of forests, savannas, and grasslands spread across public, private, and communally managed lands. Public lands, which account for roughly 8 percent of the biome, are protected by a variety of conservation unit types. Private lands and communally managed land holdings, which compose the vast majority of land in the Cerrado, are governed by the Brazilian Forest Code.<sup>42</sup> The Forest Code requires that areas around streams or on steep slopes be designated as Areas of

Permanent Protection (APP), foreclosing their development.<sup>43</sup> For large parcels, a total of 20 percent of the area must be set aside as “legal reserve.” For those portions of the Cerrado lying within the Legal Amazon (accounting for 82.5 Mha, or 40 percent, of the Cerrado), 35 percent must be preserved (by comparison, 80 percent of forest landscapes within the Legal Amazon must be preserved).<sup>44</sup> Legal reserves must contain either native habitat or a mix of native habitat and planted forests.

Although the new Forest Code provides a great deal of amnesty and leniency, its underlying parameters are still quite robust. Moreover, it introduced new mechanisms for better enforcement and for trading of legal reserves, both of which have the potential to greatly improve the environmental outcomes of the Forest Code.

42. The Forest Code was first established in 1934 and required landholders to preserve certain areas of forest to conserve riparian health, support soil health, and otherwise protect environmental health. The statute was revised in 1965, 1989, 1996, and most recently 2012. 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,” *Philosophical Transactions of the Royal Society of London B:*

*Biological Sciences* 368, no. 1619 (2013).

43. APPs include both Riparian Preservation Areas (RPAs), which protect riverside forest buffers, and Hilltop Preservation Areas (HPAs), which protect hilltops, high elevations, and steep slopes. Soares-Filho et al., 2014.

44. Frederico Machado and Kate Anderson, “Brazil’s New Forest Code: A Guide for Decision-Makers in Supply Chains and Governments,” *WWF Brazil*, 2016.

## The New Forest Code

Revisions to the Forest Code in 2012 (Law 12.651) reduced the requirements for protection by about 30 Mha, or 58 percent, across Brazil by exempting small landholders, changing the definition of Hilltop Preservation Areas (HPAs), and including Riparian Preservation Areas (RPAs) in the calculation of legal reserve.<sup>45</sup> The new Forest Code also created a special regime that offers some leniency to rural properties where native vegetation was illegally cleared for agriculture or livestock production before July 2008.<sup>46</sup> Those landholders who illegally cleared APP or legal reserve areas before July 2008 still must comply with the Forest Code, but are entitled to some benefits by enrolling in the Environmental Regularization Program (PRA) and signing a Commitment Agreement, which includes a Forest Recovery Plan.<sup>47</sup>

45. Soares-Filho et al., 2014.

46. Joana Chiavari and Cristina Leme Lopes, "Policy Brief: Brazil's New Forest Code. Part II: Paths and Challenges to Compliance," *Iniciativa para o Uso da Terra and Climate Policy Initiative*, November, 2015. Note that the size of a fiscal module is defined differently by each state.

47. Ibid.

Strong Forest Code implementation is a top priority for the MMA. It is also a major focus of international funding to the Cerrado, including the USD\$32 million FIP<sup>48</sup> and funding from the United Kingdom's Department for Environment, Food, and Rural Affairs (DEFRA). These programs are largely focused on supporting CAR registrations in a limited number of target municipalities

Effective Forest Code implementation is fundamental to the success of the conservation and forest agendas in Brazil. If done well, it will put Brazil in a strong position for protecting and managing its existing forest land, protecting its water resources, and restoring wide expanses of degraded land. Success will require several more years of dedicated focus from federal, state, and local governments, as well as civil society.

48. The FIP is the largest climate-focused foreign investment program that provides funding to the Cerrado. It is administered by the World Bank and is focused on building capacity at the federal and state levels to receive, analyze, and approve CAR entries. It also supports, in selected municipalities, landholding registration in the CAR;



Photo: CEA

## The CAR

One of the most important elements introduced by the new Forest Code is the CAR, a country-wide registry that documents the legal reserve and other Forest Code obligations of individual landowners. The lack of a country-wide CAR is one reason why enforcing the Forest Code has historically been difficult. Without this documentation it is nearly impossible to distinguish between legal and illegal deforestation on private properties.

Brazil's federal and state governments have made major, important investments into an online registration system, the National System for the Rural Environmental Registry (SICAR), to facilitate CAR registrations. Complete, timely, and equitable implementation of the CAR in a manner that is robust and transparent is fundamental to conservation and social inclusion across Brazil. It is the responsibility of state governments, particularly state-level environmental secretariats, to ensure that CAR registrations are completed. Unfortunately, many of these agencies lack sufficient capacity, staff, and budget to do so, especially given the current financial crisis. These capacity gaps hamper implementation of the CAR and will certainly hinder the subsequent verification process. CAR implementation should be marked by the following characteristics:

adoption of sustainable agriculture practices, in alignment with the ABC Plan; the National Forest Inventory in the Cerrado; and programs relating to fire prevention and monitoring of vegetation cover, including implementation of a forest fire early-warning system.

- **Timely:** Although property owners have made good progress so far, with 91 percent of private land area registered as of May 2016,<sup>49</sup> the CAR process continues to be delayed. The initial deadline of May 2015 was pushed back to May 2016, a provisional measure (PM No. 724) was signed in May 2016 to shift the deadline for smallholders to May 2017, and in June 2016, a provisional measure (PM No. 733) extended the deadline for all rural properties until December 2017.<sup>50</sup> Some delays are clearly necessary, especially to help smallholders gain inclusion under the law. However, further delays may signal that the government will not enforce the law effectively, may carry a risk of paralyzing implementation of the Code, and may open the door to weakening the law.
- **Equitable:** Much of Brazil's rural population does not have sufficient resources to complete CAR registrations. Landowners may lack the needed knowledge base or technical skills, or they may not even be aware of the requirement. Traditional communities and family farmers could be at risk of losing their land if larger, better-resourced actors register claim to the same land. Although the CAR is not a land tenure regularization program, it is conceivable that CAR registration might be a component of future land tenure claims. Thus, CAR registration could prove to be both an offensive and defensive tactic for these actors in their long-standing effort to secure land tenure.

On a technical level, it is particularly challenging to register communally owned or managed land into the CAR. INCRA has the responsibility of supporting CAR registration for established rural settlements. But INCRA has been limited by budget cuts, and many communities that have not been formally established likely do not have the support they need to register. Federal, state, and local government agencies should support traditional communities and smallholders in completing CAR registration. Furthermore, the federal agencies and associations that support traditional communities and family farmers (e.g., INCRA, the National Indian

Foundation (FUNAI), the Ministry of Agrarian Development (MDA), National Confederation of Agricultural Workers, National Federation of Family Farming) should more actively support CAR registrations for these groups, and work to ensure that conflicts involving overlapping registries in the SICAR system are timely and equitably resolved.

- **Robust:** Because the CAR will be so voluminous (roughly 5.1 million properties)<sup>51</sup> and there is a great risk of entry of false information (as a result of intentional and unintentional misrepresentations of territory and legal reserve), the validation process may delay the effort to bring properties into compliance for quite a long time. Efficient and effective validation of the CAR is crucial to avoiding derailment of Forest Code implementation. The Brazilian federal and state governments, as well as international donors, should support the technical capacity of the state-level environmental secretariats that are largely responsible for validation of the CAR. These agencies are also responsible for establishing and implementing the state-level Environmental Compliance Programs (PRA). As of October 2015, only 15 out of 26 states had enacted provisions related to the PRA, and even in those states, the programs were not yet operational.<sup>52</sup>
- **Transparent:** Ensuring a transparent CAR is critical to its integrity across the country. Public CAR data can back-stop Forest Code compliance. For example, by combining parcel-level CAR data, satellite monitoring data, and supply chain information, buyers should be able to track illegal deforestation within their supply chains. Public attorneys could benefit from CAR data in prosecuting cases relating to land tenure or illegal deforestation. Civil society organizations could also use CAR data combined with satellite monitoring data to identify municipalities in need of technical assistance and to verify compliance with corporate commitments. Some of these organizations are already calling for transparency and access to information.<sup>53</sup>

49. Serviço Florestal Brasileiro, "Cadastro Ambiental Rural: Boletim Informativo," May 2016.

50. Serviço Florestal Brasileiro, "Pequenos Poderão Fazer CAR Ate Maio de 2017," May 5, 2016 and Canal Rural, "CAR is extended to all producers," June 15, 2016.

51. IBGE, *Censo Agropecuário* (Rio de Janeiro: 2009), 777.

52. Joana Chiavari and Cristina Leme Lopes, "Policy Brief: Brazil's New Forest Code. Part I: How to Navigate the Complexity," *Iniciativa para o Uso da Terra and Climate Policy Initiative*, November 2015.

53. Machado and Anderson, 2016.



## Beyond CAR

While CAR registrations are an essential first step to Forest Code compliance, a post-CAR agenda must be developed and initiated soon to prepare for implementation once the CAR is complete.

Currently, an estimated 21 Mha of legal reserve deficit exists in Brazil.<sup>54</sup> This land is out of compliance with the new Forest Code. Legally, it should have native vegetation but it does not. Addressing these debts would deliver important climate and conservation benefits. The new Forest Code allows landowners to address these debts by either ensuring protection of native habitat in excess of the legal requirement on someone else's land ("compensation") or restoring their own legal reserve to a vegetated state ("restoration"). (APP areas cannot be compensated and instead must be restored.) The key issue in designing both compensation and restoration systems is to balance ecological and economic viability so that the systems yield real conservation benefits while minimizing the cost to producers, thereby increasing the likelihood of durable compliance with the Forest Code. The government and civil society should proactively work to ensure these dual outcomes.

## Restoration

Restoration of the country's 21 Mha of previously cleared legal reserves could provide GHG mitigation of between 7 and 11 Gt CO<sub>2</sub>e<sup>55</sup> as well as important local benefits such as reduced sedimentation into streams, higher soil moisture content, improved pollinator habitat, and increased habitat for native Cerrado species. Restored areas could

also become valuable sources of products that support the livelihoods of traditional communities and could be an important aspect of Brazil's climate adaptation strategy. Restoration of APPs will be important for securing the hydrological function of the region and should be a priority within the restoration agenda. Brazil has pledged to restore 12 Mha of degraded lands by 2030 as part of its Intended Nationally Determined Contribution (INDC) committed under the Paris Climate Agreement.<sup>56</sup>

Under the Forest Code, landowners are allowed to meet half of their legal reserve requirements with planted forests, while the remainder must be replanted with native vegetation. There is already a growing tension between the planted forest industry, which sees an opportunity for compliance-driven expansion, and the conservation community, which views planted forest (typically eucalyptus or pine) as lacking ecological integrity. Conservationists are concerned that restoration efforts that focus on tree planting rather than restoration of native habitat worsen biodiversity loss and further compromise ecosystem services, even if non-exotic species are limited to 50 percent of the recovery area.<sup>57</sup> Others see potential for planted forests to help relieve pressure on native forests when linked to supply chains interested in deforestation-free timber (e.g., the pulp and paper industry and the soy industry, which uses wood for its driers).<sup>58</sup>

A key issue will be determining how to finance restoration, which can cost up to thousands of reals per hectare. Restoration with native vegetation can be made more economical for landowners via subsidies for seeds and seedlings, technical assistance from industry associations and the National Agency on Technical Assistance and Rural Extension (ANATER), simple guidelines from the Brazilian Agricultural Resource Corporation (Embrapa), and identification of native species that have revenue generation potential, also from Embrapa. Although slower than active planting, allowing the land to regrow naturally is a less expensive route to restoration, which may also support biodiversity and species that are appropriately adapted to local climatic conditions.

54. Soares-Filho et al., 2014.

55. Ibid.

56. Federative Republic of Brazil, *Intended Nationally Determined Contribution: Towards Achieving the Objective of the United Nations Framework Convention on Climate Change*.

57. Joseph W. Veldman et al., "Tyranny of Trees in Grassy Biomes," *Science* 347, no. 6221 (2015): 484.

58. Drying soybeans is an important part of processing, helping to prevent growth of fungi and bacteria.



Photo: Caill Souza/Flickr

In the near term, the government, civil society, and academics should focus on ensuring good design of restoration systems, determining where restoration should be prioritized on the landscape, and identifying an environmentally responsible mix of vegetation. While guidelines are needed at the national level, they are particularly important for the southern Cerrado states, where most of the biome's legal reserve deficits are located. The MMA's draft National Plan for Native Vegetation Restoration (PLANAVEG) could play a key role in defining and charting the course for restoration. However, development of this plan seems to have stalled since it was open for public comment in August 2015. Lack of formal restoration guidelines threatens to further delay the environmental compliance and land regularization process.

### Compensation

The Forest Code allows landowners to come into compliance by paying other landowners with surplus native vegetation to keep that land in its natural state in lieu of restoring their own legal reserves. This system could lower the costs of Forest Code compliance and protect intact habitat on private properties. However, it also has the potential to undermine the Forest Code's environmental objectives. If poorly implemented, the CRA might allow a landowner to pay pennies

to "protect" land that is subsequently deforested, claimed unlawfully as compensation for many different properties, or located so far afield that it faced little risk of deforestation and therefore provides no additional conservation benefits. Alternatively, the complex web of laws could be so convoluted that little trading occurs, and if restoration options appear onerously expensive, landowners may either ignore Forest Code requirements or actively seek to undermine the law. The near-term goal is to develop smoothly functioning exchanges that are not prohibitively complex and are free of damaging loopholes.

State and federal governments are in the process of developing the regulations for the CRA, the mechanism that will allow these trades. The regulations governing the design of CRA markets are not yet complete. Efforts to map Forest Code implementation have revealed many remaining gaps and uncertainties in the design of CRA markets at both federal and state levels.<sup>59</sup> Open questions include the term of the compensation (e.g., ten years? fifty years?), the geographic boundaries within which compensation will be allowed, how monitoring and verification will be handled, and whether compensation can be met by buying out government liabilities in conservation units and settlements.

59. Chiavari and Lopes, 2015.



## Considerations in the design of CRA markets

Key considerations in designing CRA markets to be both equitable and efficient include the following:

- **Transparency and verification:** Landowners can claim to have protected land on the CRA market as a way to comply with the Forest Code. Thus, a registry of trades should be tracked and monitored by the government or an independent institution empowered to verify and manage the CRA markets to ensure there is no double counting or other inconsistencies. Unless trades can also be publicly verified, illegal trading and false claims of Forest Code compliance are likely. All CRA transactions should be geo-tagged and publicly reported on a system that is tied to a public CAR and land registry.
- **Compensation boundaries:** Allowing for compensation within the boundaries of the biome, rather than within the boundaries of a state, is likely to shift compensation trades to regions that are far from the agricultural frontier. There is considerably more intact native vegetation in more remote areas, where land is much cheaper. However, that land is also much less likely to be developed and its protection would therefore provide questionable additional benefits.
- **Transaction costs:** High transaction costs have the potential to dampen the market, making it less robust and less used. Finding ways to streamline the regulations and the CRA system will help keep transaction costs low.
- **Ensure additionality:** In a number of conservation units in the Cerrado, private landowners still own some portion of the land. The government has been slow to buy out this land, prompting some to suggest that landowners should be able to meet their compensation requirements by buying out this liability on behalf of the government. While these existing conservation units clearly need support, allowing for these in-holdings, estimated to total 14 Mha, to be offered as surpluses on the CRA market would not help protect additional land.<sup>60</sup>
- **Opportunity to develop conservation corridors and protect priority landscapes:** For compensation that occurs outside the state of the rural property in need of compliance, the law requires the federal government and the states to indicate priority areas for compensation.<sup>61</sup> This element of the law could allow for “smart compensation,” whereby compensation credits are targeted at areas of high conservation value, such as areas where contiguous corridors can be consolidated or those areas with high carbon stocks, important hydrological function, habitat for endemic or endangered species, or specific socioeconomic importance.<sup>62</sup> CRA regulations should guide landowners to aggregate their offsets in these areas, building off of the Ministry of Environment’s official Priority Conservation Areas.<sup>63</sup>
- **Support a range of land-related environmental services:** One idea suggested by Brazilian academics is to use the CRA offset market as a platform for a range of land-related environmental services (e.g., carbon, biodiversity, water), with the CRA infrastructure providing a ready supply of forests for a variety of potential buyers.<sup>64</sup> (See “X-CRA,” p. 39.)
- **Equity:** An additional challenge of the CRA system is that smallholders will only be able to participate if they hold formal land titles, which most do not.<sup>65</sup> This reality underscores the importance of coupling land regularization efforts with implementation of the CAR and the CRA. Again, smallholders and traditional communities will need technical assistance with all of these processes.

A more complete analysis is available from a study on the economic viability of the CRA from the Federal University of Minas Gerais.<sup>66</sup>

60. Raoni Rajão and Britaldo Soares-Filho, “Policies Undermine Brazil’s GHG goals,” *Science* 350, no. 6260 (2015): 519.

61. Machado and Anderson et al., 2016.

62. Ibid.

63. MMA, *Priority Areas for the Conservation, Sustainable Use and Benefit Sharing of Brazilian Biological Diversity* (Brazil, 2007).

64. Rajão and Soares-Filho, “Cotas de Reserva Ambiental,” 2015.

65. Chiavari and Lopes, 2015.

66. Rajão and Soares-Filho, “Cotas de Reserva Ambiental,” 2015.

## Strong compliance and monitoring

### Compliance and enforcement

Compliance with and enforcement of the Forest Code have traditionally been weak. For example, in 2008 over 85 percent of properties in the State of Mato Grosso (which spans the Cerrado, Amazon, and Patanal biomes) were not in compliance with the Forest Code as it stood at the time.<sup>67</sup> The challenge of ensuring compliance with the law was recognized implicitly by Brazil's recent international commitments to halt illegal deforestation by 2030—an acknowledgment that stopping illegal deforestation is a decadal project.<sup>68</sup> State and local governments must have the training and resources to effectively enforce the Forest Code. A culture and expectation of compliance also requires the support of landowners themselves and of the corporate buyers of their agricultural products. As of January 2017, CAR registration will be a precondition of receiving government agricultural credit, an appropriate and necessary check on compliance. Additionally, CAR registration should be a precondition to obtaining private sources of agricultural credit and a precondition to selling to corporate buyers. Rapid restoration of APPs that are out of compliance will be particularly important given the critical role that the Cerrado plays in provisioning of water for the country. In order to ensure accuracy in the CAR validation process, a high-quality, geo-referenced database of watersheds is necessary. Without this database, it will be difficult for the SICAR system to identify and protect APPs.<sup>69</sup>

### Land use and deforestation monitoring

Remote monitoring, especially satellite monitoring, is increasingly important in verifying compliance with the Forest Code. The Cerrado is a uniquely challenging environment for satellite monitoring because it can be hard to distinguish between different types of land cover and land use activities (e.g., pasture versus native grassland, degraded pasture versus pasture that is undergoing restoration). These challenges lead to a significant margin of error in satellite land cover maps of the Cerrado. At the same time, monitoring technology is continuously improving even as costs decrease.

A number of Brazilian ministries are currently involved in creating monitoring systems that will cover the Cerrado. Each of these systems plays an essential role in improving compliance and monitoring of vegetation cover in the Cerrado.

- **Terraclass:** Terraclass is a biannual land cover map developed by an MMA-led multiagency collaboration. It succeeds PROBIO (2002). Terraclass was released in November 2015 and can be found at: <http://www.dpi.inpe.br/tccerrado/>.
- **PRODES:** PRODES Cerrado will be an annual deforestation monitoring system specifically targeting the Cerrado. Its annual data will represent a great improvement over current deforestation data for the Cerrado. The most recent official deforestation (i.e., loss of natural vegetation) data for the biome is from 2010. The National Institute of Space Research (INPE) expects PRODES Cerrado to go live in 2016.
- **DETER Cerrado:** DETER will provide short-term deforestation monitoring, so that recent or in-process deforestation can be seen on a month-to-month timescale. The Institute of Environment and Renewable Natural Resources (IBAMA) is in the process of testing this system.
- **Fire monitoring:** Fire monitoring is already in place for the Cerrado; INPE issues fire alerts within hours of fires being observed. Resolution will likely continue to improve over time. Burned area maps are under development.

Academia, the private sector, and civil society can each play very important roles in augmenting official monitoring systems. For example, LAPIG currently provides time-series data on deforestation in the Cerrado from 2003 through 2015. Civil society organizations can also interpolate or help fill in where official data is lacking, as the SEEG (Greenhouse Gas Emission Estimate System) project of the Climate Observatory does. This system is currently in the process of developing annual land cover maps stretching from 1970 through 2013 (MAPBIOMES), which will allow for calculation of deforestation and carbon stock fluxes across Brazil over time. Efforts to map

67. Stickler et al., 2013.

68. Commitments include Brazil's INDC and its joint statements on climate change with the United States and Germany. Federal Republic of Brazil, *Intended Nationally Determined Contribution Towards Achieving the Objective of the United Nations Framework Convention on Climate*

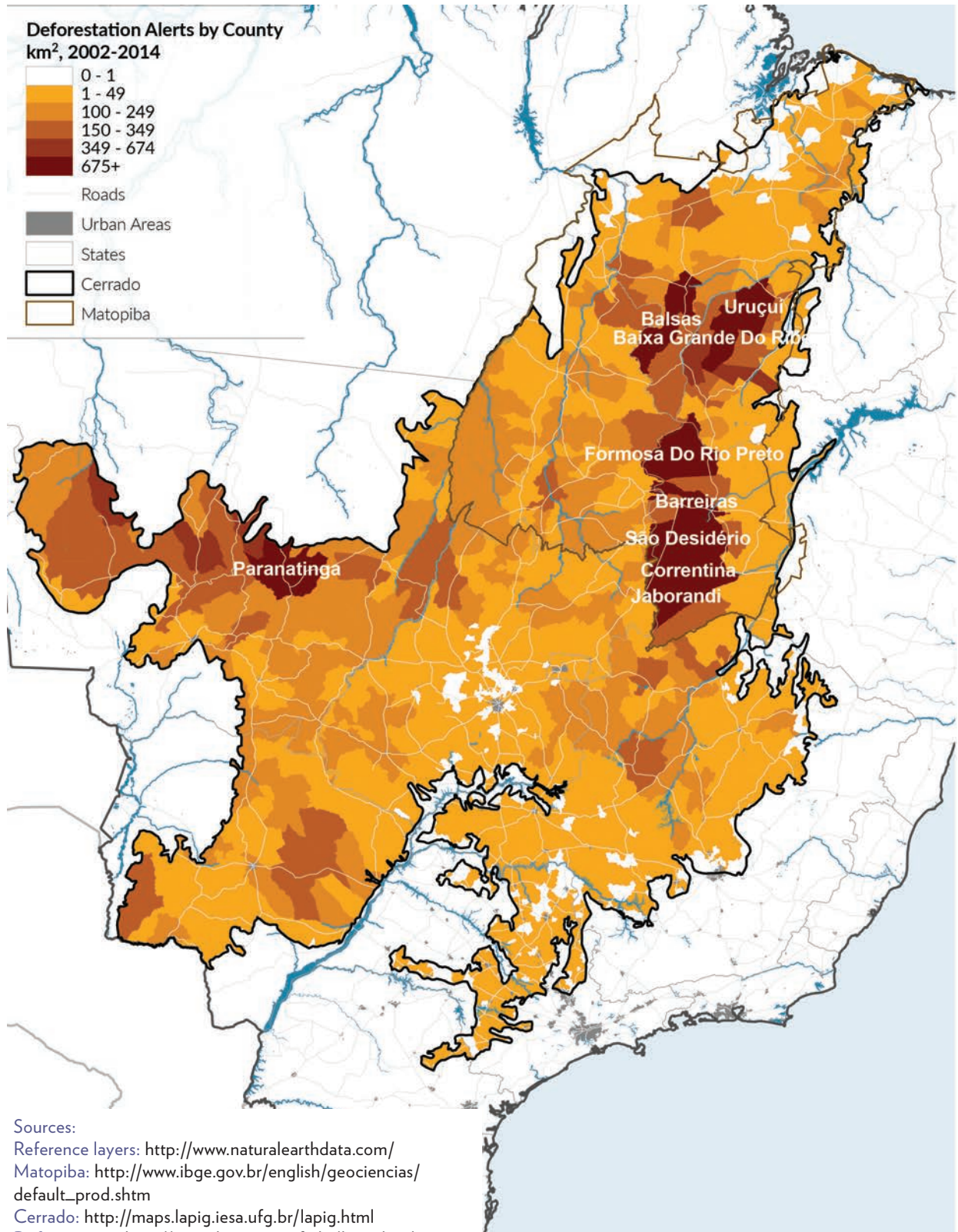
*Change* (September 28, 2015); The U.S. White House, Office of the Press Secretary, *U.S.-Brazil Joint Statement On Climate Change* (June 30, 2015); and Brazil Ministry of Foreign Affairs, *Brazilian-German Joint Statement on Climate Change* (Nota 337: August 20, 2015).

69. Machado and Anderson, 2016.

deforestation globally provide another useful set of data points. Due to the challenges of mapping deforestation and carbon fluxes remotely, having multiple systems can help to reduce uncertainty and provide a better understanding of the range of possible scenarios. These tools can help civil

society monitor deforestation rates, watch-dog implementation of the Forest Code and private sector commitments, and track success of other environmental programs (e.g., PPCerrado) and protected areas. (See Map 3.)

MAP 3: BRAZIL'S CERRADO, DEFORESTATION



## PRIORITY 2

# Protection and management of community and conservation lands

*Recognition and titling of traditional peoples' lands and territories and improved stewardship of native habitat within all types of conservation areas*

The Matopiba region of the Cerrado is a contested landscape today. The 73-Mha region has experienced the country's fastest growth in agricultural expansion and some of the highest rates of deforestation over the last decade.<sup>70</sup> It is the new agricultural frontier of Brazil. PDA-MATOPIBA has the potential to accelerate this pattern of development and further change the character of the landscape. The government views the region as poor and in need of development. Evaristo de Miranda, the coordinator of EMBRAPA's GITE (Group on Strategic Territorial Intelligence), has publicly stated that "the Matopiba region is an archipelago of islands of prosperity in a sea of poverty and rural misery."<sup>71</sup> It is undeniable that the Matopiba region is poor—its per capita GDP is R\$7,950, below the national average of R\$19,770—and that efforts to provide technical assistance and agricultural credits to small-scale producers are laudable.<sup>72</sup> The plan's stated objectives are to promote and coordinate public policies aimed at sustainable economic development, based on agricultural and livestock activities that improve livelihoods.



Photo: Peter Caton/ISPN

Yet many rural inhabitants of Matopiba bristle at the vision of development put forth by PDA-MATOPIBA and the assertion that this type of development will benefit them in the long run. Instead, they see it as a government-backed invasion of their land that will ultimately result in a massive land transfer to large-scale producers from outside of the territory and displacement of communities. An open letter for the Brazilian Society and the Presidency, issued in November 2015 by a group of 40 civil society organizations in the Cerrado, including the Interstate Movement of Quebradeiras de Coco Babaçu (MIQCB), Rede Cerrado, Comissão Pastoral da Terra (CPT), and Conselho Indigenista Missionário (CIMI), claimed that PDA-MATOPIBA will "promote further destruction of life and exclusion of the Cerrado people... [enhancing] rural exodus and increasing poverty and the invisibility of populations in the territory."<sup>73</sup> The plan has also been critiqued for not meeting the requirements of international agreements and prior consultation laws<sup>74</sup> and for not including any environmental or social representation in its governance body.<sup>75</sup>

70. LAPIG, 2015; Rudorff et al., 2015.

71. Evaristo Eduardo de Miranda, "Matopiba: Desenvolver a Agricultura ou os Agricultores?," *Correio Braziliense*, April 30, 2015.

72. Chico Santos, "Agribusiness: Inclusive Development," *The Brazilian Economy* 7, no. 7: 18.

73. Comissão Pastoral da Terra et al., "Carta Aberta à Sociedade Brasileira e à Presidência da República e ao Congresso Nacional Sobre a Destruição do Cerrado Pelo MATOPIBA," November 25, 2015.

74. Rocha, 2015.

75. The program will be governed by a Manager Committee composed of MAPA; the Ministry of Agrarian Development (MDA); the Ministry of Industry and Commerce (MDIC); the Ministry of National Integration (MIN); the Ministry of Science, Technology and Innovation (MCTI); and the Ministry of Education (ME); as well as one representative from each state and four representatives of the executive power of the four municipalities of the region—one from each state; six agribusiness representatives; six union representatives; and two representatives from academia. The executive secretariat of the program will be from MAPA.

## Major traditional communities in the Cerrado and their primary demands<sup>76</sup>

Both the Cerrado and its northern reaches (Matopiba) are home to a great diversity of rural communities that have inhabited the territory for generations. Many of these communities are officially recognized in Brazil as traditional peoples under the 1988 Brazilian Constitution and subsequent national laws. Many groups are further supported by state level constitutions and municipal and international conventions. Each is a unique group with its own social identity, connection to the land, and specific needs and demands. Many of them consider land as a commons or communally-owned resource.

- **Indigenous peoples** have constitutional rights to their lands. However, these lands are often not fully demarcated or officially recognized by the government. Their primary demand is for full recognition and protection of their lands. At the same time, indigenous peoples are demanding access to programs for sanitation, sustainable production, education, culture, housing, and health. FUNAI is the federal government agency responsible for indigenous peoples. Indigenous peoples have established their own organizations, at both the local and national level, including COIAB and APOINME.
- **Quilombolas** are ethnic groups predominantly comprised of descendants of enslaved Africans who live in rural or urban communities, established since the 17th century, during and after the period of slavery. These communities are officially recognized by the Brazilian Constitution as well as a subsequent decree which regularizes land titling procedures to guarantee their territories. To date, the Brazilian government has recognized the existence of more than 3,000 quilombos settled on some 30 Mha of land. However, as of 2016, the government had only issued about 110 ownership certificates. The primary demand of quilombolas communities is land ownership. At the same time, quilombolas are demanding access to programs for sanitation, production, education, culture, housing, and health. A diversity of federal agencies have jurisdiction over quilombos, including Fundação Palmares and INCRA. Additionally, many state governments have agencies dedicated to quilombos. Quilombolas are nationally organized through CONAQ, a social movement which also has state level branches.
- **Quebradeiras de coco** are women whose livelihoods depend on gathering the “babaçu” palm nut. Their territory stretches over nearly 30 Mha in parts of the States of Piauí, Maranhão, Tocantins, and Pará. These women are officially recognized by Brazilian laws as traditional peoples, although they don’t have their rights inscribed in the federal Constitution. They do have protections under the Constitution of the State of Maranhão as well as laws and decrees in several municipalities. Many of these communities are also quilombolas or extrativists and thus some are demanding that their babaçuais territories are demarcated as quilombos, extractive reserves (RESEX), or rural settlements. In addition, they fight for the enforcement of the “Free Babaçu” laws, which would protect the babaçuais from deforestation and would enable them to collect the babaçu nuts on private lands. Guaranteeing access and control of the babaçuais areas is their primary demand. Further, they are interested in gaining support for their products in the market. There are supported by several federal agencies, including MMA and ICMBio. They are very well organized, primarily through MIQCB, an interstate social movement.
- There are several **other agroextractivists communities** beyond the quebradeiras de coco. Some, such as the rubber tappers, gatherers of brazil nuts, and fisher people, have protections under decrees. The needs and demands of these groups are similar to those of the quebradeiras de coco. They seek guaranteed access to the land that they harvest and support for their products in the marketplace.
- **Family farmers** are not recognized as traditional peoples under the Brazilian legal framework. They do not seek to title their lands as a commons, but rather as private small farmers. Their rights over parcels of land are guaranteed by the Brazilian Agrarian Reform Legal Framework (Estatuto da Terra). However, they often struggle to secure legal title to their lands. Thus, one of their primary concerns is land regularization so that they can protect themselves from land grabbing. They are also in need of technical assistance, dedicated credit lines, and market support in order for their agricultural practices and economies to thrive.

76. Alfredo Wagner Berno de Almeida and Mason Mathews, “Traditionally Occupied Lands in Brazil,” PGSCA-UFAM, 2011.

## Regularization of the landscape

PDA-MATOPIBA might not be seen as such a threat if traditional communities and peoples had more secure tenure to their land, clearer means for securing tenure, and better mapping of their needs and territories.

Brazil has a storied history of disenfranchisement of rural inhabitants who, although they may have inhabited their land for generations, often do not have formal land title. The regularization process for this large portion of the population is complicated by the historical layers of titling, dating back to the Portuguese Crown, and the overlapping authority between federal, state, and municipal governments.<sup>77</sup> There is no single repository of land title documentation. Further complicating the matter is the fact that land claims can easily be fabricated in such an uncoordinated system, and traditional communities are often victim to more powerful, better resourced, and sometimes violent actors. According to Bastiaan Reydon, an agrarian economist, Brazil has always had a “disability...in regularizing the land market and access to land for social, economic and environmental purposes.”<sup>78</sup> Accounts of land grabbing are rampant. Even TIAA-CREF, an American investment firm that prides itself on upholding socially responsible values, has been implicated in land grabs and transgressions of laws that limit foreign investment into Brazilian agricultural land.<sup>79</sup>

The community backlash against PDA-MATOPIBA, the TIAA-CREF land-grabbing affair, and the tangle of land title conflicts across rural Brazil all point to a single reality: small-scale rural inhabitants are vulnerable in Matopiba, and without significant support from civil society and the government, they are likely to face the fate of most developing agricultural landscapes (including those in much of the southern Cerrado): they will be displaced from their land in favor of consolidated holdings with industrial-scale agricultural production.

Helping traditional communities and small-scale family farmers maintain control of their land should be a high priority for both the social movement and conservation agendas in Brazil.

It is the top priority for the communities themselves. Reducing the conflict on the landscape will require support for communities and family farmers, through mapping their situation and needs, providing capacity building and legal training, engaging the state-level public prosecutors, identifying the means to ensure access/right to land, coordinating between various federal and state ministries, and investing in upgraded data systems. At the same time, it will require more restraint on the part of large-scale agricultural producers, international buyers, and investors in agricultural lands. These actors need to understand the risks associated with land speculation in the Cerrado and must commit to conflict-free supply chains, better documentation of their individual land acquisitions, and broad support for the process of land regularization in the region.

## CAR as a means of registering land

As noted above, the self-declaratory nature of the Forest Code's CAR registry could prove to be a tool of land grabbers. Conversely, the CAR could become a good entry point for family farmers and communities working to establish their land title (although the CAR is not a land tenure regularization program). Whether the CAR is used proactively or defensively, capitalizing on the current window for registration and national and international support for the process is a good strategy for communities and family farmers. Federal, state, and local government agencies should support their participation in the CAR with technical assistance.

## Support for indigenous and quilombola lands and other communally managed lands

In addition to general improvements to land titling and land regularization in Matopiba, the area deserves much more formalization of community-managed lands. One example is recognizing and titling indigenous territories that have not yet received formal recognition but are protected under the constitution. Several are being proposed by FUNAI and are at different stages in the technical process of becoming demarcated and formalized.<sup>80</sup> (See callout box on previous page.)

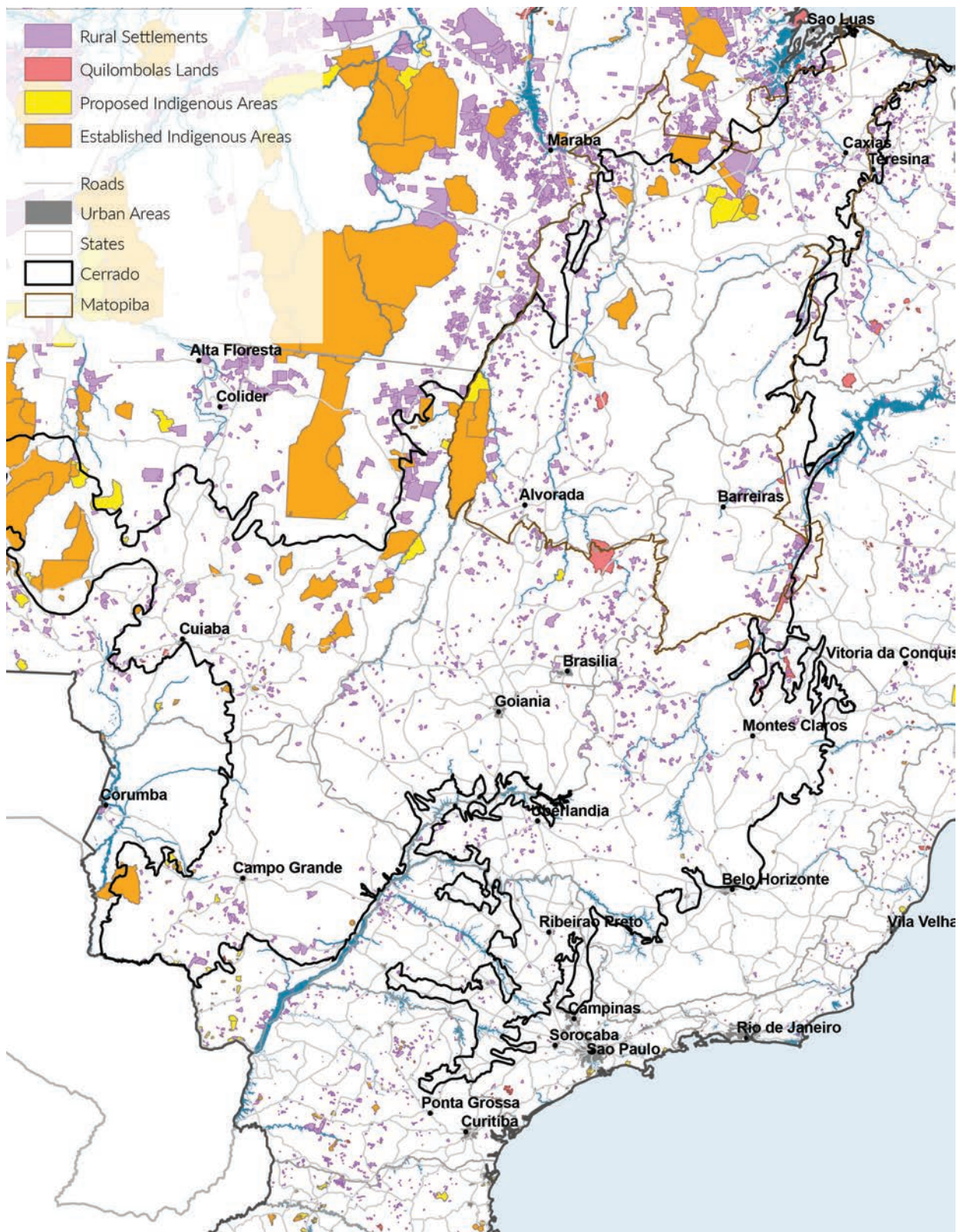
77. As an example, we heard anecdotally that in São Félix do Xingu, registry papers correspond to 27 Mha while the municipality has an area of only 8.5 Mha.

78. MDA, *Núcleo de Estudos Agrários e Desenvolvimento Rural. Mercado de Terras no Brasil: Estrutura e Dinâmica* (Brasília: 2006).

79. Simon Romero, “TIAA-CREF, U.S. Investment Giant, Accused of Land Grabs in Brazil,” *The New York Times*, November 16, 2015.

80. FUNAI, 2015.

MAP 4: BRAZIL'S CERRADO, COMMUNITY LANDS



Sources:

Reference layers: <http://www.naturalearthdata.com/>

Matopiba: [http://www.ibge.gov.br/english/geociencias/default\\_prod.shtm](http://www.ibge.gov.br/english/geociencias/default_prod.shtm)

Cerrado: <http://maps.lapig.iesa.ufg.br/lapig.html>

Indigenous Areas: <http://mapas2.funai.gov.br/i3geo/datadownload.htm>

Quilombolas: <http://maps.lapig.iesa.ufg.br/lapig.html>

Rural Settlements: <http://maps.lapig.iesa.ufg.br/lapig.html>



A more complex example is the Quebradeiras de coco babaçu (described above) who harvest the babaçu fruit (a palm species) for a variety of subsistence and commercial purposes.<sup>81</sup> Babaçu breakers are allowed access to privately held lands for foraging in some municipalities.<sup>82</sup> However, if those lands are converted to eucalyptus plantations or soy fields, their livelihoods and way of life will disappear with the babaçu palms. Establishing more secure access to their lands is essential for this community as they face expansion of planted forests. One babaçu breaker in Maranhão reports, “the eucalyptus situation is so bad right now I can barely explain it to you.”<sup>83</sup> One potential avenue of support is through a federal law proposed in 2007, “Babaçu Livre,” which would ensure free access for the babaçu breakers onto private land across the country. The same dynamics are at play in other agroextractivist communities.

Additionally, continued efforts to establish new rural settlements and expand the network of sustainable use protected areas (e.g., RESEXs and Sustainable Development Reserves (RDS)) are needed, as are development of other categories of lands such as Indigenous and Community Conserved Areas (ICCAs). (See Map 4.)

### Community mapping

In order to develop formal and defensible territories for the myriad traditional communities across Matopiba, it is essential to map the lands they inhabit and the natural resources they depend upon and help to conserve. The New Social Cartography of the Amazon is supporting many such efforts. These maps are best made via partnerships between the communities who have knowledge of the landscape and technicians who are adept at mapping. These maps should be integrated into the land use planning efforts of PDA-MATOPIBA and go/no-go zoning adopted

81. “Entre a Caatinga e o Cerrado: as Quebradeiras de Coco Babaçu,” *Ninja*, August 11, 2015.

82. Instituto Socioambiental, “Mapa Revela Aumento da Incidência de Babaçuais no PI, TO, MA e PA” (August 2015)

as a part of agribusiness expansion plans and used as a way to direct technical resources.

### Legislative threats

Environmentalists and traditional communities alike are concerned about a legislative threat to the creation of new indigenous lands and quilombola areas. A bill under discussion at the House of Representatives (PEC 215) aims to change Brazil’s constitution to shift responsibility for the approval of new areas from the President to the Congress. It also would require new quilombola lands to be created by law, a much higher bar than currently exists. These changes would make it harder to officially recognize indigenous and quilombola lands that have not yet completed this process, creating further risks and hurdles for these already-vulnerable communities.

### Better management of indigenous and quilombola territories and other traditional community lands

While indigenous, quilombola, and other traditional communities tend to manage the native habitat on their lands in a sustainable manner, expanded efforts to support good land management planning and practices will be important over the long term. A good example is the National Policy of Territorial and Environmental Management of Brazilian Indigenous Lands (PNGATI), which is designed to help foster sustainable management of natural resources on indigenous lands.

### Expanded and well-maintained protected area network

The Cerrado is a global biodiversity hotspot. It is rich with endemism, and yet an estimated 20 percent of native and endemic species do not fall within any legal protected areas, while at least 345 animal species in the Cerrado are threatened with extinction.<sup>84</sup> Additionally, the existing protected area network is not well managed. Funding from federal, state, and municipal budgets is often inadequate to meet the operational needs of the areas and, by some accounts, the rate of deforestation within “sustainable use” protected areas is just as high as the rate of deforestation outside of them (strictly protected areas fare much better in this regard).<sup>85</sup>

83. David Hill, “Meet the ‘Babassu Breakers’ on Brazil’s ‘New Agricultural Frontier,’” *The Guardian*, September 2015.

84. CEPF, 2016.

85. Ibid.



The Cerrado has roughly 17.4 Mha covered by 383 public protected areas in the various management categories defined by the National System of Conservation Units (SNUC).<sup>86</sup> This network covers 8.5 percent of the biome, below the Aichi target of 17 percent, set by the Convention on Biological Diversity.<sup>87</sup> Indigenous and quilombola lands together add about 10 Mha to the tally of native habitat under protection.<sup>88</sup> Combining indigenous and quilombola lands with the SNUC conservation units, a total of 13.5 percent of the Cerrado is protected, covering 27 Mha in over 500 different tracts.<sup>89</sup> This figure not only fails to protect the historical occupation and socio-cultural traditions of communities in the Cerrado but is insufficient to conserve the rich biodiversity of the region. (See Map 5.)

### Protected Lands in the Cerrado

Developing new protected areas in the Cerrado is particularly challenging because much of the land is privately held, so the government would need to buy out those landowners in order to establish new protected areas. However, much of the technical work necessary to develop new protected areas and new indigenous areas has been done. The MMA, in partnership with WWF, analyzed the priority areas for conservation in the Cerrado (updated from a 2007 publication).

The maps of priority areas for conservation have been published by WWF, but have not yet been officially published by the government.<sup>91</sup> WWF's publication identifies 300 priority areas in the Cerrado (covering roughly 78 Mha, or about 40 percent of the Cerrado biome); 20.6 Mha of this area is classified as "extreme priority." The Critical Ecosystems Partnership Fund's (CEPF) Ecosystem Profile of the Cerrado identifies 765 key biodiversity areas (KBAs), covering 118 Mha (roughly 10 percent of these areas are currently inside protected areas or indigenous areas). KBAs are strategic locations for the conservation of globally important biodiversity in the Cerrado. Approximately 21 Mha of CEPF's KBAs are classified as "priority."<sup>92</sup> There are large overlaps between WWF's priority areas and CEPF's KBAs.

Expanded and strengthened protected areas remain critical for the long-term health of the Cerrado, its traditional communities, its plant and animal species, and also its hydrological function. In the near term, efforts should be focused on shoring up management and protection of existing protected areas and on using the CRA ("smart compensation"), agricultural credits, and supply chain commitments to protect areas of high conservation value and guide agricultural development to less biologically and socially valuable land. (See Maps 5, 6 and 7.)

### Protected Lands In The Cerrado <sup>90</sup>

CATEGORY	AREA (MHA)	PERCENT OF BIOME	NUMBER OF PARCELS
<b>Cerrado lands in the National System of Nature Conservation Units (SNUC)</b>			
Strict protection	6.28	3.1%	119
Sustainable use	11	5.4%	103
Private Natural Heritage Reserves (RPPN)	0.16	0.1%	161
<b>Other protected lands</b>			
Indigenous lands	9.6	4.7%	95
Quilombola lands	0.4	0.2%	44
<b>All protected areas</b>	<b>27</b>	<b>13.5%</b>	<b>522</b>

86. MMA, "Unidas de Conservacao por Bioma," February 26, 2016.

87. Ibid.

88. Note that the total area in indigenous territories is 9.6 Mha, of which 9.1 Mha is covered by native vegetation, and the total area of quilombola areas totals 0.4 Mha, of which about 0.2 Mha is covered by native vegetation. CEPF, 2016.

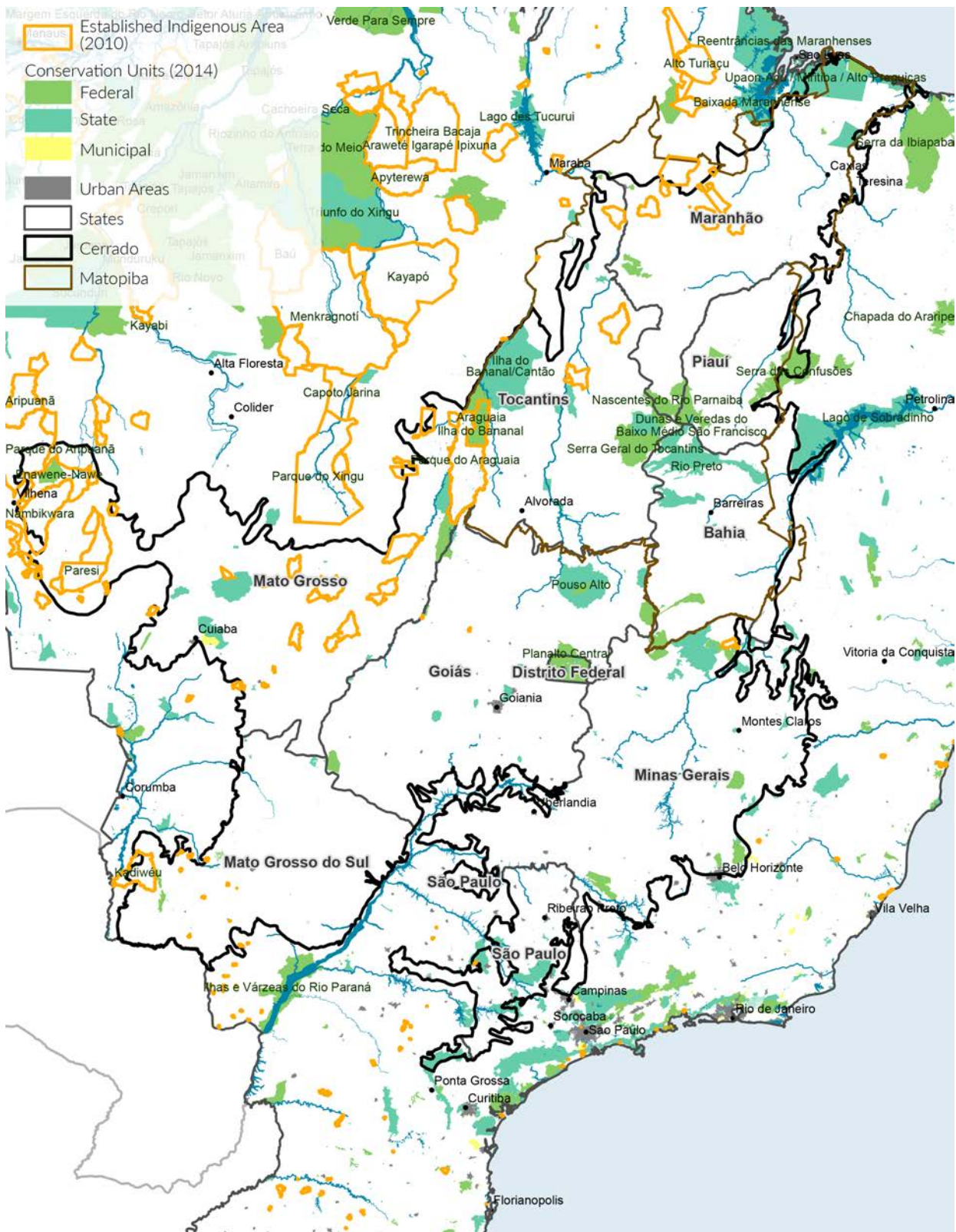
89. Ibid.

90. MMA, 2016; CEPF, 2016.

91. Mario Barroso et al., "Áreas Prioritárias para Conservação do Cerrado e Pantanal," *WWF Brasil*, 2013.

92. CEPF, 2016.

MAP 5: BRAZIL'S CERRADO, PROTECTED AREAS



Sources:

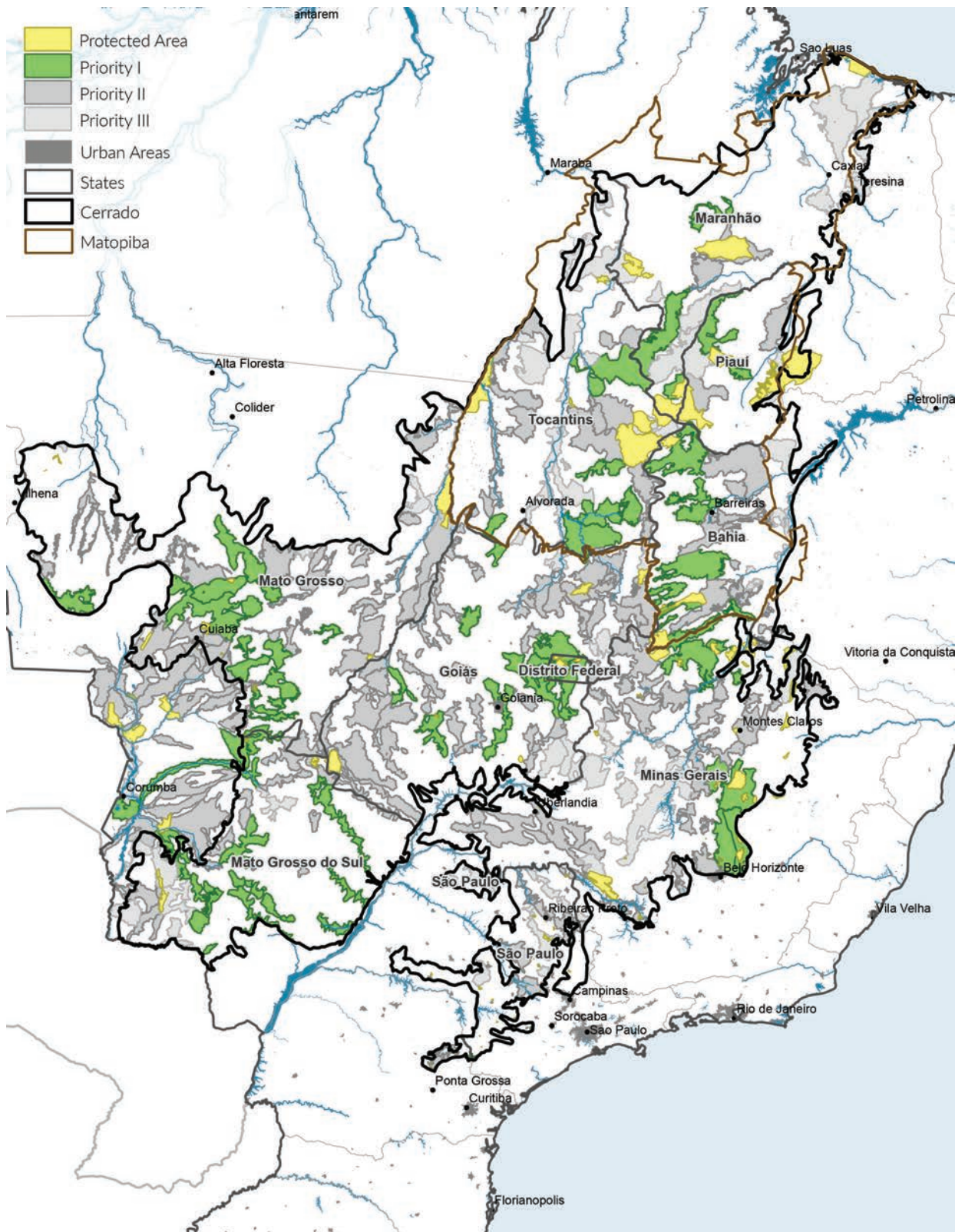
Reference layers: <http://www.naturalearthdata.com/>

Matopiba: [http://www.ibge.gov.br/english/geociencias/default\\_prod.shtm](http://www.ibge.gov.br/english/geociencias/default_prod.shtm)

Cerrado: <http://maps.lapig.iesa.ufg.br/lapig.html>

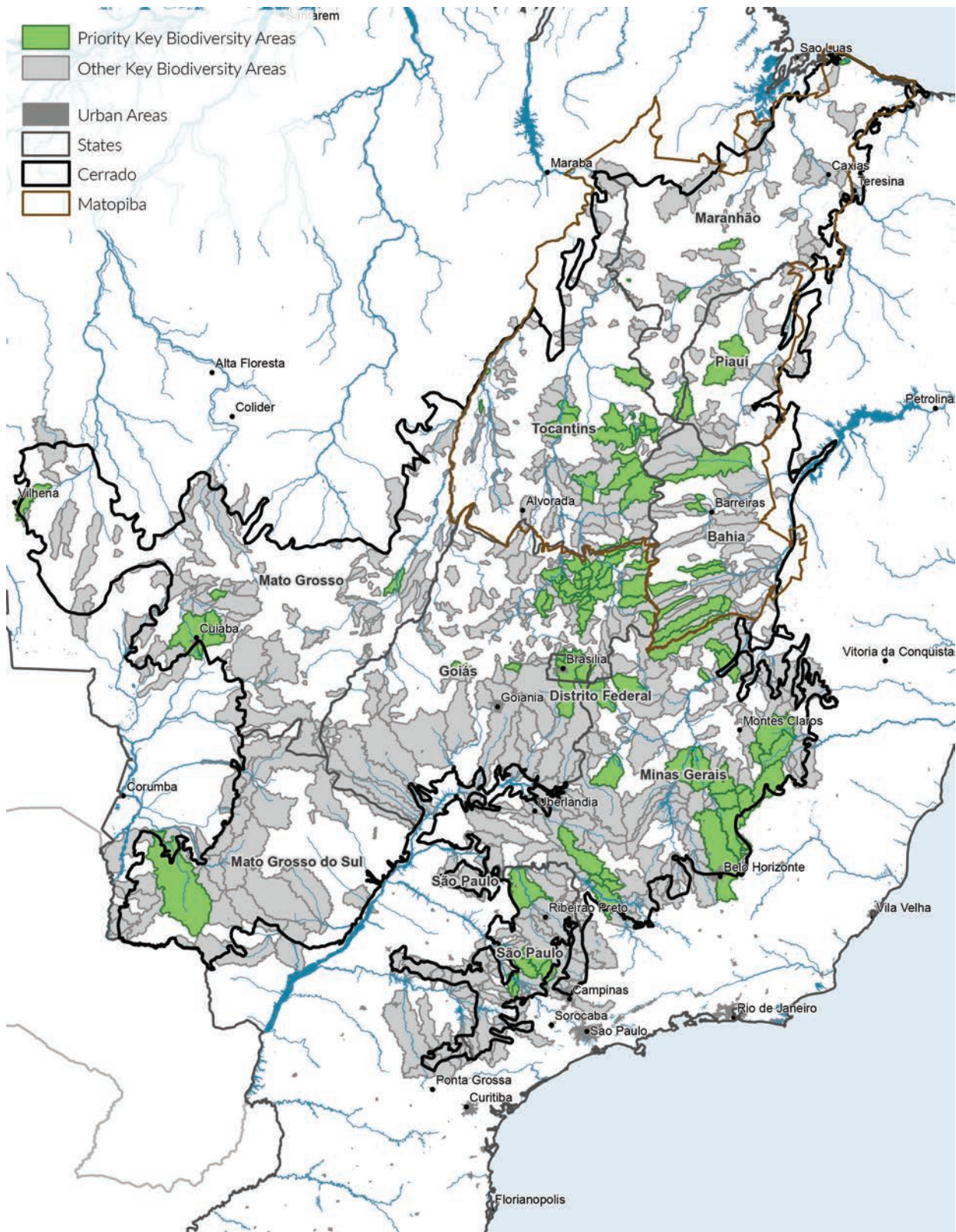
Protected Areas: <http://mapas.mma.gov.br/mapas/aplic/probio/datadownload.htm>

MAP 6: BRAZIL'S CERRADO, PROTECTED AREAS AND PRIORITY CONSERVATION AREAS



Sources:  
 Reference layers: <http://www.naturalearthdata.com/>  
 Matopiba: [http://www.ibge.gov.br/english/geociencias/default\\_prod.shtm](http://www.ibge.gov.br/english/geociencias/default_prod.shtm)  
 Cerrado: <http://maps.lapig.iesa.ufg.br/lapig.html>  
 Protected Areas & Priorities: Mario Barroso et al., "Áreas Prioritárias para Conservação do Cerrado e Pantanal,"  
 WWF Brasil, 2013.

MAP 7: BRAZIL'S CERRADO, KEY BIODIVERSITY AREAS



Sources:

Reference layers: <http://www.natureearthdata.com/>

Matopiba: [http://www.ibge.gov.br/english/geociencias/default\\_prod.shtm](http://www.ibge.gov.br/english/geociencias/default_prod.shtm)

Cerrado: <http://maps.lapig.iesa.ufg.br/lapig.html>

KBAs: Critical Ecosystem Partnership Fund (CEPF), "Ecosystem Profile: Cerrado Biodiversity Hotspot," April 2016.

Cerrado Biodiversity Hotspot." December, 2015.

## Other threats

Other threats to native habitat and community lands must continue to be tracked, understood, and mitigated.

## Illegal fires

Fire is the most common method used to remove natural vegetation in the Cerrado, even though it is illegal. In addition to destroying native vegetation, fires are a significant source of GHG emissions (including methane, nitrous oxide, and black carbon), and their smoke can cause major human health impacts. Brazil already has a strong fire detection system; however, the capacity to respond to fires is mixed and varies by area. ICMBio is responsible for fire suppression and control in conservation units, PrevFogo covers most state-owned lands, and local fire brigades are responsible for managing fires on private lands. Fire response is expensive and it will be challenging to fund improved fire management in a time of declining budgets, even though international funds have been dedicated to this issue, including from the FIP and various agencies in the UK and Germany.

## Infrastructure

Both PDA-MATOPIBA and the government's Growth Acceleration Program (PAC) will focus on expanding investment in infrastructure, including expanded railways, highways, and ports. Infrastructure development is aimed at bringing down storage, energy, and transportation costs in order to increase the region's competitiveness in domestic and international markets. Specifically, PAC is focused on the development of new hydropower, the completion of a 3,000 km North-South railway, support for a 2,700 km East-West railway (to connect Brazil to the Pacific Ocean), and expansion of the highway system including BR-235 in the state of Piauí and the paving of BR-163 in Mato Grosso.<sup>93</sup> Additionally, a priority for the region has been the new Maranhão Grain Terminal (Tegram), which was financed by a number of private companies including Glencore Plc, Amaggi, Louis Dreyfus, and NovaAgri.<sup>94</sup>



Photo: CEA

These infrastructure investments will reduce cost and delays for producers in the mid-west region of Brazil, creating economic benefits for large-scale agribusinesses focused on exports. At the same time, expansion of transportation infrastructure threatens to make the Matopiba region more attractive for large-scale agriculture, cause further direct deforestation, and open up new areas to accelerated deforestation due to improved ease of access. Transportation infrastructure is thus a serious threat to native habitat and traditional communities. The full suite of costs and benefits of these investments should be carefully considered, and if the projects are undertaken, the routes should be carefully planned to avoid the most valuable biological and social resources.

## Mining

Gold mining brought some of the earliest non-indigenous settlers to the Cerrado biome in the 18th century. Today, mining of iron ore deposits accounts for less than one percent of the Cerrado's territory.<sup>95</sup> However, the roads, railroads, and pipelines that have been built to transport this resource greatly expand the impact of mining. Additionally, the steel industry has traditionally used charcoal burned from native woody species, often harvested illegally.<sup>96</sup> Today, charcoal for the steel industry is increasingly coming from eucalyptus plantations. Harvesting of native species for charcoal and expansion of eucalyptus plantations are both contributing to deforestation in the Cerrado.

93. MMA, *Environmental Regularization Project Rural Property in the Cerrado – CAR FIP. Forest Investment Program – FIP. Marco Environmental and Social Management – GMES. Version for Consultation* (Brasília: January 2014).

94. Gustavo Bonato, "Brazil Ships 1st Corn Cargo from New Grains Terminal in Maranhão," *Reuters*, July 2015.

95. CEPF, 2016.

96. *Ibid.*

## PRIORITY 3

### Incentives for conservation

#### *Ensuring sufficient incentives from public and private sources for the conservation of surplus natural habitats on private and communally managed lands*

The Cerrado is largely held by private landowners. The behavior of these landowners will determine the future of the biome and will be strongly influenced by the range of incentives and disincentives for land use decisions, from both public and private sources. Incentives that can support sustainable management of communally managed or public lands will also be important. Strong Forest Code implementation should protect a baseline amount of native vegetation and prevent development in highly environmentally sensitive areas. However, protecting more than the baseline Forest Code requirements will depend upon aligning incentives to ensure that landowners view preservation as valuable. There is relatively little direct funding for such voluntary protections. Yet it is important to have good mechanisms in place to capture what funding does exist and to continue to explore creative ways to build incentives that do not require large cash outlays.

#### Credits

The Brazilian federal government provides by far the largest pool of available resources to incentivize landowners, primarily in the form of credits. However, these are used almost exclusively to support large agribusiness rather than agroecological production or protection of native vegetation. Moving forward, there may be opportunities to use a range of public and private credits, including under the ABC Plan and The Harvest Plan,<sup>97</sup> to guide expansion of crops, encourage conservation of native habitat beyond the level required by the Forest Code, and promote the adoption of agroecological and low-carbon practices (See *Priority 4*). Tying credits to zoning, as was done

97. Brazil's Harvest Plan is the primary source of agricultural credits for large and medium producers in Brazil, providing a mix of credits with subsidized interest rates and interest rates at parity with the market. Family farmers in Brazil are supported by a separate credit program under the National Program for the Strengthening of Family Agriculture (PRONAF). Ministério da Agricultura, Pecuária e Abastecimento, *Plano Agrícola e Pecuário 2015–2016* (Brasília: 2015).

98. Machado and Anderson et al., 2016.

with Brazil's sugarcane sector through ZAE Cana, can encourage agricultural development in certain areas (such as land that is already open or degraded or land that is highly productive) and discourage agricultural development in areas of high conservation value or areas that are important for traditional communities. This kind of regional targeting of agricultural development could also be incorporated into new programs, such as PDA-MATOPIBA, or used to bolster "smart compensation." "Smart compensation" is the concept of guiding Forest Code compensation credits to areas where contiguous corridors can be consolidated and areas with high carbon stocks, important hydrological function, habitat for endemic or endangered species, or particular socioeconomic value.<sup>98</sup>

#### Corporate commitments and supply chain incentives

Corporate commitments and corporate support can play an instrumental role in efforts to protect native habitat and to protect land tenure and land access rights for communities and family farmers. Market access can serve as a very powerful incentive. In the Amazon, soy and beef commitments have helped keep goods produced on recently deforested lands from entering supply chains. Recent analysis shows that both of these private sector initiatives have been effective in changing the purchasing practices of key supply chain actors and in reducing deforestation.<sup>99</sup>

Zero-deforestation commitments on the part of leading global brands and trade associations that work in Brazil are proliferating. These commitments typically include pledges to make supply chains deforestation-free by a certain date, to respect human and labor rights, and to support land tenure and the economic development of communities and family farmers. Cargill, McDonald's, and Unilever have all made strong commitments to make their supply chains deforestation-free.<sup>100</sup> These individual corporate commitments have followed the 2010 pledge by the

99. Holly K. Gibbs et al., "Brazil's Soy Moratorium," *Science* 347, no. 6220 (2015): 377–378; Holly K. Gibbs et al., "Did Ranchers and Slaughterhouses Respond to Zero-Deforestation Agreements in the Brazilian Amazon?" *Conservation Letters* (2015).

100. "Cargill Policy on Forests," Cargill, September 23, 2014; *McDonald's Corporation Commitment on Deforestation*, McDonald's Corporation, April 21, 2015; "Eliminating Deforestation," *Unilever*, <https://www.unilever.com/sustainable-living/transformational-change/eliminating-deforestation/>.

Consumer Goods Forum (CGF) to “help achieve zero net deforestation by 2020.”<sup>101</sup> While the CGF commitment is to zero net deforestation, many of the individual company commitments are to zero deforestation. (See callout box on this page.) Additionally, the 2014 New York Declaration on Forests, which calls for a reduction of forest loss by half by the year 2020 and a total end to deforestation by 2030, was signed by dozens of countries, sub-national governments, private companies, NGOs, and indigenous groups.<sup>102</sup> (Note that Brazil is not a signatory of the New York Declaration on Forests, but several Amazonian states are.)

Currently, the question of the appropriate target for reducing deforestation in the Cerrado is an open one. Pushing for agreement on this target should be a priority for the private sector and civil society to achieve clarity and alignment and to allow implementation to begin in earnest. While full adherence to zero-deforestation commitments (e.g., expansion of the Amazon’s soy moratorium to the Cerrado) will likely not be palatable for key parts of the agribusiness sector, agreement on more moderate targets should be achievable. For example, a great starting point for the Cerrado would be a target commitment that includes: 1) compliance with the Forest Code, 2) establishment of go/no-go zones around areas of high conservation value and community/indigenous lands, 3) avoidance of areas that have social conflicts (e.g., evidence of land grabbing, violence, or significant land disputes), and 4) exclusion of producers that rely on slave labor. Sectors could then work toward full implementation of zero-deforestation commitments by a future date.

Determining an appropriate target in the Cerrado will be challenging and may create tension between different actors within agricultural supply chains. For example, CGF has just established new principles that explicitly call out the Cerrado as a landscape where its net-zero-deforestation commitments will apply. At the same time, most large agricultural producers operating in Matopiba seem to take the position that their environmental obligations can be sufficiently met through compliance with the Forest Code.

101. “Deforestation Resolution,” *Consumer Goods Forum*, November 2010.

102. UN Climate Summit 2014, “Forests Action Statement and Action Plans,” September 23, 2014.

## Zero vs. Zero Net Deforestation

Zero deforestation is a commitment to rid an area or a supply chain of all deforestation.

Zero net deforestation allows for deforestation as long as another area of equal size is restored.

Advocates for zero net deforestation explain that the concept does not simply require the restoration of an area equivalent in size to a converted area. Rather, zero net deforestation aims to maintain primary or well-conserved ecosystems. It allows only for low levels of conversion of ecosystems exclusively for maintaining the livelihoods and the subsistence of local communities. In order to offset this inevitable deforestation, an area of the same size with equivalent social and environmental characteristics should be restored.<sup>103</sup>

Critics of zero net deforestation point out that the concept can make sense in well-defined regions but doesn’t work well with supply chains, and the approach is difficult to monitor and enforce in practice.

103. Machado and Anderson et al., 2016.

The Brazil Rural Society (SRB), in partnership with the MMA, Conservation International, the Global Environmental Facility (GEF), and the Inter-American Development Bank, are demonstrating some appetite for voluntary conservation targets. Through their “Matopiba 2020” initiative, the group has proposed a target of 40 percent native habitat conservation in key parts of the Cerrado biome in total (including all conservation units, indigenous lands, and Forest Code requirements).<sup>104</sup> At the same time, any level of voluntary conservation on the part of the agribusiness industry is becoming harder to achieve through corporate commitments because Brazil’s soy exports increasingly flow to China, which has historically demonstrated less corporate responsibility leadership.<sup>105</sup>

104. Sociedade Rural Brasileira, Conservation International Brazil, and FBDS, “Matopiba 2020 – Vanguarda para um Futuro Produtivo e Sustentável,” October 2015.

105. In 2014, China was the destination for about 70% of whole soybean exports. Roughly half of all soybeans produced in Brazil are exported as whole beans. MDIC-Aliceweb.

It is important to note that until corporate actors have access to robust satellite monitoring of deforestation in the Cerrado, those actors will be unable to implement and honor zero-deforestation commitments. This fact creates yet another imperative for expedient launches of both the PRODES Cerrado and DETER Cerrado satellite monitoring systems. In the meantime, companies with supply chain commitments should ensure that suppliers register with the CAR and adhere to commitments concerning human, labor, and land rights.

Granting preferential or expanded market access to stakeholders that comply with these commitments or policies is a promising incentive-based approach. Implementing zero-deforestation commitments in partnership with select municipalities may be a strategic way to begin working in the Cerrado. At the sector level, companies could identify those municipalities that are most important to their supply chain and express the strongest will and capacity for this kind of partnership. Together, they could set targets for reduced deforestation rates and provide incentives to producers for compliance (e.g., fast tracking permits, preferential market access). This kind of jurisdictional approach is championed by a number of conservation organizations working in Brazil.<sup>106</sup>

### Certifications

Another incentive for producers is increased demand for certifications, such as those promoted by the Roundtable for Responsible Soy (RTRS), Alianca da Terra (ADT), and Soja Plus, which allow corporations to reward responsible growers with access to premium markets, and potentially a price premium for nontransgenic soy. Though not necessarily aligned with zero-deforestation commitments, these frameworks do support a range of best practices and could be strengthened to include zero-deforestation principles that may help promote their wider adoption. To date, certification schemes have faced shortcomings in

both supply and demand, have often supported only best actors, and have offered little to no price premium, meaning farmers have not been compensated for their investments. In the beef sector, the Brazilian Roundtable on Sustainable Livestock (GTPS) and the Global Roundtable for Sustainable Beef (GRSB) both offer development and dissemination of best practices and technical guidance on sustainable practices. To date, certifications have not been part of either GTPS's or GRSB's programs.

### Payment for Ecosystem Services (PES)

PES has long been touted as a way for farmers to secure funds for conservation from parties that have an economic interest in the ecosystem services provided by forest or watershed conservation (e.g., downstream water quantity or quality that can result from better protection of water springs or water recharge zones). A PES scheme could harness private sector or philanthropic dollars from local, national, or international actors. Proposed legislation to create a national PES policy has been introduced in Congress, but has been stalled since February 2015.

The ANA has already successfully piloted a PES program, called the Water Producer Program. This program provides financial and technical assistance to landowners for natural resource restoration and conservation programs that can reduce erosion and sedimentation, thereby improving water quality and the overall hydrological health of watersheds. As of 2015, 38 projects covering 400,000 ha had been established or were in progress.<sup>107</sup> Though these pilots have been successful, legislation would help the model scale more rapidly. State- and municipal-level PES programs should also be explored and expanded. Mato Grosso's State REDD+ System (Law 9.878/2013), which was designed to provide economic incentives for reduced deforestation, is one example.

106. Earth Innovation Institute, "Territorial Performance System," June 2015.

107. Dos Santos and Devanir Garcia, "Productor de Agua Seminario do PPA," *Brazil National Water Agency*, March 2015.





Photo: Bento Viana/ISPN

### **X-CRA**

One idea suggested by Brazilian academics is to use the CRA offset market as a platform for a range of land-related environmental services (e.g., carbon, biodiversity, water).<sup>108</sup> Built on the foundation of the Forest Code compensation trading system (the CRA), the “X-CRA” would be a PES system that allows any buyer (not just those seeking Forest Code compliance) to pay for intact vegetation or associated ecosystem services. This mechanism has the potential to direct voluntary funding streams, such as those from corporate buyers, international carbon markets, or international mechanisms such as REDD+, to the native habitat in Brazil. While the quantity of voluntary funding may be limited, the trading platform and monitoring, reporting, and verification that will need to be built into the CRA system to promote Forest Code compliance would provide a relatively straightforward entry point for buyers, and would thus be an effective way to capture funds. Developing such a market would require working

out a number of technical and regulatory details. At present, the task should be to focus on getting the CRA working for compliance, but to design it in such a way that it would be possible to establish an X-CRA-type system in the future.

### **Tourism**

A final idea for creating incentives for native habitat is for federal, state, and local governments, in partnership with communities and private developers, to support an agenda for strengthening the tourism industry in the Cerrado. The Cerrado landscape is very beautiful, with waterfalls, colorful birds, vistas, and charming towns. Opportunities for bird-watching, hiking, rafting, cultural experiences, and a range of other outdoor adventures are plentiful. A strengthened tourism industry would increase the value of native habitat, protected areas, and traditional communities and practices, as it has in many other parts of Brazil and in other countries.

108. Rajão and Soares-Filho, “Cotas de Reserva Ambiental,” 2015.

## PRIORITY 4

# Improved sustainability and productivity of existing agricultural lands and pasturelands

*Encouraging sustainable intensification of pasturelands, mainstreaming low-carbon agricultural practices, expanding adoption of other sustainable practices, and supporting traditional agricultural products*

Agriculture and livestock production are tremendously important to Brazil's economy, accounting for over 35 percent of Brazil's exports, by value.<sup>109</sup> Agriculture and livestock production also dominate much of the Cerrado's landscape; approximately 19 Mha are dedicated to agricultural crops and 50 Mha to pastureland (as of 2002).<sup>110</sup> Across Brazil, crop production is expected to expand by 33.5 Mha through 2040 to meet growing demand.<sup>111</sup> However, through sustainable intensification of pastureland and restoration of degraded pastureland, it is theoretically possible to freeze the footprint of pastureland while increasing its economic productivity.<sup>112</sup> At the same time, there is enormous opportunity to improve the ecological performance of cropland in terms of GHG emissions, water quality, soil health, toxicity, and biodiversity through broader adoption of low-carbon agricultural practices and other ecologically and socially sound production methods, including those typically employed in traditional agricultural systems.

## Sustainable intensification of pasturelands

Brazil's low density of cattle (<1 head per hectare), spread out over 20 percent of Brazil's total area, offers considerable room for intensification.<sup>113</sup> Intensification of pastureland can 1) reduce the land required to produce cattle, thus reducing pressure on forests, 2) free up land for crop expansion, thus reducing pressure on forests, 3) reduce the enteric fermentation (methane) emissions



Photo: CEA

associated with the cattle herd by improving forage quality, and 4) help sequester carbon in grasslands. Analysis by Brazilian scientists indicates that productivity increases in pasturelands could allow crops to expand onto freed up pastureland without clearing any more natural vegetation.<sup>114</sup> Productivity improvements on Brazil's pastures might save as much as 250 to 450 Mt CO<sub>2</sub>e per year by 2030, through both reduced deforestation and reduced enteric fermentation emissions.<sup>115</sup> According to Strassburg et al., 2014, about 40 percent (20 Mha) of the potential for pasture restoration is found in the Cerrado (and another 10 percent, or 5.6 Mha, is found in the transition areas between the Amazon-Cerrado and Caatinga-Cerrado).<sup>116</sup>

It is important to note that agricultural intensification is not a panacea. There can be downsides to intensification, in particular soil compaction, the potential for water quality degradation and increased methane emissions if manure becomes too concentrated, and increased use of fertilizers and chemicals. Moreover, there is considerable debate among academics and thought leaders across Brazil and internationally regarding the validity of the land sparing theory. Many believe that intensification alone might increase the profitability of cattle production, creating an economic incentive for increasing the size of the herd and thus counteracting its land sparing benefits (a phenomenon known as the "rebound effect"). Any effort to support intensification would be most effective if done in a way that ensures the social and ecological sustainability of

109. Belinky, 2014.

110. MMA, PROBIO Land Cover Map (Brazil, 2002).

111. Strassburg et al., 2014.

112. Ibid.

113. Pasture intensification means increasing the productivity from a given unit of land by improving forage quality, rather than by expanding the land footprint.

114. Strassburg et al., 2014.

115. Strassburg et al., 2014; Cohn et al., "Cattle Ranching Intensification in Brazil Can Reduce Global Greenhouse Gas Emissions by Sparing Land from Deforestation," *Proceedings of the National Academy of Sciences* 111 (2014): 7236–7241.

116. Strassburg et al., 2014.

intensification and is coupled with complementary instruments such as environmental compliance, land regularization, and supply chain governance as a way of mitigating the rebound effect.

### Economics of intensification

Preliminary studies indicate that pasture intensification can deliver economic benefits to ranchers over the long term. For example, a pilot program that helped ranchers in Northern Mato Grosso adopt production practices based on Embrapa's Good Agricultural Practices delivered increases in productivity, stocking density, and gross margins.<sup>117</sup> However, it is not yet clear whether expanding onto degraded pasturelands is economical for producers of soy or other crops, compared with converting native vegetation. It can take several years of significant investments to boost production after moving soy onto degraded pastures. Comparatively, forested land is generally cheaper to buy, and the first couple years of production on newly cleared land typically produce high yields, but clearing forest and preparing the ground for crops can be expensive depending on the region, land value, and local policy. A more detailed assessment of the relative costs of clearing new land versus restoring degraded pastures is currently being conducted by soy supply chain experts in Brazil.

### The role of credits

There are many barriers to transitioning pasturelands and ranching operations to more intensive management practices. To begin with, despite the long-term economic benefits, more intensive herd management methods typically require upfront financial investments for fencing machinery, labor, and pastureland management. Therefore, credits will play an important role in promoting intensification of pastureland. Recovery of degraded pasture is one of the primary targets of the ABC Plan. In fact, from January 2013 through March 2015, roughly 40 percent of all of the dispersed ABC credits were for pasture recovery.<sup>118</sup>

Tying mainstream credits and investment to intensification benchmarks, including through Brazil's Harvest Plan and credits extended through the supply chain, would further support intensification. Additionally, there may be opportunities to better target credits to those lands that are best suited for restoration, reforestation, or conversion to crops. Conversely, withholding credit and investments from recipients who are engaging in unsustainable or overly extensive practices could be part of the strategy for promoting intensification.

### Technical assistance and other strategies

Intensive management practices require new knowledge and changes in longstanding culture and habits. Thus, technical assistance and training is required for ranchers, for those directly dealing with cattle health management, and for others along the supply chain.<sup>119</sup> While some of the burden for this assistance will lie with government, it may also be useful to support private sector businesses specializing in this sort of technical assistance.

Other strategies to support sustainable intensification that are being piloted and pursued by the private, public, and civil society sectors include demonstration projects, intensification feasibility mapping, and decision-support tools for supply chain actors. One such example is the 2012 GTPS memorandum of understanding (MOU) with MAPA, the MMA, and Embrapa for cooperation in achieving the goal of recovering 15 Mha of degraded pasture, in accordance with the PNMC. GTPS's activities under this MOU include creating demonstration units and training centers.<sup>120</sup> More efforts along these lines are needed.

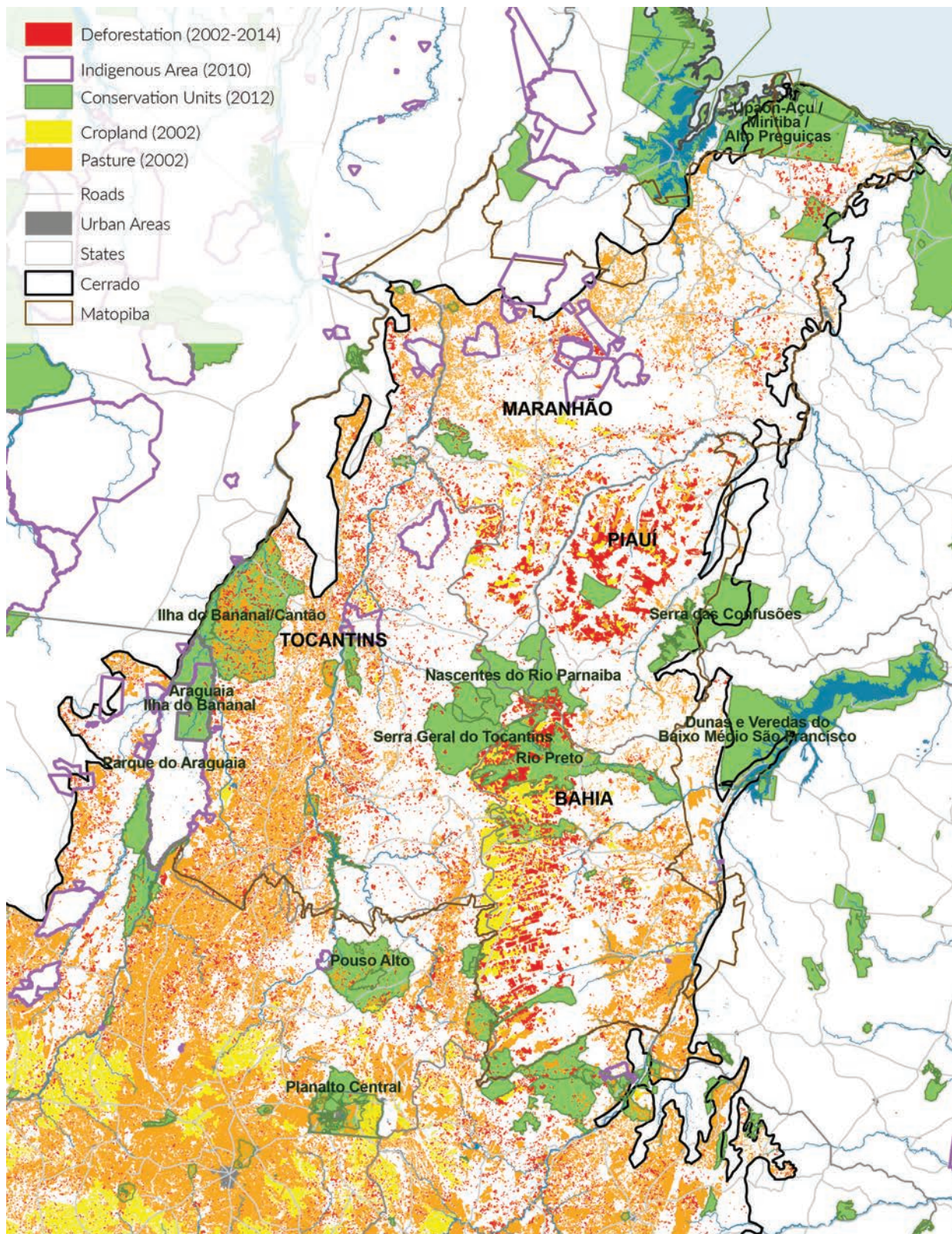
Another factor driving extensive management of cattle is the fact that grazing is sometimes used as a method to establish and maintain land tenure. Establishing an official land tenure registry is key to combat this trend as it provides a formal means for defining and maintaining land ownership. (See Map 8.)

117. Silvia Franz Marcuzzo and Andréa de Lima, "Novo Campo Program: A Strategy for Sustainable Cattle Ranching in the Amazon" (Alta Floresta-MT: ICV, 2015).  
118. Direct correspondence with the Ministry of Finance, March 2016.

119. Latawiec et al., 2014.

120. Brazilian Roundtable on Sustainable Livestock, "Pathways for Sustainable Beef" (summary of presentations delivered at the IV Internal Seminar of the Brazilian Roundtable on Sustainable Livestock – BRSL, São Paulo, Brazil, November 29, 2012).

MAP 8: LAND USE IN MATOPIBA



Sources:

Reference layers: <http://www.naturalearthdata.com/>

Matopiba: [http://www.ibge.gov.br/english/geociencias/default\\_prod.shtm](http://www.ibge.gov.br/english/geociencias/default_prod.shtm)

Cerrado: <http://maps.lapig.iesa.ufg.br/lapig.html>

Deforestation: <http://maps.lapig.iesa.ufg.br/lapig.html>

Protected Areas: <http://mapas.mma.gov.br/i3geo/datadownload.htm#>

Cropland/Pasture\*: <http://mapas.mma.gov.br/mapas/aplic/probio/datadownload.htm>

\*Interpretation of Landsat TM satellite images, taken in base year 2002 and field work in August 2005

## Low-carbon agriculture

Expansion of low-carbon agriculture practices on established farmland also has an important role to play in the long-term sustainability of the agriculture sector in the Cerrado and across Brazil. Brazil's ABC Plan was established as the agriculture and livestock sector element of the National Policy on Climate Change. Launched in the 2010/2011 crop year, it provides a dedicated set of government credits specifically designed to support low-carbon agriculture practices. In total, the ABC Plan aims to mitigate 133.9 to 162.9 Mt CO<sub>2</sub>e from 2010 through 2020.<sup>121</sup>

The ABC Plan is structured into seven programs (with GHG abatement targets included):<sup>122</sup>

1. Recovery of degraded pastureland (83–104 Mt CO<sub>2</sub>e)
2. Crop-livestock-forestry integration system (18–22 Mt CO<sub>2</sub>e)
3. No-tillage systems (16–20 Mt CO<sub>2</sub>e)
4. Biological nitrogen fixation (10 Mt CO<sub>2</sub>e)
5. Planted forests (the total mitigation contribution to be calculated as part of the iron industry sectoral plan)
6. Animal waste treatment (6.9 Mt CO<sub>2</sub>e), and
7. Adaptation to climate change

Brazil may be unique on the global stage for having a major government program aimed primarily at reducing GHGs from agriculture, and supporting the ABC has been a priority for the FIP and other sources of international funding. Nevertheless, at roughly R\$4.5 billion (2013/2014), the ABC Plan is dwarfed by Brazil's general investments in the agricultural sector. The Harvest Plan allocated R\$187 billion in agricultural credits for the 2015/2016 growing season.<sup>123</sup>

The ABC Plan has not been widely accessed, evenly distributed, or well monitored. Only R\$3 billion was actually distributed in 2013/2014, due to low demand for the funds. Although the distribution of the funds has since improved, it has been concentrated in regions with superior access to technical assistance, such as southern and western Cerrado. Barriers to uptake of ABC credits include burdensome paperwork and complicated

requirements, lack of training and knowledge among bankers regarding the practices the program is designed to support, an interest rate that is only marginally lower than that of traditional loans, and the fact that these practices require training and education. Lastly, no specific monitoring of the ABC plan has occurred yet, so we don't know if the plan has in fact reduced emissions.

There are a number of ways to address the shortcomings in the ABC program. These include establishing a monitoring system, providing better training to the bank officers who issue the loans, increasing the percentage of credits that can be used for technical assistance to more than 2 percent, better targeting loans to farms where pasture restoration or integrated agriculture will most benefit the landscape, and improving the design of the loans so that they are better suited for ranchers, who often need more time to repay investments on pasture restoration (e.g., 8–10 years rather than 1–3 years). An ideal outcome of the ABC Plan would be to integrate support or requirements for these low-carbon practices into the Harvest Plan, Brazil's primary agricultural credit facility.

## Sustainable and traditional agriculture

Much of the national and international attention paid to agriculture in Brazil is focused on large-scale agriculture, which primarily produces commodity crops for national and international consumption. However, Brazil also has a strong alternative field of agricultural producers spanning a range of traditions from agroextractivists to small-scale family farms. These agricultural models even have separate ministries: MAPA for large- and medium-scale farmers and the MDA for small-scale farmers. All of these types of producers could be better supported in making their practices more sustainable. Brazil's large- and medium-scale farmers should face stronger regulations and incentives to reduce use of agrochemicals, exercise better stewardship over waterways, and improve conditions for farm laborers. Small-scale producers and agroextractivists, meanwhile, need better access to credit, technical assistance, and guarantees or support for their markets so that their culture and livelihoods can thrive.

121. MAPA, *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)* (Brasília: MAPA/ACS, 2012).

122. *Ibid.*

123. MAPA, 2015.

## Better enforcement of pesticide and labor laws

Over the last few decades, Brazil's agricultural sector has become increasingly industrialized. In 2013, Brazil purchased USD\$10 billion of pesticides, or 20 percent of the global market, and it is now the largest buyer in the world.<sup>124</sup> A number of pesticides that are banned in the United States and Europe are legally sold in Brazil, and even though Brazil has relatively lax laws, much of the food grown and sold in the country violates national regulations.<sup>125</sup> Many point to Brazil's powerful agricultural lobby as a key factor blocking a better regulatory environment governing pesticides.<sup>126</sup> The overuse of dangerous pesticides poses a great risk to the public health of farm workers and rural communities, often the most poor and vulnerable. For example, in 2013, a crop duster sprayed insecticide on a school, hospitalizing 30 schoolchildren and teachers.<sup>127</sup>

There are similarly grave concerns with respect to farm labor. Since 1995, when Brazil acknowledged in the International Labor Organization that slave labor was a problem in the country, almost 47,000 workers have been rescued from conditions that include forced labor, unsanitary or dangerous conditions, and restrictions of civil liberties. Of the workers found in such compromised positions, most were migrants from Cerrado states.<sup>128</sup> Today, the agriculture and livestock sectors are most likely to have labor transgressions. Of the workers found in restrictive or dangerous conditions from 2003 to 2014, 29% were working in the livestock sector, 25% in sugarcane production, and 19% in other crop production.<sup>129</sup>

To date, much of the attention that civil society has brought to the Brazilian agricultural sector has been focused on deforestation, but it is important that other environmental and social considerations receive increased attention. Corporate actors have a role to play by ensuring adherence



Photo: Bento Viana/ISPN

to agrochemical and labor laws across their supply chains, or better yet, by adopting certifications or guidelines that support best practices for sustainability in agricultural production. (See “Certifications” on page 38.)

## Better support for agroecological principles and traditional agricultural products

Brazil has a rich history of small-scale agricultural traditions and is a stronghold of agroecological producers. The federal government has established a number of policies and plans to support these practices. A prime example is the 2012 National Policy on Agroecology and Organic Production (PNAPO), which aims to increase food security, sustainable use of natural resources, and valuation of agro-biodiversity and socio-diversity. A National Plan on Agroecology and Organic Production (PLANAPO) was developed to advance the objectives of PNAPO.<sup>130</sup> PLANAPO dedicated R\$7 billion in credits for agroecological production between 2013 and 2015 and identified other tools to support the transition to agroecological practices, including tax measures, technical assistance, and funding for research and innovation. Unfortunately, neither the policy nor the plan has been well funded or well implemented and as a result, the communities slated to benefit from these programs have continued to struggle.

124. Note: pesticides include herbicides, insecticides, and fungicides, together known as “agrotóxicos” in Portuguese. Paulo Prada, “Why Brazil Has a Big Appetite for Risky Pesticides,” *Reuters Investigates*, April 12, 2015.

125. *Ibid.*

126. *Ibid.*

127. *Ibid.*

128. Of these, 23.9% were from Maranhão, 9.4% from Bahia, 8.3% from Minas Gerais, 5.6% from Tocantins, and 5.5% from both Piauí and Mato Grosso. “Trabalho Escravo Contemporâneo: 20 Anos de Combate (1995–2015),” *Reporter Brasil*, 2015.

129. *Ibid.*

130. The governance of PNAPO and implementation of PLANAPO are the responsibility of the National Committee of Agroecology and Organic Production (CNAPO) and the Interministerial Chamber of Agroecology and Organic Production (CIAPO). CNAPO includes representatives from 14 government agencies and 14 civil society organizations. The executive secretariat of CIAPO sits with the MDA.

FIGURE 5: CONCENTRATION OF FAMILY FARMS IN THE CERRADO STATES

Each dot represents 25,000 family farms.



Source: IBGE - Censo Agropecuário, 2006. There is a greater concentration of family farms in Matopiba than in Southern Cerrado. Though Southern Cerrado is 2.3 times larger than Matopiba, there are 400,000 more family farms in Matopiba. The available data on characteristics of the agricultural sector is only available by state rather than by the state area within the biome.

The National Plan for Promotion of Socio-Biodiversity Value Chains (PNPSB) is another plan that deserves enhanced support. Created in 2009, it is designed to promote conservation and sustainable management of sociobiodiversity products (e.g., pequi fruit, babaçu fruit, and native honey) by strengthening production chains in all biomes, relevant financial mechanisms, traditional knowledge networks, and the social and productive capacity of quilombolas, indigenous peoples, traditional communities and smallholders. However, it has also lacked the political will necessary to ensure its success and desired impact. Another key source of funding for the sustainable use of biodiversity by local communities in the Cerrado, the GEF-UNDP Small Grants Program, which invested USD\$10 million into more than 100 projects, was recently discontinued.

Finally, policies focused on direct acquisition of products from small-scale farmers have been instrumental to family farming and traditional peoples' communities and need better support in the current financial crisis. Specifically, the Food Acquisition Program (PAA), which aims to help

producers reach institutional markets, and the National Program for School Meals (PNAE), which mandates that 30 percent of school meal budgets be used to purchase food produced by family farmers, traditional communities, indigenous people, and quilombolas, have been effective in sustaining small-scale farmers and should be continued and strengthened.

Broadly speaking, good programs have been designed to promote agroecological practices, agroextractivists, and small-scale farming. However, these programs have not received the political support necessary to achieve their stated goals. Small-scale farmers across Brazil require enhanced technical assistance, financing, and guaranteed markets. They have a much harder time accessing these kinds of resources than medium- and large-scale farmers do. They need significantly more support in order to develop the agricultural economies that can allow their cultures and communities to thrive, especially given the pressures they are facing from advancing large-scale production and climate change.

## PRIORITY 5

# Building the case for biodiversity and landscape conservation

*Highlighting and enhancing scientific research on the importance of water and its relationship with native vegetation, and on impacts of climate variability in the Cerrado*

Waters originating in the Cerrado support agriculture, hydropower generation, and downstream cities and rural populations (inside and outside the Cerrado biome). Because the Cerrado is a central plateau, rainwater falling in its highlands runs off in all directions and feeds major rivers across South America.<sup>131</sup> Ten of Brazil's twelve major river systems flow in part through the Cerrado. The headwaters of three major rivers, the Tocantins, São Francisco, and Paraná, lie in the Cerrado.<sup>132</sup> As a result, the Cerrado is widely considered "the cradle of Brazil's water" or "the large water tank of Brazil."<sup>133</sup> The implications of water management in the Cerrado reach far beyond the biome.

## Water risks

There is mounting scientific evidence and growing concern among a range of stakeholders in Brazil that the Cerrado biome is vulnerable to water stress, and that such stress could have major repercussions for the country's water supply. Because the Cerrado has such a strong seasonal climate with pronounced wet and dry seasons, it is particularly vulnerable to precipitation shocks and long-term climatic changes. The vast majority of agriculture in the Cerrado is rain-fed, so even small changes to precipitation patterns could significantly affect crop yields.<sup>134</sup> Although the scientific literature on the topic is not conclusive, the research to date suggests that too much natural vegetation conversion in the Cerrado could seriously threaten hydrological cycles in



Photo: Bento Viana/ISPN

the region.<sup>135</sup> Many experts strongly believe that these dynamics are already in play. CEPF calls for maintaining half of the biome in native vegetation in order to mitigate the effects of climate change on the region, specifically for the maintenance of precipitation patterns.<sup>136</sup>

Further research is also needed to better understand the relationships between natural vegetation conversion and local and regional temperatures, precipitation, surface water flows, groundwater recharge rate, water retention in soils, erosion prevention, flood risk, and health and longevity of water springs. Research on these issues would be very helpful for land use planning in the Cerrado and in Matopiba in particular. Specifically, the following questions would be useful to address:

- Are there certain thresholds of natural habitat conversion at the watershed level that will trigger a step-change in negative economic impacts on downstream actors (e.g., agricultural yields, hydropower, municipal water supply)? That is, at what point do changes in land cover affect local and regional precipitation patterns and, thus, agricultural productivity and water supply?
- Are there certain priority areas where intact native vegetation is most important from a climate and hydrology perspective? Can these be identified on a watershed-by-watershed basis?

131. Jorge Enoch, "Situation and Prospects for the Cerrado Waters," 2011.

132. Enoch, 2011; Paulo Tarso and Sanches de Oliveira, "Water Balance and Soil Erosion in the Brazilian Cerrado," University of São Paulo, 2014.

133. Enoch, 2011.

134. Spera et al., "Land-Use Change Affects Water Recycling in Brazil's Last Agricultural Frontier," *Global Change Biology* (2016).

135. Ana Cláudia Malhado, Gabrielle Pires, and Marcos Costa, "Cerrado Conservation is Essential to Protect the Amazon Rainforest," *AMBIO: A Journal of the Human Environment* 39, no. 8 (2010): 580–584; Marcos Costa and Gabrielle Pires, "Effects of Amazon and Central Brazil Deforestation Scenarios on the Duration of the Dry Season in the Arc of Deforestation," *International Journal of Climatology* 30, no. 13 (2010): 1970–1979.

136. CEPF, 2016.



## Climate change risks

Global climate change will likely compound the pressure on the Cerrado's water supply. A Brazilian Panel on Climate Change study found that the Midwest and Northeastern regions of Brazil (largely overlapping with the Cerrado) are projected to be the most affected by forthcoming climate change. Studies developed by INPE and Embrapa suggest that temperatures will increase by between 1 and 5.8 degrees C in the Midwest by 2070, creating a drier and warmer dry season. Furthermore, most of the rivers in the Midwest will see reduced flow in the years from 2017 to 2100. In terms of the effects of climate change on biodiversity, a 2003 study of Cerrado flora found that 10 to 32 percent of 162 analyzed tree species could end up without habitable areas in the Cerrado region or could go extinct by 2055.<sup>137</sup> Additionally, over half of the species were projected to decline by more than 90 percent in the Cerrado, with major range shifts to the south and east.<sup>138</sup>

## Mitigating water and climate risks

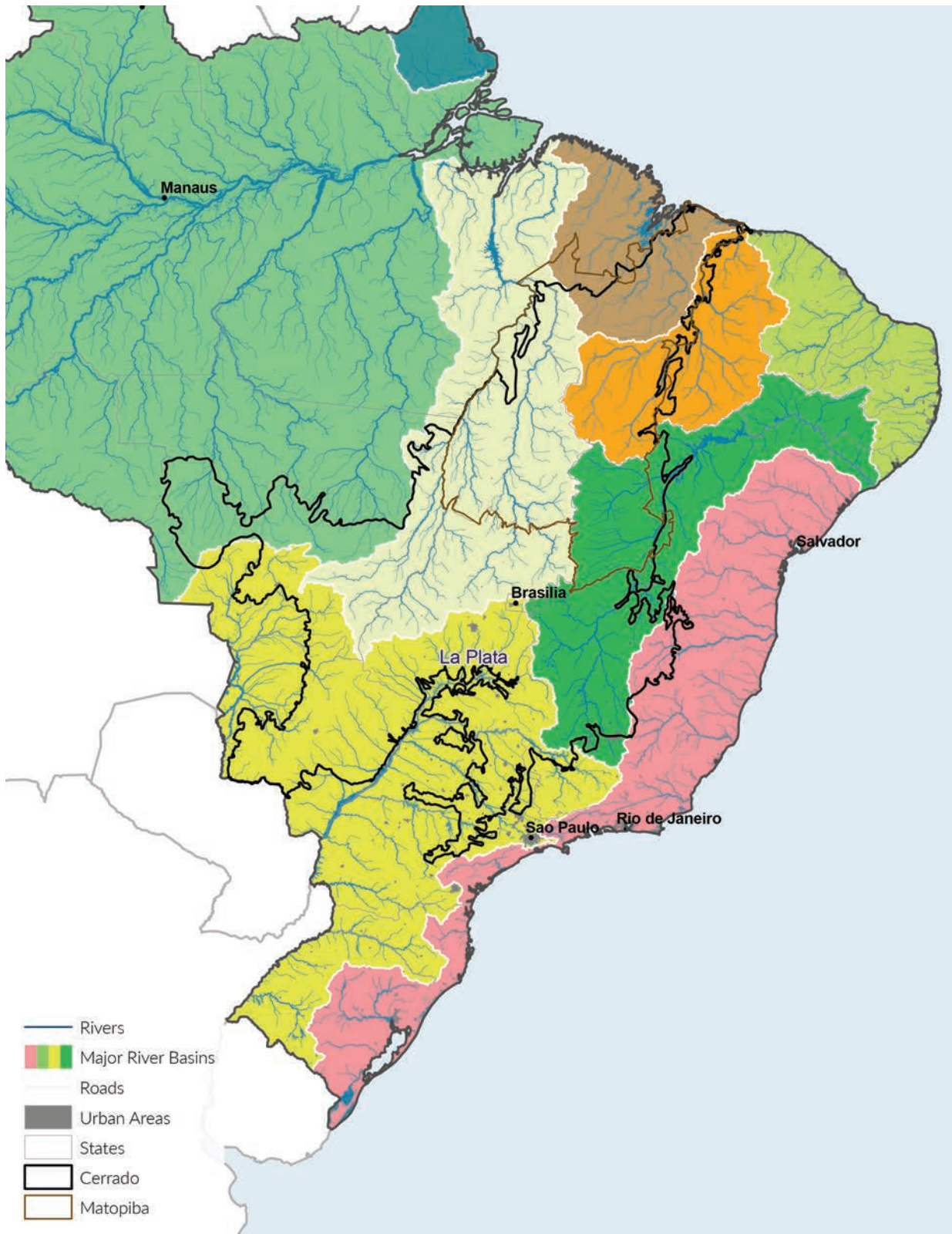
Although understanding water resources and climate adaptation strategies in the Cerrado requires more research, there are already some well-understood solutions with little downside to help build resiliency in the face of global climate change. Many of these solutions have been touched upon in earlier sections of this document.

- **PES:** Given the number of downstream cities, municipalities, and hydropower generators that rely on water from rivers flowing through the Cerrado, PES schemes could help to channel investments from downstream water users to upstream conservation efforts.
- **Targeted CRA trading:** The trading of CRA credits could be guided to protect areas that are particularly valuable from a water resource perspective. This kind of targeting would help to optimize the benefits of the Forest Code's compensation mechanism, but requires rule-making to constrain the market in certain ways.
- **Incentives for water conservation practices:** As credit programs for climate-smart agriculture are revised or expanded, it may be possible to extend cheaper credit lines to individual growers or whole sub-basins that are taking steps to improve water management and climate resiliency. Preferential market access for these parties may also be possible. Banks may be compelled to integrate more water conservation safeguards into their loans to producers as well as for infrastructure because of the risks inherent in variable water supply. Likewise, corporate buyers of agricultural products may begin to add water conservation safeguards into their purchasing agreements or loans.
- **Strategic restoration:** Restoration through the Forest Code will be an important way to support adaptation measures in the Cerrado. One strategy is to target restoration support to areas that are expected to be refuges for flora and fauna species as ranges shift due to climate change.

137. Ibid.

138. CEPF, 2016.

MAP 9: WATERSHEDS OF BRAZIL



Sources:

Reference layers: <http://www.naturearthdata.com/>

Matopiba: [http://www.ibge.gov.br/english/geociencias/default\\_prod.shtm](http://www.ibge.gov.br/english/geociencias/default_prod.shtm)

Cerrado: <http://maps.lapig.iesa.ufg.br/lapig.html>

Hydrography: <http://www.fao.org/geonetwork/srv/en/main.home>

Aquifers: WWF

## RESEARCH AGENDA

### **Gaps in knowledge about the Cerrado, including lack of information about biodiversity, carbon stocks, traditional communities, and hydrology, contribute to uninformed development that threatens the long-term ecological and economic health of the biome.**

A range of efforts are beginning to address these gaps. For example:

- CEPF recently developed a thorough ecosystem assessment of the Cerrado that includes a map of key biodiversity areas and conservation corridors.<sup>139</sup>
- The FIP recently committed R\$60 million to a new project designed to collect and disseminate information on forest resources, including diversity and abundance of forest species, estimates of forest stock and above- and below-ground carbon stock, and use of forest products by local populations.<sup>140</sup>
- The Ministry of Science, Technology and Innovation (MCTI) has established an initiative called ComCerrado that aims to establish protocols for monitoring biodiversity in the Cerrado and to conduct survey sampling across the biome to determine ecosystem health and function.
- LAPIG and Agrosatelite have developed pasture and crop maps, respectively, for all of Brazil.

Efforts such as these to perform new research, develop repositories of existing data and information, and map resources for the Cerrado biome are critically important. What follows is a list of some of the highest priority research gaps that persist, though the list is not intended to be comprehensive, and in some cases, efforts may be underway to address the gaps already. Answering these research questions will be particularly helpful in guiding development and conservation in the Cerrado and across Brazil.

#### **Land cover and hydrological cycles**

As noted above, there is mounting scientific evidence and growing concern among a range of stakeholders in Brazil that the Cerrado biome is hydrologically fragile and that the risk of water supply disruptions is serious. Intact vegetation could be one of the most important variables for ensuring a sustainable water supply, especially in the context of a changing global and regional climate.

Research on the relationship between hydrological cycles and land cover in the Cerrado would be very helpful for land use planning. Field-level research in the region should be combined with modeled results. Because the findings may vary from sub-basin to sub-basin, specific locations should be targeted (e.g., Matopiba) to help develop a more complete understanding of high-priority parts of the region. The ultimate objective of this work would be to define as clearly as possible the likely hydrological, social, ecological, and economic effects of different development scenarios.

#### **Soil carbon**

The Cerrado holds a high proportion of its carbon in root systems and soils, but the amount of this carbon is uncertain. Furthermore, the loss of below-ground carbon resulting from land use change is hard to estimate accurately. More conclusive mapping of the carbon in the Cerrado's root systems and soils, as well as estimates of the carbon lost when land is converted, would be helpful to understand and prioritize areas for protection.

139. Ibid.

140. Izabela Prates, "Bioma Cerrado Contará com 60 Milhões de Reais para Pesquisa," *MundoGeo*, September 2015.

## Traditional communities mapping

Part of the misperception about the Cerrado is that it is an open and empty land not currently occupied or in productive use. In many parts of the biome that is simply not the case. In late August 2015, the MIQCB published a map of the remaining babaçu forests—nearly 30 Mha that stretch across northern Maranhão and Tocantins.<sup>141</sup> The MIQCB is hopeful that the map will be a useful tool for traditional communities in defending their access to the babaçu forest and informing local, state, and federal planning efforts.

Many other traditional communities in Matopiba and elsewhere in the Cerrado have conducted similar mapping efforts or have mapping efforts underway, often as a collaboration between communities and mapping technicians. Continuation of such efforts is important. A detailed understanding of where these traditional communities are and what natural resources they depend upon is essential to developing good land use plans and is a necessary step toward establishing conservation units for sustainable use.

## Legal issues around land tenure

Conflicts over land are as old as Brazil and have a fraught history in the country known for its Landless Workers' Movement. In Matopiba today, there is a fresh fear of land expropriation from large agribusiness operators looking to expand. Many traditional communities and family farms have claims based on historical use but not formal land title. Because historical use can be difficult to prove and many rural populations do not have the training or resources to defend their claims, they can be vulnerable to expropriation by larger, better-resourced actors. Research into the rights and legal protections for the various traditional people and local communities to help clarify and codify what kind of land expropriation is illegal, where the gray areas are, and what steps communities need to take to protect themselves can help these groups maintain access to their traditional lands and ensure that they are not displaced.

## Ecosystem service valuation

Given that the Cerrado is an economic priority for Brazil, it would be extremely useful to quantify the value of the natural resources in the biome (e.g., carbon stocks, water resources, soil health, biodiversity, pollinators) in financial terms. A recent assessment by the TEEB for Business Brazil Project highlighted the environmental value of agricultural practices of two companies, Natura and Monsanto, in order to demonstrate the environmental and economic benefits generated by more sustainable agricultural production practices.<sup>142</sup> Quantifying the financial risks of depleting the biome's natural resources would likewise be valuable. Putting these resources in financial terms would allow the government and other actors to understand the trade-offs of different development scenarios. Of course, good ecosystem valuation data is difficult to come by, but the assessment tools and methodologies in this field are getting better all the time. Investing in this knowledge base is certainly worthwhile.

## Economics of expanding soy onto open pasture

The effort to intensify pasture use across Brazil is a top priority for a number of conservation-oriented organizations. Part of the appeal of this approach is that it opens up land for soy and other crops. The International Institute for Sustainability and others have demonstrated positive economic and herd health effects from intensification practices,<sup>143</sup> and tools such as Otimizagro can simulate cropping patterns under different agricultural land demand and deforestation policies in Brazil.<sup>144</sup> However, little has been published on the economics of expanding soy or other crops into degraded pastureland. Experts seem to disagree about whether expanding soy onto degraded pastures is more or less expensive than opening new forest. A more robust assessment that identifies where and under what conditions soy expansion onto degraded pastures can be profitable would help the field understand how cattle intensification may help to constrain the overall footprint of agriculture.

141. "Cartografia Social dos Babaçuais: Mapeamento Social da Região Ecológica do Babaçu," *Projeto Nova Cartografia Social da Amazônia*, July 2015.

142. "Natural Capital Accounting in Brazil," TEEB for Business Brazil, March 2014.

143. "Economic Analysis of a More Sustainable Livestock," *International Institute for Sustainability*, May 2015; Latawiec et al. (2014): 1255–1263.

144. Otimizagro is a model being developed by the Remote Sensing Laboratory at the Federal University of Minas Gerais. Using spatially explicit data about the productivity of cattle herds, the model can identify areas with the largest opportunities for restoration.

## CONCLUSION

**The Cerrado is a vitally important region. It is Brazil's breadbasket, with more than 40 percent of the country's agricultural land. It is home to a wealth of indigenous and traditional communities and has some of the highest densities of family farmers in Brazil. It is the most biodiverse tropical savanna in the world and is a storehouse of vast amounts of carbon. It is the birthplace of many of Brazil's rivers and also has a significant, if inadequately understood, role in the weather and water cycles that feed agriculture, hydropower generation, and urban areas across Brazil. Support for development in the Cerrado that can sustain and support these myriad assets and functions is essential, not just for the Cerrado's communities, but for the entire country. It is a matter of national importance: Brazil's food security, water security, and biological and cultural heritage depend on a healthy Cerrado.**

Agricultural expansion and related infrastructure development in the Cerrado, left wholly unchecked, threaten the region's indigenous and traditional communities and its ecosystem functions. Thus, it is essential to adopt a balanced approach to development in the Cerrado, one that recognizes the value of varied approaches to agricultural production, protection of biodiversity and landscapes, and social inclusion of small-scale farmers and indigenous and traditional communities. This paper outlines five approaches that, if taken together, could prove successful in achieving these multiple goals.

Realizing such an agenda will not be easy, particularly given the economic and political challenges facing Brazil today. It will require critical support and enhanced political will from the federal, state, and municipal governments, the private sector, academics, international donors, and civil society. Yet just as Brazil has pioneered the development of agriculture in tropical savannas for the rest of the world, it now has the opportunity to be perhaps the first major agricultural economy to develop in a manner that truly integrates social, cultural, environmental, economic, and climate agendas.

Additional resources are available online:

[www.climateandlandusealliance.org/reports/cerrado/](http://www.climateandlandusealliance.org/reports/cerrado/)