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REDD in Brazil: A focus on the Amazon

Principles, criteria, and institutional structures for a national program for Reducing Emissions from Deforestation and Forest Degradation – REDD

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REDD in Brazil: A focus on the Amazon

Principles, criteria, and institutional structures for a national program for Reducing Emissions from Deforestation and Forest Degradation – REDD

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Preface

Brazil is the world's leading nation in both committing to and achieving greenhouse gas reductions. In Copenhagen, Brazil announced its official goal of reducing GHG emissions 36 to 39% by 2020 as it reported a 64% reduction in Amazon deforestation its major source of emissions. There is now an important opportunity for consolidating the policies, market trends, and deforestation reductions that have been achieved over the last few years.

Over the past few decades, the conversion of forests to agriculture and ranching in the Amazon has been the most important national source of GHG. Around half of the gross emissions of GHG come from the incorporation of new areas into ranching, the large majority in the Amazon. Since the 1970s, the Amazon region has been quickly integrated into the national economy. Successive waves of migration have driven expansion of the agricultural and ranching frontier, and attracted migrants and capital from other regions. This economic integration, however, has followed a logic based on the extraction of raw materials and extensive ranching, resulting in natural resource depletion, social inequalities and poverty.

This dynamic of continuous frontier expansion must be substituted by a new logic of natural resource and land use. This would include the creation of positive incentives to reduce pressure on standing forests, and support those responsible for the conservation of remaining forest stocks. It is also necessary to add knowledge to the production processes and induce economic and social agents to change their behaviour in a direction that promotes education, innovation and criativity. This new development model should be grounded on a low carbon emissions production matrix. These possibilities require significant investments in infrastructure, research, and technological innovation. A REDD policy (compensations for Reducing Emissions from Deforestation and Forest Degradation) is one important mechanism for financing this new development model for the Amazon.

The Secretariat for Strategic Affairs of the Presidency of Brazil (SAE/PR) has been following the national mobilization for mitigating and adapting to climate change since its inception. In 2009, SAE/PR actively participated in discussions on compensation for deforestation reduction taking place under the auspices of the Amazon Governors' Task Force. The partnership of SAE/PR, the Center for Strategic Studies and Management (CGEE), and the Amazon Environmental Research Institute (IPAM) is making an important contribution to the debate over REDD in Brazil. The selection of IPAM to conduct the research was especially appropriate, given that it not only has a long history of research into issues related to sustainable development in the Amazon, but has also been engaged in international discussions on REDD since they began in the 1990s.

SAE/PR has investigated two basic questions: Who has carbon in the Amazon? How would a compensatory carbon market function in the region, especially considering the differences in the historical profile of forest use by states as diverse as Amapá (with almost all of its forest still intact) and Rondônia (which has already lost more than 40% of its original forest cover)?

The answers to such questions went far beyond the limited scope of most publications on REDD. More than simply situating the matter in terms of regulatory parameters that exist today, the present work proposes a structure around which the debate on alternatives open to Amazonia can result in better choices for current and future generations.

Mariano Francisco Laplane
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Executive summary[1]

Brazil can make a substantial contribution to mitigating global climate change if it reduces its emissions of greenhouse gases (GHG) caused by deforestation and, at the same time, makes progress in creating the foundations for low-carbon economic development. One of the most promising paths for bringing about such development is currently being debated under the auspices of the UNFCCC, identified by the acronym REDD (Reducing Emissions from Deforestation and Forest Degradation). Through this mechanism, developing countries with tropical forests that commit to carrying out successful programs for reducing GHG emissions from deforestation in their territories can obtain positive incentives or financial compensation. The expectation is that the system will stimulate a new world economy based on low emissions, which takes into account efforts toward protecting forests and reducing emissions from deforestation.

Numerous funding sources geared toward capacity-building in developing countries for monitoring and controlling deforestation are emerging, with several already in operation, such as the Amazon Fund, launched in 2008 by the Brazilian government. Such funds will be crucial for putting experiments into practice and to configuring and regulating national REDD systems. The rapid progress in discussions about REDD in the forum of the United Nations Framework Convention on Climate Change (UNFCCC) suggest that emissions resulting from the clearing of forests are now gaining attention from developed and developing nations, and will be highlighted in the next climate accord signed by the Convention.

Beyond UNFCCC, movements in developed countries such as the U.S. are deliberating, through Congressional meetings, the implementation of national mechanisms for limiting emissions. These discussions are rapidly evolving and may find in REDD a solution for decreasing the costs of reducing GHG emissions in their own countries, generating major economic opportunities. Alliances among states in different countries, such as the Governors' Climate and Forest Task Force (GCF) created by California (U.S.), Acre (Brazil), and Chiapas (Mexico), and which include REDD programs, will become ever more common.

1 This is the first edition of the REDD book in English and contains concepts discussed in the 2nd reviewed and expanded edition published in Portuguese, in July 10th, 2011, in addition to new ones. For example, this edition presents a revised methodology to calculate the targets for reductions in carbon emissions from deforestation by 2020, as established by the Brazilian Federal Government and some states of the Legal Brazilian Amazon. The improvements presented in the English version of the book will soon be incorporated in the Portuguese one. Despite our effort to present the most up to date information, the REDD mechanism is a dynamic process that changes rapidly both nationally and internationally, so the reader may find some information that is out of date.

Considering this scenario, REDD programs may bring important dividends to Brazil. The country finds itself sufficiently prepared and in a privileged position to take advantage of the full potential that this new economic mechanism offers. Brazil has had valuable experiences with endeavors such as the Amazon Fund, as well as the National Policy on Climate Change (PNMC) approved by the national Congress, establishing national targets for the first time, which aim at reducing GHG and deforestation in the Amazon and the cerrado savanna. These efforts demonstrate how well prepared Brazil is to absorb a new economic logic mediated by the mechanism of REDD. Furthermore, Brazil maintains a satellite monitoring system operated by the National Institute for Space Research (INPE), which puts the country at the vanguard of technology that can assist in measuring and verifying new deforestation activities, thereby effectively assessing reductions in the rhythm of forest destruction. Finally, the engagement of various sectors of Brazilian society in discussions of a national REDD system, added to the efforts of the Amazonian states to establish their own plans and targets for reducing deforestation, reinforces the notion that the country has enormous potential for implementing a new economic logic based on low carbon emissions.

Brazilian leadership in this new economic order can only be consolidated if the country paves the way for others by defining its national REDD strategy. Such a strategy should rest on different levels of action, both national and state, that have two primary objectives: giving financial value to efforts to maintain forest stocks and reducing GHG emissions from deforestation. Similarly, the strategy must ensure that the distribution of REDD benefits is fair and transparent, reaching those who truly make efforts to reduce deforestation or conserve the forest. A massive investment of financial resources must be made to bring about a genuine transformation of agriculture and ranching, enabling these to become low carbon activities. These actions, integrated with those of command and control, will allow the country to create the foundations of an economy based on the valorization of forests and their environmental services and to contribute toward the development of its economy based on low GHG emissions.

A REDD strategy for Brazil that is economically efficient, socially just, and politically viable will certainly create more modern, efficient economic means for environment protection and the sustainable use of forest resources. Otherwise, the risk of a return to deforestation will be high. The tendency over the long run of rising world demand for commodities (grains and meat), for example, in addition to infrastructure investments (such as the Accelerated Growth Program (PAC) and attacks on environmental legislation, will exert pressures for new rounds of deforestation in the future. The country will thus encounter difficulties in fulfilling its emission reduction goals established by the PNMC.

As a contribution to the formulation of a new REDD strategy for Brazil, the Amazon Environmental Research Institute (IPAM), with support from the Secretariat for Strategic Affairs of the Presidency of Brazil (SAE/PR) and the Center for Strategic Studies and Management (CGEE), produced this publication, which offers some of the political, institutional, technical, and operational principles for a REDD system. More specifically, the objective was to select and analyze the options for institutional and operational arrangements for a REDD system that includes schemas for benefit-sharing and which could serve as the basis for a national strategy. Since the Amazon region contributed the largest portion of national emissions, the present report focuses on that region.

PART I – Emissions from Tropical Deforestation and the Role of the Brazilian Amazon

Tropical rainforests serve as massive storehouses of carbon, which, if protected, will assist in controlling global warming. However, GHG emissions from the deforestation and degradation of tropical forests continue at high levels. Deforestation in the Brazilian Amazon alone corresponds to more than half the total emitted by deforestation in the whole country. Despite the recent declines in the rates of rainforest destruction, Brazil continues to lead the ranking of countries with the highest deforestation rates. However, the greater Amazon region represents the largest block of continuous remaining tropical vegetation in the world, with 80% of its area still considered preserved. Brazil encompasses 60% of this richness. The region is also considered a great cradle of planetary biodiversity, harboring more than 20% of known terrestrial species. It represents a fundamental component in the maintenance of regional and global climatic equilibrium, such as regulating rain in the region or mitigating global warming.

The combination of deforestation with the progress of global warming may increase the emissions of greenhouse gases caused by fire. The increase in the frequency and intensity of droughts, with reductions in the volume of rain on the order of 20-30%, could become common in the future in certain regions of the Amazon. Besides more intense drought periods, the uncontrolled exploitation of forest resources elevates the flammability of vegetation. Under this new regional climate order, the impoverishment of the rainforest could intensify, culminating in a process of forest degradation that could lead to savannization of a large part of the region.

Although the Amazon rainforests are highly tolerant of dry seasons, they can enter into collapse if submitted to prolonged droughts, giving rise to a process of irreversible degradation. The process of forest degradation will be even more intense if the production of grains and livestock, the demand for biofuels, and infrastructure investments continue along a rising trajectory, like that recorded in the past several years, despite the oscillations and recent declines in deforestation rates.

Deforestation in the region, however, cannot be viewed simply as a reflection of the national economy and government investments. It is also a "globalized" process. Historically, a strict relationship exists between deforestation and the growth in the gross domestic product (GDP) in the Amazon. The greater the available capital for the Amazonian or national economies, the greater the amount of government or private investments (in infrastructure, agriculture, and ranching) in the region, which require or result in deforestation. The current pressures exerted by the expansion of new areas under cultivation and the growing demand for Amazonian products, such as beef and soybeans produced with state-of-the-art technology, could stimulate extensive deforestation in the future. Such increases would threaten the benefits attained from the recent decline in the rates at which the rainforest is being cut down.

In the last two decades, Amazonian deforestation has been combated by mechanisms of command and control (effective monitoring, robust and coherent environmental legislation, and a government presence in remote areas of the region). These mechanisms are important and should be improved, but they are, nonetheless, insufficient. In general, the reduction or even elimination of deforestation in the Amazon has not materialized due to the fragility of governance, since the state is still absent. To put a stop to Amazonian deforestation, governance should be established before making investments in infrastructure, which stimulate new deforestation. Government actions, in combination with policies of incentives and payments for environmental services, coordinated through a mechanism such as REDD, could alter the historical course of development and economic growth in the region.

PART II – REDD: An Opportunity for a New Forest Economy

The dynamics of the global economy in relation to agribusiness, as well as the productivity of smallholder farmers, indicate that the forest will remain standing only when the cost of cutting it down or the profits from conserving it become greater than the potential profit of converting it to other uses. Without destroying the link between profit and deforestation, the conservation of large areas of tropical forests will be a difficult task. The most powerful economic mechanism for financing policies

aimed at conserving extensive portions of tropical rainforests may be anchored in commodities that are invisible but nevertheless real, such as the environmental services provided by standing forests. Given today's global warming, the environmental service that is the most valuable and has the broadest range for providing economic value to forest conservation appears to be the mechanism of REDD. If well handled, this mechanism could represent the foundation of a new rural economy that would not require new deforestation and could bring significant dividends to the country.

Regardless of the arena where this takes place, reducing GHG emissions from deforestation should follow certain basic principles that will not only provide a foundation for a national REDD system, but also envision efforts toward conservation and the reduction of deforestation on both local and regional levels.

Proposals for REDD put forward through the UNFCCC have seen great progress in recent Conferences of Parties (COPs), especially since COP13 in Bali, Indonesia, held in December, 2007. Brazil is in a privileged position to take advantage of the potential for a REDD market by the fact that it commands the technological, political, social, and business conditions to bring governance to bear on deforestation in Amazonia. Brazil could play a fundamental role on the international stage if it is willing to make progress in planning and implementing a strategy for a national REDD system that could serve as a model for other developing countries.

The mechanism of REDD could create a dynamic world economy if it is regulated by an international climate accord reached after 2012, the year when the first commitment period of the Kyoto Protocol comes to a close. The results recently attained during the 15th Conference of Parties (COP15) and assembled in the Copenhagen Accord point in this direction. Numerous funding sources geared toward capacity-building in developing countries for monitoring and controlling deforestation are emerging, with several already in operation. Among them is the Amazon Fund, launched in 2008 by the Brazilian government. Such funds will be crucial for putting experiments into practice and for configuring and regulating national REDD systems. The rapid progress in discussions about REDD in the context of the UNFCCC suggest that emissions resulting from the clearing of forests, not previously considered by the Kyoto Protocol, are now gaining attention from developed and developing nations, and will be highlighted in the next climate accord. Beyond UNFCCC, movements in developed countries such as the U.S. are deliberating, through Congressional meetings, the implementation of national mechanisms for limiting emissions. These discussions are rapidly evolving and may find in REDD a solution for decreasing the costs of reducing GHG emissions in their own countries. Alliances among states in different countries, such as the Governors' Climate and Forest Task Force (GCF), may create avenues for remunerating the reduction of emissions resulting from deforestation.

PART III – A National REDD Strategy for Brazil: Elements in Place

With the approval of Federal Law Federal 12187/2009, which set up the National Policy on Climate Change (PNMC), and with the experiences derived from the Amazon Fund, Brazil assumed the vanguard and ensured its eligibility in a future REDD mechanism. In addition, the states of the Legal Amazon are launching their own plans for controlling deforestation, while some (Pará, Mato Grosso, Acré, and Amazonas) have even established quantitative targets for deforestation reduction and state REDD plans. This context confers on Brazil the ability to negotiate within the UNFCCC, including the establishment of more ambitious obligatory targets in a post-2012 international agreement, and to construct its own national REDD strategy.`

Other important elements that ensure Brazil's prominence in REDD issues are: the discussions in the National Congress surrounding a legislative bill (5586/2009) to institute certified reductions of emissions from deforestation and degradation, as well as the initiatives for social control introduced by the establishment of the Climate Observatory. Added to these are numerous REDD pilot projects scattered throughout Brazil. These efforts suggest that the mechanism of REDD can be a viable alternative for the conservation of standing forests and the valorization of its multiple co-beneficiaries.

PART IV – A National REDD Strategy for Brazil: Key Principles

REDD must be one of an array of tools comprising a national strategy for reaching the targets defined in Brazil's National Policy on Climate Change (PNMC) for reducing deforestation. The major challenge for the country, therefore, lies in clearly defining its national strategy and how such a system is likely to be regulated.

To meet this challenge, several principles should be followed when articulating and implementing a national REDD system. These principles would be useful in the formulation and operation of a system that could result in an effective implementation of the National Policy on Climate Change (PNMC), leading the country to a new economic dynamic based on low carbon emissions. The ten principles for a national REDD system are: (1) operate on a national scale; (2) be safeguarded by effective, permanent forestry legislation; (3) incorporate state-level plans for reducing deforestation in the Amazon; (4) distribute the benefits according to efforts dedicated to emission reductions (flow) and forest conservation (stock); (5) identify, from the start, the beneficiaries of a REDD system; (6) promote a just, equitable, and rigorous distribution of REDD benefits; (7) respect the rights of

forest peoples; (8) not ignore the potential for investments through the carbon market; (9) set up a procedure for documenting, confirming, and reporting carbon emission reductions; and (10) invest REDD resources in coordinated actions and policies for reducing deforestation, conserving forests, and improving the system itself.

PART V – A National REDD Strategy for Brazil: Models and Institutional Structures

To ensure that the implementation of a national REDD system is just and effective, it is not enough to distribute benefits solely according to the contribution toward reducing emissions; it will also be necessary to give financial value to efforts made to conserve forest stocks, even those located in remote areas and not under immediate threat of deforestation. Otherwise, the benefits of REDD would be directed mainly to those who deforested a great deal in the past and who are now reducing their emissions.

Two structural models for a national REDD system are proposed. Both are designed to accommodate resources coming from public funds (donations) as well as from a mandatory or voluntary market (using carbon credits). The targets for deforestation reduction set by the PNMC for the Amazon are also discussed.

Model I – This proposes the implementation of "state REDD systems," which are regulated and monitored by the federal government through a "federal REDD system" established in line with the aims of the PNMC. States would receive financial compensation based on emission reductions in the Amazon region according to three basic criteria: (1) their contribution toward emission reductions (flow) within a given time frame; (2) the amount of forest stock in their territory; and (3) their performance in fulfilling their promised state targets for reducing deforestation.

Model II – This model focuses on the contribution of different land-use categories (indigenous lands, conservation areas and extractivist reserves, rural settlements, and non-assigned public lands and private properties) to the reduction in emissions from deforestation. The distribution of benefits would be made according to the proportional contribution of each category toward reducing deforestation and conserving forest stock. The funds related to each land-use category would be set up within a federal REDD system through a committee or commission made up of representatives from the public (representative entities, social movements, businesses, etc.).

To take advantage of the opportunity for development within a new economic order of low carbon emissions, developing countries with forestlands should be institutionally prepared to formulate national REDD systems in an effective and transparent manner. There is no point in Brazil promoting the development of numerous REDD projects if these are not regulated and incorporated into a national system that gives them room to operate in an orderly manner. This is why a discussion is so necessary concerning the distribution of REDD benefits in a manner that is just, equitable, and aligned with the PNMC.

Conclusion

Brazil has shown that it is the country best prepared to implement a national REDD system. If the country chooses to establish this system, it will be opening up immense opportunities for promoting economic development based on low carbon emissions and the valorization of its forests and the biodiversity contained in them. In a world of continuous warming, making this choice now could bring significant advantages in the future, including economic ones. To do so, a national REDD system should integrate national and regional (state) actions. There is no point in Brazil promoting the development of numerous REDD projects if these are not regulated and incorporated into a national system that gives them room to operate in an orderly manner, contributing toward the fulfillment of the PNMC objectives.

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List of abbreviations

AC – Acre
ACESA – American Clean Energy and Security Act
AER – State REDD Agency
AFB – Adaptation Fund Board
AM – Amazonas
AP – Amapá
AP – Protected Areas
APA – Environmentally Protected Area
APA – American Power Act
APP – Permanently Protected Areas
AR – Rural Settlement
ARPA – Amazon Region Protected Areas
AST – Forest Settlement
BNDES – Brazilian Bank for Economic and Social Development
CCBS – Community, Climate and Biodiversity Standard
CCSX – Socioenvironmental Commitments Inventory Project, Xingu
CCX – Chicago Climate Exchange
CDM – Clean Development Mechanism
CER – Certified Emission Reductions
CGEE – Center for Strategic Studies and Management
CIF – Climate Investment Funds
CITL – Community Independent Transaction Log
CO_2 – Carbon dioxide
COFINS – Contribution to Social Security Financing
COP – Conference of Parties
C-REDDs – REDD certificates
CSLL – Social Contribution on Net Profits
DEGRAD – Mapping of Forest Degradation in the Brazilian Amazon
DETER – Real-Time Deforestation Detection System
DF – Federal District
EMBRAPA – Brazilian Agriculture and Livestock Research Agency
EPA – U.S. Environmental Protection Agency
ETS – European Trading Scheme
EU – European Union
FAO – Food and Agriculture Organization
FAS – Sustainable Amazonas Foundation
FBMC – Brazilian Forum on Climate Change
FCPF – Forest Carbon Partnership Facility
FIP – Forest Investment Programme
FNMC – National Climate Change Fund
FNS – National Health Foundation
FVPP – Foundation for Life, Production, and Preservation
GCF – Governors' Climate and Forest Task Force
GDP – Gross domestic product
GEF – Global Environment Facility
GHG – Greenhouse gases
GTA – Amazon Working Group
$GtCO_2$ – Gigaton of carbon dioxide (equal to one billion tons)
GTZ – German Agency for Technical Cooperation
Ha – hectares
HDI – Human Development Index
IBAMA – Brazilian Institute for the Environment and Renewable Natural Resources
IBGE – Brazilian Institute of Geography and Statistics
ICMS – Tax on Circulation of Goods and Services
ICV – Center of Life Institute
IDESAM – Institute for Conservation and Sustainable Development of Amazonas
IIRSA – Initiative for the Integration of the Regional Infrastructure of South America
IMAFLORA – Institute for Agricultural and Forest Management and Certification
IMAZON – Amazon Institute of People and the Environment
INCRA – National Institute for Colonization and Agrarian Reform
INPE – National Institute for Space Research
IPAM – Amazon Environmental Research Institute
IPCC – Intergovernmental Panel on Climate Change
ISA – Socioenvironmental Institute
ISE – Corporate Sustainability Index (São Paulo Stock Exchange)
ISS – Service Tax
JI – Joint Implementation
Kg – kilogram
Km – kilometer
MA – Maranhão
MAPA – Ministry of Agriculture, Livestock, and Food Supply
MBRE – Brazilian Market for Emissions Reduction
MCTI – Ministry of Science Technology and Innovation
MMA – Ministry of the Environment
MRV – Measurement, reporting, and verification
MT – Mato Grosso
$MtCO_2$ – Metric tons of carbon dioxide
NAMA – Nationally Appropriate Mitigation Action
NGO – Nongovernmental Organization
PA – Pará
PAC – Growth Acceleration Program
PAS – Sustainable Amazon Plan
PBF – Forest Assistance Program
PgC – Petagram of carbon (equal to one trillion kilograms)
PIC – Community Investment Plan
PIS – Social Integration Program
PL – Legislative Bill
PNMC – National Policy on Climate Change
POF – Household Budget Survey
PP – Private Property
PPCAD-PA – State Plan for the Prevention, Control, and Alternatives to Deforestation in the State of Pará

PPCD – State Plan for Prevention and Control of Deforestation
PPCDAM – Plan for Prevention and Control of Deforestation in the Amazon
PPM – Parts per million
PR – Paraná
PRODES – Deforestation Monitoring Program of the Brazilian Amazon
RDS – Sustainable Development Reserve
REDD – Reducing Emissions from Deforestation and Forest Degradation
RESEX – Extractive Reserve
RL – Legal Reserve
RO – Rondônia
RPPN – Private Natural Heritage Reserve
RR – Roraima
SAE/PR – Secretariat for Strategic Affairs of the Presidency of Brazil
SBSTA – Subsidiary Body for Scientific and Technological Advice
SDS – Secretariat of Environment and Sustainable Development
SEDE – State Secretariat for Economic Development
SEMA – State Environmental Secretariat
SEUC – State System of Conservation Areas
SNUC – National System of Conservation Areas
SP – São Paulo
SPVS – Wildlife Research and Environmental Education
SUS – Unified Health System
tC – ton of carbon
tCO_2e – ton of carbon dioxide equivalent
TD – Deforestation rate
TDM – Average deforestation rate
TI – Indigenous Lands
TNC – The Nature Conservancy
TO – Tocantins
TP – Unassigned public land
UC – Conservation Area
UC PI – Full Protection Conservation Area
UC US – Sustainable Use Conservation Area
UNDP – United Nations Development Programme
UNEP – United Nations Environmental Programme
UNFCCC – United Nations Framework Convention on Climate Change
UN-REDD – United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
USAID – United States Agency for International Development
VCS – Voluntary Carbon Standard
WWF – World Wildlife Fund
ZEE – Ecological Economic Zoning
ZSEE – Socioeconomic and Ecological Zoning

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Introduction

A consensus is emerging that, to avoid "dangerous interference" in the global climate system – the primary aim of the United Nations Framework Convention on Climate Change (UNFCCC), Article 2[1] – tropical deforestation[2] should be drastically reduced (IPCC, 2007; Bali Roadmap, UNFCC, COP13). Annually, between 0.8 ± 0.2 and 2.2 ± 0.8 billion tons of carbon arising from deforestation are released into the atmosphere, representing 10-35% of global carbon emissions (Achard et al., 2002; DeFries et al., 2002; Houghton, 2005; IPCC, 2007; Le Quéré et al., 2009) , an amount equivalent to the annual emissions in the U.S. Given the current concentration of atmospheric carbon dioxide at 379 parts per million (ppm) (IPCC, 2007), it is imperative to keep the concentration below 450 ppm by the year 2100 to prevent the global temperature from increasing more than 2 degrees Celsius.[3] To prevent such dangerous interference, the reduction of global emissions must be on the order of 2-3% per year beginning in 2010 (O'Neill & Oppenheimer, 2002; Elzen & Meinshausen, 2005). This means that, to avoid exceeding the limit of 450ppm, the emissions levels in 2050 should be at least 15-25% below those recorded in 1990 (Elzen & Meinshausen, 2005). Without reductions in the forest sector, the additional increase in the concentration of carbon dioxide will be around 30ppm by 2100. If this continues, the economic damage resulting from deforestation emissions could reach US$12 trillion by 2200 (Eliasch Review, 2008). Thus, the drastic, rapid deceleration in the destruction of tropical forests is a key part of the effort toward a global reduction of greenhouse gas (GHG) emissions. Without it, the likelihood of the atmosphere being even minimally stable in the future is dim.

In these circumstances, Brazil can make a substantial contribution to mitigating global climate change if it reduces its GHG emissions from deforestation (55-65% of national emissions) and, at the same time, seizes the opportunity to create the foundations for low-carbon economic development. One of the most promising paths for bringing about such development is currently being debated under the auspices of the UNFCCC, identified by the acronym REDD (Reducing Emissions from

1 Article 2 states: "The ultimate objective of this Convention... is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."

2 Deforestation is defined here as the total removal of vegetation, i.e., clear-cutting. This is distinguished from logging operations, characterized by selective timber extraction and, consequently, of only part of the forest cover.

3 The goal of the European Union (EU) and the consensus reached by many researchers is that the rise in the global temperature should not exceed 2°C (or 400-450 ppm), using as a reference point the temperature recorded in the pre-industrial period. This limit would allow the conditions conducive to the "habitability" of the planet to be maintained.

Deforestation and Forest Degradation). Through this mechanism,[4] developing countries with tropical forests that commit to carrying out successful programs for reducing GHG emissions from deforestation in their territories can obtain positive incentives or financial compensation. In this way, REDD[5] could create a dynamic world economy if it is regulated by an international climate accord reached after 2012, the year when the first commitment period of the Kyoto Protocol comes to a close. The results recently attained during the 15th Conference of Parties (COP15) and assembled in the Copenhagen Accord point in this direction. Numerous funding sources geared toward capacity-building in developing countries for monitoring and controlling deforestation are emerging, with several already in operation. Among them is the Amazon Fund, launched in 2008 by the Brazilian government. Such funds will be crucial for putting experiments into practice and to configuring and regulating national REDD systems.[6] The rapid progress in discussions about REDD in the context of the UNFCCC suggest that emissions resulting from the clearing of forests, not previously considered by the Kyoto Protocol, are now gaining attention from developed and developing nations, and will be highlighted in the next climate accord. Beyond UNFCCC, movements in developed countries such as the U.S. are deliberating, through Congressional meetings, the implementation of national mechanisms for limiting emissions. These discussions are rapidly evolving and may find in REDD a solution for decreasing the costs of reducing GHG emissions in their own countries. Alliances among states in different countries, such as the Governors' Climate and Forest Task Force (GCF),[7] may create avenues for remunerating the reduction of emissions resulting from deforestation.

Considering this scenario, REDD programs may bring important dividends to Brazil. The country finds itself sufficiently prepared and in a privileged position to take advantage of the full potential that this new economic mechanism offers. Brazil has had valuable experiences with endeavors such as the Amazon Fund, as well as the National Policy on Climate Change (PNMC) approved by the national Congress, establishing for the first time national targets, which, although voluntary, aim at reducing GHG and deforestation in the Amazon and the cerrado savanna. These efforts demonstrate how well prepared Brazil is to absorb a new economic logic mediated by the mechanism of REDD. Furthermore, Brazil maintains a satellite monitoring system operated by the National Institute for

4 The phrase "REDD mechanism" will be used in this text to refer to REDD as discussed in the Climate Convention.

5 Discussions in the forum of the UNFCCC began with "RED" (limited to deforestation) and later evolved to "REDD" (taking forest degradation into account).

6 In this text, the phrase "REDD system" refers to the policies, operational mechanisms, and institutional structures necessary for carrying out REDD actions at the national level or subnational (state or large regional) level. "REDD programs" refer to a set of actions at the regional level (sub-state, for instance) to reduce deforestation emissions and promote forest conservation. Finally, "REDD projects" are actions conducted on a smaller (local) scale.

7 See http://www.gcftaskforce.org/.

Space Research (INPE), which puts the country at the vanguard of technology that can assist in measuring and verifying new deforestation activities, thereby effectively assessing reductions in the rhythm of forest destruction. Finally, the engagement of various sectors of Brazilian society in discussions of a national REDD system, added to the efforts of the Amazonian states to establish their own plans and targets for reducing deforestation, reinforces the notion that the country has enormous potential for implementing a new economic logic based on low carbon emissions. The clearest indication of this new tendency was the discussion held by the Amazonian Governors' Forum, which sponsored debates on the issue through its task force and pointed to various avenues for implementing a REDD strategy in the country.[8]

Brazilian leadership in this new economic order can only be consolidated if the country paves the way for others by defining its national REDD strategy. Such a strategy should rest on different levels of action, both national and state, that have two primary objectives: giving financial value to efforts to maintain forest stocks and reducing GHG emissions from deforestation. Similarly, the strategy must ensure that the distribution of REDD benefits is fair and transparent, reaching those who truly make efforts to reduce deforestation or conserve the forest. A massive investment of financial resources must be made to bring about a genuine transformation of agriculture and ranching, enabling these to become low carbon activities. These actions, integrated with those of command and control, will allow the country to create the foundations of an economy based on the valorization of forests and their environmental services and to contribute toward the development of its economy based on low GHG emissions.

A REDD strategy for Brazil that is economically efficient, socially just, and politically viable will certainly create more modern, efficient economic means for environment protection and the sustainable use of forest resources. Otherwise, the risk of a return to deforestation will be high. The tendency over the long run of rising world demand for commodities (grains and meat), for example, in addition to infrastructure investments (such as the Accelerated Growth Program (PAC) and attacks on environmental legislation, will exert pressures for new rounds of deforestation in the future. The country will thus encounter difficulties in fulfilling its emission reduction goals established by the PNMC.

As a contribution to the formulation of a new REDD strategy for Brazil, the Amazon Environmental Research Institute (IPAM), with support from the Secretariat for Strategic Affairs of the Presidency of Brazil (SAE/PR) and the Center for Strategic Studies and Management (CGEE), produced this publication, which offers some of the political, institutional, technical, and operational principles for

8 See http://www.ipam.org.br/biblioteca/livro/id/248.

a REDD system. More specifically, *the objective was to select and analyze the options for institutional and operational arrangements for a REDD system that includes schemas for benefit-sharing and which could serve as the basis for a national strategy*. Since the Amazon region contributed the largest portion of national emissions, the present report focuses on that region.

The contents of this volume are divided into five main parts. The first contains a brief introduction concerning emissions from tropical deforestation and the relevance of Amazonia to the regional and global climate. In the second, opportunities for a new forest economy are reviewed, taking as a point of departure the benefits arising from a REDD system. This part demonstrates the importance of REDD in the national context of preserving the biodiversity of the Amazon rainforest and the role it plays in the international context, especially within the UNFCCC. Also discussed are elements relevant to determining the amount of emissions reduction from avoided deforestation and sources of financing available for REDD, as well as the history of REDD and the role of Brazil in its creation.

The third part of this report surveys the main institutional arrangements in place for implementing a regulatory framework for REDD in the Brazilian Amazon. In the fourth, the basic principles for implementing a national REDD system are presented. In the fifth and final part, models and institutional structures are proposed that will support an Amazonian system of REDD as a start toward the creation of a national process. Also suggested are two methodologies that could constitute the foundation of an accounting system for emissions reduction and the distribution of benefits arising from a REDD system. The report then closes with a presentation of future challenges in implementing a national REDD strategy in Brazil.

PART I
Emissions from Tropical Deforestation and the Role of the Brazilian Amazon

Tropical rainforests serve as massive storehouses of carbon (200 billion tons of carbon; IPCC, 2000), which, if protected, will assist in controlling global warming (IPCC, 2007; Stern Review, 2006). However, greenhouse gas emissions from the deforestation and degradation of tropical forests continue at high levels. During the 1990s, an average of almost 10 million hectares of forests were cut down each year, releasing between 0.8 ± 0.2 and 2.2 ± .8 PgC (petagrams of carbon), an amount equivalent to 10-35% of the global emissions of greenhouse gases (Houghton, 2055; Achard et al., 2002; DeFries et al., 2002; IPCC, 2007, Table 1). In the current decade (up to 2005), the amount hovered around 1.5 PgC, while in 2008 it declined to 1.2 PgC, 12% of the global total (Le Quéré et al., 2009; Global Carbon Project, 2009[9]). The total amount of emissions, therefore, remains the same (approximately 9.9 PgC in 2008, a reference year: Global Carbon Project, 2009).

Brazil and Indonesia lie at the top of the global ranking of emitters of greenhouse gases from deforestation and degradation (60% of the global total, 2000-2005). Deforestation in the Brazilian Amazon alone corresponds to more than half the total emitted by deforestation in the whole country. Despite the recent declines in the rates of rainforest destruction, Brazil continues to lead the ranking (Global Carbon Project, 2009). In 2005, around 70% of Brazil's emissions were related to land use activities, especially deforestation (MCT, 2009).

On the other hand, the greater Amazon region represents the largest block (approximately 5.4 million km^2) of continuous remaining tropical vegetation in the world, with 80% of its area still considered preserved. Brazil encompasses 60% of this richness. The region is also considered a great cradle of planetary biodiversity, harboring more than 20% of known terrestrial species (Raven, 1988). It represents a fundamental component in the maintenance of regional and global climatic equilibrium, such as regulating rain in the region or mitigating global warming (Malhi et al., 2008).

9 See http://www.globalcarbonproject.org/

Carbon emissions resulting from deforestation and forest fires

The Amazon rainforest covers an enormous area of South America and has been suffering from uncontrolled settlement. To date, deforestation has reached 680,000 km^2 (17% of the total Amazon; see Figure 1), an area equivalent to the size of France or almost twice as much as the Brazilian state of Maranhão. Over the last two decades, an average of more than 18,000 km^2 per year was deforested (20,000 km^2 in the 1980s, and 18,165 km^2 in the '90s). The highest annual rate was recorded in 1995 (29,059 km^2). During the last decade, the net emissions of greenhouse gases from deforestation (the difference between emissions from deforestation and the absorption by regenerating forests) reached 200 million metric tons of carbon per year (tC/year) (3% of the global total; Houghton, 2005, Table 1). In 2005, according to preliminary data from the Second National Inventory of Greenhouse Gas Emissions,[10] these emissions were 380 million tC, corresponding to 70% of Brazil's total emissions, the same proportion as during the prior decade (MCT, 2009). Actually, the amount of national emissions may have been higher relative to the portion due to deforestation, since the emissions caused by Amazon forest fires are not completely included in the Brazilian Greenhouse Gas Emissions Inventories (Nepstad et al., 1999; Alencar et al., 2006).

Table 1 - Carbon emissions from fossil fuels, tropical deforestation, and forest fires

Geographical reference	Source	Carbon emissions (billions of tons per year)	Reference
Brazil	Fossil fuel (year: 2008)	0.1	*
	Deforestation	0.17 +- 0.04	**
	Forest fires (El Niño year, 1998)	0.2 +- 0.2	Mendonça et al., 2004 Alencar et al., 2006
	Forest fires (not El Niño year, 1995)	0.02 +- 0.02	Mendonça et al., 2004 Alencar et al., 2006
Global	Fossil fuel	7.2 +- 0.3	IPCC 2007
Tropical	Change in land use (deforestation)	(0.8 +- 0.2) to (2.2 +- 0.8)	Houghton, 2003; Clini et al., 2003; Achard et al., 2002; IPCC 2007
Global	Fires (El Niño year, 1997-98)	2.1 +- 0.8	Van der Werf et al., 2004

*U.S. Energy Information Administration (http://www.eia.doe.gov/)..

** Average of 2006-2009: 11.578 km2/year multiplied by 150 tons of carbon per hectare.

10 These inventories must be submitted by each country to the UNFCCC.

The combination of deforestation with the progress of global warming may increase the emissions of greenhouse gases caused by fire. The increase in the frequency and intensity of droughts, with reductions in the volume of rain on the order of 20-30%, could become common in the future in certain regions of the Amazon (Malhi et al., 2008; Oyama & Nobre, 2003; Nobre et al., 1991). This reduction is linked, in large part, to the El Niño events,[11] which bring long periods of drought to the region.

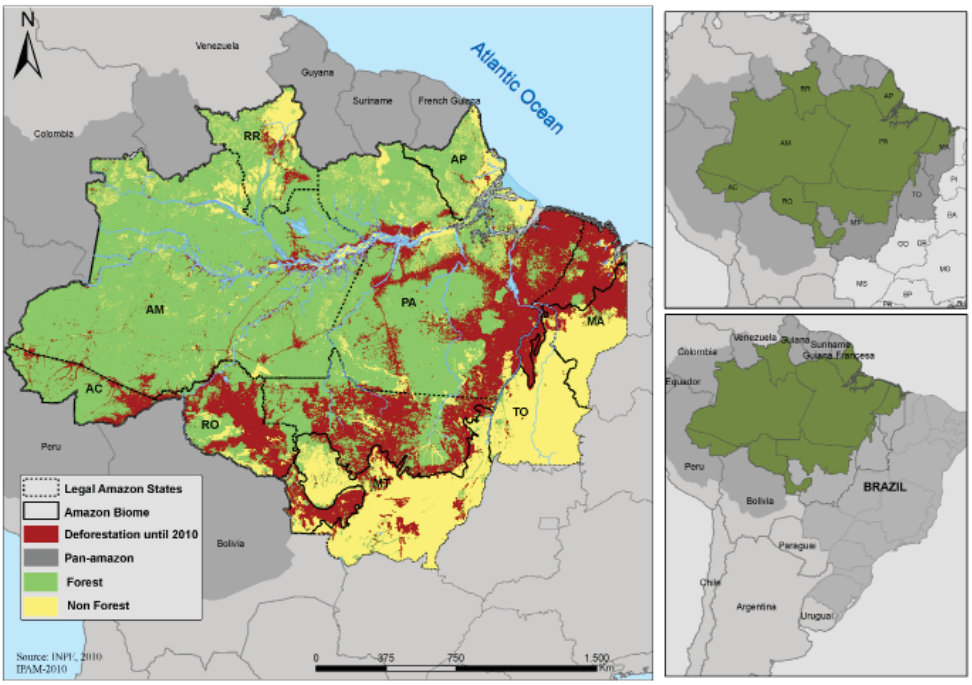

Figure 1. Deforestation of the Amazon Rainforest, based on data from INPE, 2010. Source: IPAM, 2011.

The impoverishment of the rainforest

Under this new regional climate order, the impoverishment of the rainforest could intensify, culminating in a process of forest degradation that could lead to savannization[12] of a large part of the region (Malhi et al., 2008; Nepstad et al., 2001, 2008; Oyama & Nobre, 2003). The impact of

11 El Niño is periodic climate phenomena that reflect periods of exceptionally warm sea surface and atmosphere temperatures across the eastern tropical Pacific.

12 Given the altered climate in Amazonia, continued deforestation would lead to a large-scale substitution of the dense vegetation in the rainforest with a type more characteristic of the cerrado savanna, mainly in the eastern part of the Amazon Basin.

this process on the soil is related to two typical components of the cerrado savanna environment: recurrent forest fires and invasive grass species. Lacking resistance to fire, Amazonian trees can be replaced by a type of vegetation composed of species of trees, bushes, and grasses that are more tolerant of flames. Although the Amazon rainforests are highly tolerant of dry seasons (Nepstad et al., 1994, 2007; Brando et al., 2008, 2010), they can enter into collapse if submitted to prolonged droughts (more than three consecutive years), giving rise to a process of irreversible degradation (Nepstad et al,., 1994, 2008). Studies that simulate the effect of severe dry seasons (marked by a 50% reduction in annual precipitation) on the Amazon forest (Nepstad et al., 2007; Brando et al., 2008) indicate that, following three years of accumulated deficits of groundwater, tree mortality would increase for five years. Surprisingly, the increase in mortality would be greater for large trees, raising the potential for higher carbon emissions in the future. Moreover, such tree mortality would expose the forest interior to sunlight, increasing its vulnerability to fire. Under water stress of this magnitude, the production of flowers and fruits would decline up to 60%, leading to a drastic reduction in vegetation growth (wood production), with a resultant decrease in the absorption of carbon by the forest (Nepstad et al,., 2002b; Brando et al., 2008). Under these conditions of degradation, the forests in the region would become more susceptible to forest fires, with even greater increases in tree mortality and the probability of new fires occurring (Ray et al., 2005; Alencar et al., 2006). Thus, the environmental impact of forest fires goes far beyond those caused by the immediate effect of fire. The reason for this is simple: forest fires increase the susceptibility of the forest to future fires; that is, fire provokes more fire. After a forest fire, up to 40% of mature trees may die. This mortality increases considerably if a second fire occurs. The process of forest degradation will be even more intense if the production of grains and livestock, the demand for biofuels, and infrastructure investments continue along a rising trajectory, like that recorded in the past several years (Nepstad et al., 2008, 2009), despite the oscillations and recent declines in deforestation rates.

Past and present causes of deforestation

Deforestation in tropical forests results from the interaction of numerous factors that vary along two axes: one geographical and the other temporal (annual). It is therefore a complex phenomenon. However, the causes of deforestation and forest degradation appear to be the same across the different tropical regions of the planet. The causes can be summarized as direct or indirect. Direct causes are linked to: (1) the conversion of forests into agricultural or livestock areas (with or without land titles), (2) logging extraction, and (3) forest fires. Indirect causes refer to: (4) subsidies for ranching and agribusiness, (5) infrastructure investment policies, (6) land titling problems, (7) lack of governmental control and oversight, (8) the demand for forest products (wood and others), and (9) market prices that favor products (such as grains and livestock) raised in areas previously covered by forests.

In the Amazon during the 1960s, policies for investing in infrastructure, especially roads, facilitated the colonization of a large portion of the region for geopolitical reasons. Large-scale mining and hydroelectric projects, as well as the expansion of ranching and agriculture, were implemented and subsidized by the government (Mahar, 1989; Nepstad et al., 2001; Carvalho et al., 2001, 2002). The region thus underwent what could be called the first phase of colonization. Currently, the Amazon is in the midst of a second phase, in which government incentives for occupation are less substantial, being replaced by the profitability of logging extraction, agribusiness, and ranching (despite the latter's low returns) (Mattos & Uhl, 1994; Margulis, 2003; Alencar et al., 2004; Nepstad et al., 2007, 2009). This process is bolstered by the government's historic investments in infrastructure, facilitated by numerous "development" programs (Carvalho et al., 2001, 2002; Nepstad et al., 2001), such as the recent Growth Acceleration Program (PAC) and, in the Amazon basin, the Initiative for the Integration of the Regional Infrastructure of South America (IIRSA). Highways connecting the northern and central regions of Brazil to the southern may result in significant increases in deforestation rates, given that more than 70% of deforestation in the Amazon is concentrated within fifty kilometers on either side of paved highways (Alves et al., 1999; Nepstad et al., 2001, Lourenço, 2009; Soares-Filho et al., 2006). Some of these highways, such as BR-319 linking Manaus and Porto Velho, could change the dynamics of deforestation, putting pressure on regions of dense forest that have previously been uninhabited. There is no denying that roads are necessary for the region, but the failure to incorporate socioenvironmental costs into highway investments, compounded by the absence of regional planning, ends up causing forest degradation and greenhouse gas emissions. The highway infrastructure investments called for in PAC could cancel out the recent efforts of the federal and state governments in Amazonia to contain deforestation and enhance the positive effects of emission reductions.

Deforestation in the region, however, cannot be viewed simply as a reflection of the national economy and government investments. It is also a "globalized" process. Historically, a strict relationship exists between deforestation and the growth in the gross domestic product (GDP) in the Amazon (Alencar et al., 2004). The greater the available capital for the Amazonian or national economies, the greater the amount of government or private investments (in infrastructure, agriculture, and ranching) in the region, which require or result in deforestation. The current pressures exerted by the expansion of new areas under cultivation and the growing demand for Amazonian products, such as beef that is free from infections (such as mad-cow or hoof-and-mouth disease) and soybeans produced with state-of-the-art technology, could stimulate extensive deforestation in the future (Soares-Filho et al., 2006; Nepstad et al., 2000, 2001, 2006). Such increases would threaten the benefits attained from the recent decline in the rates at which the rainforest is being cut down. In the case of soybeans,

used in animal feed to supply Asian countries, particularly China,[13] the international market has intensified pressure for new areas to grow grains. The rising demand for soybeans in recent years has also resulted from prohibiting the use of bovine cadavers in making animal feed, a consequence of the outbreak of mad-cow disease (Nepstad et al., 2008), as well as the new wave of optimism related to the production of biofuels, especially biodiesel (Nepstad et al., 2008). Similarly, the reduction of agricultural subsidies in the U.S. and Europe have also contributed to the search for new areas for cultivation in tropical regions. Finally, variations in the monetary exchange rate have played an important part in provoking deforestation. Although this is no longer the case, the devaluation in the Brazilian real relative to the dollar that occurred in 2001-2004 indirectly stimulated deforestation (peaking at 27,400 km2 in 2004). Currently, the Brazilian real is more highly valued, while soybeans and beef are less lucrative, which may explain in part the reduction in deforestation observed since 2006 (Nepstad et al., 2009; Soares-Filho et al., 2010). Adding only marginally to this process are smallholder producers, who depend on their own manual labor and produce to meet their basic necessities. They contribute with an absolute rate of deforestation that is far lower than other activities, although proportionally it is higher than in the past.

Besides environmental damage, perhaps the most dramatic feature of Amazonian deforestation lies in the fact that it does not lead to social, human, or even economic development in the region. According to Demographic Census data (IBGE, 2000), approximately 43% of the Amazonian population has an insufficient income, meaning that the income per capita is below the line of poverty. In about 40% of the municipalities in the region, considerable poverty is found[14] (IBGE, Demographic Census of 2000, Household Budget Survey, 2002-2003). Furthermore, the top1% of the population receives 11% of the total income, leaving the bottom 50% with only 15% of the income (IBGE, Synthesis of Social Indicators, 2000). Data from the 2010 Census, although not fully released, indicate improvements in these rates, but in comparison with the rest of the country, little has changed. This situation of enduring economic and social inequality is perpetuated by the false impression that investments will continue to be made in the region, sooner or later, based on historical models of development, despite the environmental cost of deforestation. The most recent study on this issue reveals exactly the opposite. Although development, measured by the Human Development Index (HDI), increases with investments entailing deforestation, it does not last more than fifteen years (Rodrigues et al., 2009). The consequences following this period reveal

13 The consumption of pork, beef, and poultry is now high in China (averaging 53 kg per person per year), according to 2006 data in Anualpec, the Brazilian Livestock Yearbook (see http://www.fnp.com.br/publicacoes/anuarios/anualpec).

14 These are municipalities with a poverty rate higher than 50% and a Gini index above 40. The Gini index is a measure of economic disparity, varying from 0 to 100: the lower the coefficient, the greater the equality in the distribution of wealth in a population.

environmental and social liabilities of alarming proportions. This could be described as the boom-and-bust cycle of development. After one decade, the HDI of municipalities with most of their land deforested is as low as those where the settlement process is only beginning (Rodrigues et al., 2009), except for municipalities with most of their area planted in soybeans.

Current tools for controlling deforestation in the Amazon

Historically, Amazonian deforestation has been combated by mechanisms of command and control (effective monitoring, robust and coherent environmental legislation, and a government presence in remote areas of the region). These mechanisms are important and should be improved, but they are, nonetheless, insufficient. In general, the reduction or even elimination of deforestation in the Amazon has not materialized due to the fragility of governance[15] – the state is still absent. To put a stop to Amazonian deforestation, governance should be established before making investments in infrastructure, which stimulate new deforestation. As mentioned earlier, more than 70% of deforestation in the Amazon is concentrated along paved highways (Alves, 1999; Nepstad et al., 2000, 2001). Only after forest degradation has occurred do government institutions establish a presence. This logic needs to be altered in order to bring about governance in the agriculture frontier.

Straightforward initiatives of governance to ensure greater economic and environmental sustainability in the region, leading to deforestation reductions, could be easily formulated. The government could take such measures as: (1) encouraging the restoration of old frontiers through incentives for positive economic activities that are environmentally friendlier; (2) making investments in a network of local roads around commercial centers and cities, which could constitute an important part of a sustainable "network of cities" (Becker, 2009); (3) supporting effective credit programs through rural extension services for producers who are involved in sustainable production; and (4) enlarging protected areas (Nepstad et al., 2006). These decisions, among many others (see Table 2), would reduce the necessity for more lands for expansion, increasing their market value as well as incentivizing the use of perennial crops, low-impact forest management, and other more sustainable systems of production (Nepstad et al., 2000, 2001, 2009; Carvalho et al., 2002), such as direct seeding

15 Governance is defined here as "the exercise of economic, political, and administrative authority to manage a country or region at all levels," in a manner that will guarantee the effectiveness of the processes and institutions through which citizens articulate their interests, exercise their legal rights, fulfill their obligations, and mediate their differences (Bandeira, 1999).

in straw.[16] These actions, in combination with policies of incentives and payments for environmental services, coordinated through a mechanism such as REDD, could alter the historical course of development and economic growth in the region.

Table 2 - Potential measures to reduce deforestation in the Brazilian Amazon and resultant benefits.

Measure taken against deforestation	Benefits
Concentration of agricultural development in areas already altered or degraded.	Decrease pressure on forested areas.
Land use zoning that restricts agricultural activities in areas of inadequate production due to existence of rocky outcroppings, rolling topography, or seasonally flooded areas.	Avoid unnecessary deforestation in areas of low agricultural potential.
Development of mechanisms that facilitate and stimulate sustainable use of legally protected areas for smallholder producers.	Add income alternatives based on the sustainable use of forests.
Establishment of formal processes for consultation and participation of local population in political decision-making about occupation of the region.	Ensure transparency and legitimacy of decisions made by the government.
Dissemination, improvement, expansion, and/or creation of systems for environmental licensing based on remote sensing technology, requiring land owners to locate their properties in satellite images (Landstat) before burning or deforestation licenses are granted.	Control deforestation in private property.
Incentives for forest-based economic activities, such as rubber tapping, harvesting of Brazil nuts and oils, and low-impact logging.	Develop economic alternatives in the forests to replace current ones requiring deforestation.
Improvement of secondary and access roads spurred by investments in paving and maintaining main highways.	Facilitate commercialization of local products and give rural population access to health, education, and technical services.
Creation of incentives for implementing technology that improves agricultural productivity and sustainability in deforested areas.	Increase productivity and reduce demand for new forested areas.
Technical assistence to family producers and smallholder farmers.	Reduce the indiscriminate and uncontrolled use of fire and increase agricultural productivity.
Creation of line of credit to compensate smallholder producers for environmentally sustainable behaviors.	Reduce pressure on forested areas, generate income from differentiated products (agroforests, organic products).

16 Direct seeding is a technique for preparing soil based on non-tillage, crop rotation, the use of cover crops to form straw, and the integrated pest management of insects, diseases, and weeds (EMBRAPA, 2002).

Protected areas and deforestation

The creation of Protected Areas (AP)[17] has been one of the main strategies for conservation, the reduction of deforestation, and the protection of lands occupied by traditional populations in the Brazilian Amazon (Capobianco, Veríssimo et al., 2001; Silva 2005; Schwartzman, Moreira et al., 2000; Nepstad e al., 2006; Soares-Filho et al., 2010). Along with Indigenous Lands (TI), Conservation Areas (UC) form part of an extensive set of Protected Areas, which are playing a key role in restraining the expansion of the agricultural frontier and deforestation in the region (Ferreira & Venticinque, 2005; Nepstad et al., 2006a). These areas constitute an important instrument for restraining land speculation, thereby ensuring the use of the territory by traditional populations constantly threatened by land grabbers and violence (Schwartzman et al., 2000). Deforestation within various types of Conservation Areas tends to be low, but they have often been the targets of invasions and plunder of their natural resources. Ensuring the integrity and environmental quality of these protected areas is vital not simply for the policy of conserving the Brazilian Amazon, but also for the populations that live off their forest and water resources and for the strategies for mitigating future emissions from deforestation.

The protected areas in the northern region of Brazil cover approximately 192.8 million hectares, that is, 38% of the total area of the Legal Amazon. These large areas not only serve as obstacles to the spread of deforestation, but they also have a regional inhibiting effect, since they contribute to the reduction of deforestation beyond their boundaries up to a distance of 10 km (Nepstad et al., 2006b, on TI and AP). Consequently, they play a significant part in preventing potential emissions associated with greenhouse gases (IPAM, 2009; Soares-Filho et al., 2010).

A study by the Amazon Environmental Research Institute (IPAM) and its partners (Soares-Filho et al., 2010) concluded that, although a few protected Amazon areas show clear signs of deforestation, the percentage of the land deforested within these areas is usually reduced, not exceeding 2%. The rate for extractive reserves (RESEX) does not exceed 3%, and is about 1% for indigenous territories (TI). By using numeric models that simulate the spatial spread of deforestation, it is possible to demonstrate the role of these areas in reducing future deforestation (2008-2050). If these areas were not protected, five billion tons of carbon would be launched into the atmosphere by 2050. This amount corresponds to about 2.5 times the amount of emissions reduction in the first commitment period of the Kyoto Protocol (around two billion tons), assuming its effective implementation.

17 For a definition of terms, see Appendix I.

Enforcement and combating deforestation

As part of good governance, enforcement and the current means of command and control are crucial. But, despite a few recent successful efforts, enforcement does not seem to be sufficient for restraining the spread of forest degradation. The vast geography of the region, structural deficiencies in enforcement, and corruption and impunity are among those factors that make it difficult to fulfill the law. Despite some success by recent campaigns to reduce deforestation by combating land grabbing and illegal deforestation, the problem of the incapacity of the government to enforce the laws continues. The lack of resources and trained personnel in federal and state agencies, compounded by the complete absence of incentives for fulfilling the law, are factors that impede more effective results. As for impunity, even when those who commit illegal deforestation are charged, they rarely pay the fines imposed. The collection of fines issued by the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) is under 2.5% (Brito, 2009). From 2004 to 2006, almost twenty thousand fines were imposed. If these were effectively applied, the disincentives for illegal deforestation would increase exponentially (Barreto et al., 2009).

Legislation and control over deforestation

In conjunction with proper enforcement, which has been lacking, strong environmental legislation is another important avenue for reducing deforestation. The problem of legislation, touted as modern, lies in how it is carried out. The classic case is the Forest Code, which established Legal Reserves (RL). By law, each property in the Amazon should maintain 80% of its land as forest, except in areas under the control of state plans for Ecological Economic Zoning (ZEE). For the most part, land owners are not complying with this regulation. An important factor aggravating the failure of environmental legislation to be carried out in the Amazon is the difficulty faced by farmers or ranchers who try to follow the law. The clearest example of this difficulty is the legislative change in 1996 in the Legal Reserve requirements from 50% to 80% of each rural property. Overnight, a large number of producers in the Amazon were no longer in compliance with the Forest Code and were given no mechanisms by the government to adjust to the new regulation (Stickler 2009a). On the government's side, there are still no incentives or mechanisms for making this happen. Due to this situation, numerous efforts are being made to alter the current Forest Code. The most recent is the proposal in the National Congress to change the Forest Code by focusing on the status of the Legal Reserve and the necessity of legalizing areas that have already been deforested in the Amazon. The proposal even includes a provision for amnesty for those who have committed illegal deforestation.

Although, in many cases, land owners in the region are not in the wrong when they say they cannot meet the requirements of the Forest Code, the debate has always favored undermining the legislation rather than improving it. Almost 80% of the areas in private property in the Amazon that are now deforested could be legalized through Ecological Economic Zoning at the state level in conjunction with the flexible measures included in the Forest Code, such as compensation for Legal Reserves (Lima & Capobianco, 2009). Attempts to weaken environmental legislation continue to make their way through the Brazilian Congress. In short, what is illegal today might be legal tomorrow.

Recent reductions in deforestation

Although deforestation rates were high in the last two decades of the twentieth century and the beginning of the twenty-first, the amount of deforested land has been declining since 2006. This suggests that the essential elements for establishing governance in the region and putting an end to the destruction of the forest are present. According to data from the Deforestation Monitoring Program of the Brazilian Amazon (PRODES),[18] the average rate of destruction of the Amazon forest between 2006 and 2010 was 11 651km^2 (see Figure 2), corresponding to approximately 176 million metric tons of carbon per year (tC/year).[19] This represents approximately 50% of the total emissions in Brazil,[20] a figure much lower than that recorded through 2005. Moreover, the deforestation rate in 2010 was the lowest in the history of records kept by PRODES, affecting 6,400 km^2, with emissions estimated at 96 million tC. Although the drop in commodity prices for soybeans and beef between 2005 and 2009 had an influence on the downward trend of deforestation in Amazonia (Nepstad et al., 2009), the dramatic reduction during this period in deforestation to 65% of the historical average (19,500 km^2) was due to effective interventions by the Brazilian government (Nepstad et al., 2009; Soares-Filho et al., 2010). For example, in 2004-2005, the government created 240,000 km^2 of new protected areas in the Amazon, mainly in the region undergoing active deforestation (see prior section). The creation of these areas was facilitated by political support from smallholder farmer organizations, preventing the emission of millions of tons of carbon (Campos & Nepstad 2006). This recent reduction in deforestation rates, however, may not represent a proportional reduction in the emissions associated with carbon, since deforestation is occurring in areas of denser forest that that recorded in the past (Tollefson, 2009).

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18 See http://www.obt.Inpe.br/prodes/prodes_1988_2009.htm.

19 These emissions are calculated by multiplying the average rate of deforestation from 2006 to 2009 and the average volume of carbon in the Amazon forest, which is 150 metric tons of carbon per hectare.

20 The emissions from deforestation are still higher than those from burning fossil fuels (see Table 1), which registered 100 million tC/year for the reference year 2008 (EIA, 2009).

In fact, between 2006 and 2010, Brazil stopped emitting almost a billion tons of carbon due to the decline in Amazon deforestation rates, an amount equivalent to 50% of the reduction efforts of the Kyoto Protocol (around 2 billion tons). This reduction further indicates how much Brazil could benefit from compensation mechanisms for emission reductions, such as REDD, by means of multilateral international accords.

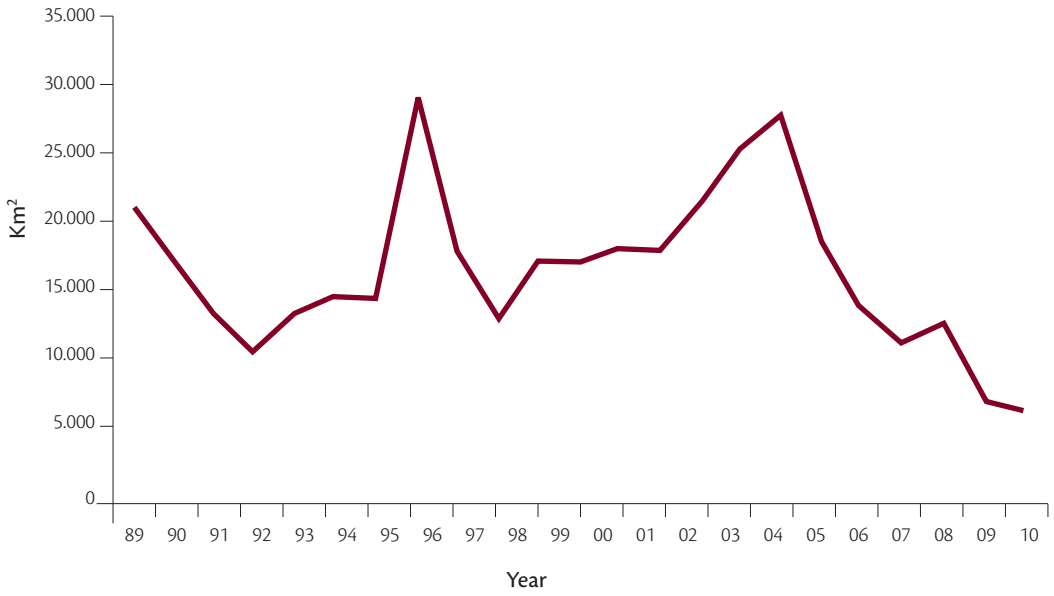

Figure 2. Deforestation rates in the Brazilian Amazon between 1988 and 2010 (km2/year).

Source: PRODES 2010.

PART II
REDD: An Opportunity for a New Forest Economy

Although vigorous enforcement and strong legislation are essential components of any policy designed to extinguish deforestation in the Brazilian Amazon, they are not sufficient. On their own, they lack mechanisms for generating economic value for the maintenance of standing forests or the improvement of agriculture and ranching through practices such as intensification. In the Amazon, it is still more profitable to cut down the forest than to preserve it. Changing the economic logic, which is based on continuing deforestation, is therefore essential for the goal of developing a rural and regional economy with low greenhouse gas emissions. To do so, an economic mechanism must be found that rewards the decision to not cut down forests and/or to preserve them. Without this, forested areas will have no economic appeal in comparison with other uses of the same land.

The dynamics of the global economy in relation to agribusiness, as well as the productivity of smallholder farmers, indicate that the forest will remaining standing only when the cost of cutting it down or the profits from conserving it become greater than the potential profit of converting it to other uses. Without destroying the link between profit and deforestation, the conservation of large areas of tropical forests will be a difficult task. The most powerful economic mechanism for financing policies aimed at conserving extensive portions of tropical rainforests may be anchored in commodities that are invisible but nevertheless real, such as the environmental services provided by standing forests.[21] Given today's global warming, the most valuable environmental service is one that results from actions that reduce GHG emissions from deforestation and promote the conservation of forest carbon stocks.

Despite numerous actions to benefit Amazonian populations by valuing forest products and traditional knowledge, thereby generating local economies that require the preservation of the forest, their range is geographically limited. To enable economic value to be generated for the forest on a large scale, a robust economic mechanism must be instituted that is anchored in compensation for the preservation of large portions of forestlands, whether or not they are inhabited by human populations. This is the only way to ensure a significant contribution toward mitigating global climate change. The sustainable use of forest resources, coupled with investments in intensifying production

21 Environmental services are defined as services provided by ecosystems (in this case, the Amazonian rainforest), such as maintaining climate stability, water and soil quality, and biodiversity conservation.

and improving technology in areas that were already cleared, could assist a process that preserves the forest cover and maintains the ecological functions of intact forest ecosystems (Stickler et al., 2009a). The factor with the broadest range for providing economic value to forest conservation is the mechanism of REDD. If well handled, this mechanism could represent the foundation of a new rural economy that would not require new deforestation and could bring significant dividends to the country.

The international context of REDD

Broad agreement extends through the international community that there must be a REDD mechanism that is robust enough to deal with emissions caused by deforestation in developing countries. REDD may be implemented through the United Nations Framework Convention on Climate Change (UNFCCC) until 2012, but a great deal of skepticism now exists about whether this target will actually be met. Regardless of the arena where this takes place, reducing GHG emissions from deforestation should follow certain basic principles that will not only provide a foundation for a national REDD system, but also envision efforts toward conservation and the reduction of deforestation on both local and regional levels.

Proposals for REDD put forward through the UNFCCC have seen great progress in recent Conferences of Parties (COPs), especially since COP13 in Bali, Indonesia, held in December, 2007. Brazil could play a fundamental role on the international stage if it is willing to make progress in planning and implementing a strategy for a national REDD system that could serve as a model for other developing countries. By abandoning its historically cautious position on whether to include tropical rainforests in international climate accords, adopting instead a more active and positive stance, Brazil has become the world's most important protagonist in taking actions to mitigate climate changes that involve emission reductions from deforestation. Brazil's position in the vanguard was solidified with the implementation of the Amazon Fund, which uses the notion of offering incentives for the achievement of deforestation reductions, and by launching the National Climate Change Plan, now passed into law, which established for the first time reduction targets for national deforestation. These recent advances could contribute toward the emergence of a global economic process in which the sustainable use of forests, forest protection, and the reduction of deforestation lead to vigorous, sustainable economic growth, besides representing the seeds of a model of development based on low carbon emissions in the coming decades.

The history of REDD and Brazil's role in its creation

The concept underlying the operation of REDD emerged in 2003 during COP9 held in Milan, Italy. A group of researchers coordinated by the Amazon Environmental Research Institute (IPAM) launched a proposal known as "Compensated Reduction of Deforestation" (Moutinho & Schwartzman, 2005). It argued that developing countries that succeed in voluntary efforts to promote reductions in their national emissions from deforestation should receive international financial compensation corresponding to the level of avoided emissions (Santilli et al., 2005; Moutinho & Schwartzman, 2005; Schwartzman & Moutinho, 2008; Moutinho et al., 2009). The frame of reference for the value to be received would be the price of carbon credits on the global market. Such a mechanism, focusing on developing nations with tropical forests, would address a specific objective: enabling these nations to voluntarily participate in global efforts to reduce GHG emissions. This was a significant proposal, since avoided deforestation had not been included in the Kyoto Protocol (Moutinho & Schwartzman, 2005).

However, the proposal for Compensated Reduction of Deforestation was initially viewed as an inadequate measure for mitigating climate change, for supposedly political, technical, and conceptual reasons (see Table 3). The result was that the only international climate accord with reduction targets in place, the Kyoto Protocol, dealt only with forests (planted or regenerating) in their role as carbon sinks for countries that were not part of Annex I,[22] through Clean Development Mechanisms (CDM), nominally through afforestation and reforestation activities.

22 Annex I countries refer to the bloc of 41developed countries and those in transition to market economies, which agreed at the Kyoto Protocol to reduce their total greenhouse gas emissions to 5.2% of the 1990 levels, a target set for the first commitment period, 2008-2012. Non-Annex I countries do not have mandatory emissions reduction targets for the first commitment period. These are countries that were Parties to the UNFCCC but were not listed in Annex I, that is, developing or underdeveloped countries, which included Brazil.

Table 3 - Main criticisms and counter-criticisms on the technical viability of mechanisms for reduction of emissions caused by deforestation and forest degradation (REDD)

Criticism	Reason	Counter-criticism
Impossibility of monitoring deforestation globally.	Except for Brazil, the majority of tropical countries do not have monitoring systems or, if they do, the systems are inadequate.	Remote sensing scientists concur that advances in the field and possible technological agreements among countries can overcome barriers to the precise measurement of tropical deforestation (Defries et al., 2005).
Lack of an adequate definition of "forest." That adopted by the Kyoto Protocol is not appropriate.	In the Protocol, "forest" is defined by each host country among variants on "a minimum area of land of 0.05-1.0 hectares with tree crown cover of more than 10-30% with trees with the potential to reach a minimum height of 2-5 meters at maturity."	The current definition makes it difficult to assess the actual dimensions of areas covered with tropical forests and what should be monitored in order to measure avoided emissions (Defries et al., 2005; Moutinho & Santilli, 2005). Several countries, especially Brazil, are working toward an alternative definition.
Many uncertainties over the measurements of carbon emissions from deforestation.	There is enormous variation in the forest biomass in the tropics, compounded by the difficulty of estimating the amount of carbon sequestered in roots.	Measurements of forest carbon stocks are difficult, but databanks exist with "spatialized" measurements of vegetal biomass (Saatchi et al., 2007). Also, new satellites such as ALOS can measure tropical forest biomass (Kellndorfer et al., 2007). Under IPCC guidance, countries could adopt standardizations that adjust for uncertainties inherent in the measurements.
Additionality cannot be assessed in reducing deforestation.	Uncertainties exist about whether deforestation reductions can result from direct mitigation actions. In many cases, a reduction in deforestation is a consequence of such things as a fall in commodity prices.	There are no signs that tropical deforestation will diminish significantly in the short term (Soares et al., 2006). Any reduction is therefore, by definition, additional. Given the Brazilian government's recent decision to set targets in its PNMC for deforestation reductions, the issue of additionality can now be gauged. This will show projections of what will be reduced, using historical deforestation as a reference point.
Uncertainties about the baseline to be adopted.	There is still no clarity about what baseline to use. Either a future or historical baseline could be adopted, that is, deforestation predicted for the future (based on projections) or reductions of deforestation to rates below those documented in the past.	If REDD becomes a mechanism that compensates countries for their efforts to reduce deforestation, the direction apparently taken in the UNFCCC discussions, then a historic baseline should be adopted (Santilli et al., 2005), since the measurements will be based on data that are actually documented, not projected. This is the approach followed by the Amazon Fund, for example. This logic works well for countries with high rates of deforestation but not for those that do not, such as Guyana and Gabon, which have deforestation rates below 0.2% per year (FAOSTAT, 2008). In such cases, suggestions have been made to remedy the situation, such as the proposal for "Stock Flow and Target" (Cattaneo, n.d.) recently submitted to the UNFCCC, described in later sections of this volume.

Criticism	Reason	Counter-criticism
Lack of technology and methodologies for controlling "leakage."	Deforestation avoided in one location can be "displaced" to another where no REDD project operates.	Since REDD tends to compensate countries, reductions will have to be calculated at the national level or, in the case of Amazonia, regional, decreasing leakage risks. The leakage of deforestation from one country to another (for example, if Brazilians who stopped logging in Brazil went to log in Bolivia) could occur, but if many countries in the same region (Amazon countries, for instance) adhere to the same reductions compensation mechanism, this possibility would decrease. Furthermore, unlike MDL projects, deforestation does not "leak" to the energy or transportation sectors (Santilli et al., 2005; Schlamadinger et al., 2005). Finally, some studies (Soares Filho et al., 2010) provide tools for assessing leakage, using deforestation simulation models.
There is no assurance of the permanence of REDD and the emissions reductions it achieves.	The benefits of avoided deforestation in a given region today could be lost in the future if a natural disturbance or predatory human activity destroys the forest.	Permanence will be ensured through a measure that requires participating countries that increase deforestation (emissions) above their baseline level to take responsibility for the excess as a future reduction target. Assuming the existence of carbon credits for REDD, permanence could be guaranteed through some sort of "insurance." That is, only a small part of the reductions obtained could be traded. The rest would serve as a guarantee of permanence for the credits it generates.
REDD cannot generate carbon credits.	The market risks being flooded with cheap carbon credits, making reduction efforts malleable in wealthy countries. Reductions might take place in developing countries but allow emissions to occur in developed ones.	The idea of flooding the market is unfounded, since most of the reductions (80-95%) in developed countries should be achieved within their own borders. REDD credits will only make sense if those countries adopt mandatory targets that are more ambitious than those announced so far. Finally, instituting a banking system in which REDD credits can be traded in the future rather than after reductions have been confirmed woul also decrease the risk of "flooding."

Terminology:

Additionality: the reduction of greenhouse gas emissions or the increase in CO2 removals in addition to what would occur in the absence of a REDD project or action.

Baseline: a REDD project baseline is the scenario representing the level of anthropogenic emissions and removals of CO2 equivalent to what would occur in the absence of the project.

Leakage: the increase in greenhouse gas emissions that occurs beyond the range of influence of a REDD project or action but at the same time can be measured and attributed to the project activity.

Permanence: the residence time of carbon stored through sequestration or maintained at stable levels in a storehouse (such as a forest) before it is released back into the atmosphere

The proposal for Compensated Reduction for Deforestation suggested by IPAM and its collaborators met with stiff resistance not only from the Brazilian government, but also from national and international NGOs (Moutinho et al., 2005, 2009), which raised numerous methodological questions related to the difficulty of measuring and monitoring actual reductions in emissions from deforestation, as well as the difficulty of determining a reliable baseline and the high risk of "non-permanence" and "leakage." Added to these questions were others of a political nature, such as ones linked to sovereignty issues and the risk of substitution or dilution of efforts at emission reductions "at the source" of Annex I countries (that is, instead of motivating emission reductions in Annex I countries, efforts toward reducing emissions would be "shifted" to developing countries). Such objections were put forward as an argument against including forests in the Kyoto Protocol (Alvarado & Wertz-Kanounnikoff, 2007).

The debate over how to deal with emissions from deforestation continued especially in Brazil (Moutinho, 2007). During COP11 in Montreal in 2005, the topic of deforestation entered definitively into the UNFCCC discussions. Through the initiative of a bloc of developing nations led by Papua New Guinea and Costa Rica, the topic gained momentum, and tropical rainforests came to be viewed as entities regulating the climate. These nations argued that the costs of conserving tropical forests should be shared by the international community. One year later, at COP12 in Nairobi in 2006, the Brazilian government announced a concrete proposal for dealing with the issue of deforestation. This proposal was based on the concept of Compensated Reduction for Deforestation (Santilli et al., 2005; Moutinho & Schwartzman, 2005). However, instead of adopting the original idea of including this mechanism in a market system, that is, as a means of generating carbon credits, the government proposed that a voluntary fund be created, supported with resources donated by developed countries that wanted to contribute toward deforestation reductions in developing countries. This notion was the seed for the Amazon Fund.[23] On March 25, 2009, this Fund received its first donation, the sum of US$110 million, from the Norwegian government (which intends to donate a total of US$1 billion by 2015).

With progress in international debates over deforestation, the role of forests in climate equilibrium became widely and officially recognized in 2007 at COP13 in Bali, Indonesia. REDD was presented as a potential mechanism for dealing with emissions derived from deforestation and forest degradation. After two years of discussion, with various REDD pilot projects being implemented, participants at COP15 in Copenhagen, Denmark, in December 2009, sought a consensus on a mechanism to be

23 The main goal of the Amazon Fund, created on August 1, 2008, by Decree 6527, is to obtain resources for projects for preventing, monitoring, and combating deforestation and promoting the conservation and sustainable use of the Amazonian biome.

adopted. According to the Bali Roadmap,[24] launched after COP13, it was decided that REDD should involve the following aims: (1) emission reductions arising from deforestation and forest degradation in developing countries; (2) forest conservation; (3) the sustainable management of forests; and (4) increases in forest carbon stocks in developing countries. The combination of these four aims comprises what is now known as REDD+ ("REDD plus").[25] From here on in, the acronym REDD, when cited in this report, will refer to REDD+ and include this set of aims.

Since Bali, various efforts have been made to facilitate funding for actions to reduce emissions from deforestation. For example, in 2007, the World Bank launched the Forest Carbon Partnership Facility (FCPF) Fund, designed to assist developing countries in implementing means to increase the capacity of governance over deforestation in their territories. The FCPF plan is considering various stakeholders to initiate a readiness phase for emission reductions. So far, thirty-seven countries in Africa, Latin America, and Asia have been selected by FCPF.

Along similar lines, the Brazilian government announced its National Policy on Climate Change (NPCC)[26] during COP15, which, for the first time, sets voluntary reduction targets for deforestation rates in Amazonia and the cerrado savanna. This plan proposes a reduction of 80% below the historical annual rate of deforestation (19,500 km2) until 2020 in the Legal Amazon. During the UNFCCC discussions at COP15, Brazil also committed to a voluntary national target of reducing GHG emissions on the order of 36.1%-38.9% by the year 2020.[27,28] In the UNFCCC, the question of deforestation as a source of emissions requiring urgent counter-measures was one of the most actively discussed issues at COP15. Although an accord was not approved during the Climate Convention (requiring consensus among 192 member nations), proponents are working toward getting one passed in subsequent conferences. It is important to take into account the advances that have been made regarding REDD in prior negotiations so that, in future international accords, this mechanism can be improved as a means of restraining climate changes and adapting to their ensuing problems.

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24 UNFCCC: Decisions 2-4/CP.13; decision 2/CP.13 dedicated to REDD.

25 The possibility of including carbon stored in agricultural land use has also been suggested (sometimes called REDD ++).

26 See http://www.mma.gov.br/estruturas/smcq_climaticas/_arquivos/plano_nacional_mudanca_clima.pdf.

27 In relation to emissions projected for a "business-as-usual" scenario in 2020.

28 See http://unfccc.int/files/meetings/application/pdf/brazilcphaccord_app2.pdf.

During COP15, the major advances concerning REDD were:

- Recognizing the necessity for REDD actions, including activities that seek to conserve and increase the forest carbon stock in areas that were forestlands up to 1990. This will prevent the risk of REDD incentivizing the transformation of natural forests into plantations (since it will only allow the reforestation of natural forests, not the afforestation of unforested land parcels using exotic species);
- Facilitating consolidated financing arrangements, which will be administered in three phases, as suggested in the REDD Options Assessment Report (Angelsen et al., 2009);
- Guaranteeing the participating of indigenous and traditional populations;
- Ensuring consistency in the preservation of biodiversity;
- Excluding the incompatible conversion of natural forests;
- Seeking mechanisms that eliminate possible sources of leakage and risks of non-permanence.

However, many questions remain, which the Copenhagen Conference was unable to answer:

- Will REDD be an independent mechanism or, instead, part of a system of Nationally Appropriate Mitigation Actions (NAMAs)?[29] How will financing mechanisms operate, through donated funds (public or international) or through markets to be defined nationally or internationally, or even a mix of the two?
- Financing will depend heavily on the context in which REDD is inserted within the Climate Convention. Will this occur through NAMAs or through an independent mechanism, such as one regulated by the market? Different sources of financing might also be applied to different types of activities.

The Climate Change Convention of the U.N. also published the requirements for developing countries to establish a national REDD strategy. Some of the main requirements are: (1) differentiating between plantations and native forests; and (2) developing a national system for forest monitoring that conducts systematic measurements of all the alterations in the vegetation cover and establishes national reference levels for forest cover and carbon emissions from deforestation and forest degradation. The Convention further suggests that (3) an institutional framework be structured that will minimize the risks of leakage and non-permanence.

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29 NAMA is a set of actions with the goal of reducing GHG of a country at the national level. These actions are being negotiated by the Ad Hoc Working Group on Long-term Cooperative Action under the UNFCCC, which is also negotiating whether they should be voluntary or mandatory in nature. Brazil's National Policy on Climate Change (PNMC) can be considered an example of NAMA.

The costs of reducing Amazonian deforestation: implications for a REDD mechanism

Historically, the inclusion of avoided deforestation, and now also REDD, in an international climate accord was, as mentioned above (Table 3), the subject of debates and criticism. Brazil and other countries, as well as various NGOs, were and, to a certain degree, still are, resistant to REDD, especially if this will operate through market mechanisms (generating carbon credits) (Moutinho & Schwartzman, 2005). One of the fears has been that the market will be flooded with cheap credits, since the cost of reducing emissions from deforestation is much less than from burning fossil fuels. Even though numerous solutions to this problem have been proposed (Table 3), such as limiting the amount of REDD credits that can be traded and requiring most of the target reductions to take place within each country's borders, resistance to the market option remains strong. Despite the creation of the Amazon Fund and the recent announcement of voluntary targets for deforestation reduction in the Amazon by the federal government (as well as some state governments) through PNMC, Brazil still maintains a stance against generating carbon credits, advocating donations instead. However, a REDD market would allow the country to gain relevant economic advantages. As envisioned through the Clean Development Mechanism (CDM), a market in REDD credits has the potential to generate resources hundreds of times greater than that possible through donations. Utilizing even a small portion of REDD to generate carbon credits could multiply the resources for the Amazon Fund dozens of times over. A market mechanism has the potential to be much more efficient and less bureaucratic compared to one that derives resources from international donations. Moreover, the costs of reducing deforestation and, consequently, national carbon emissions, are not high (Nepstad et al., 2009). The economic advantages of having a market mechanism are enormous for Brazil, especially in comparison with other developing countries, such as China and India, where the cost of reduction is high, due to the fact that the vast majority (>90%) of their carbon emissions come from burning fossil fuels.

The Intergovernmental Panel on Climate Change (IPCC), based on analyses of opportunity costs, calculates that a reduction of 25% of global emissions from deforestation could be achieved for less than US$20 per ton of carbon dioxide equivalent (tCO2e). It is worth noting that the price per ton negotiated on the European emissions market in 2008 was US$35/ tCO2e (IPCC, 2007), suggesting that it would be possible to cover the costs of reducing deforestation and still produce an excess.

Recent evaluations indicate that the cost of reducing global GHG emissions accumulated by the year 2030 by a margin of 55% (from all sources, including deforestation), that is, from 70 billion tons to 32 billion, would be under US$90/tCO2e (McKinsey, 2009). A small part of the reductions (around

20%) could take place for an average cost on the world market of US$27/tCO2e, a figure far above the cost in Brazil of US$13/tCO2e (McKinsey, 2009).[30] However, the cost of reductions solely from deforestation emissions would be even less. Most studies estimate that, on a global level, this would be somewhere from US$3-12 billion per year until 2030. In the Amazon, 70-80% of the reduction in emissions from deforestation could be achieved for a cost of less than US$5/tCO2e, due to the low profitability of ranching, an activity that is currently responsible for 70% of deforestation in the region (Nepstad et al., 2009).

In a more detailed "budgetary" analysis,[31] IPAM and other institutions have estimated that the cost of reducing deforestation in the Brazilian Amazon to zero in 2020 would be US$7-18 billion over ten years, reducing emissions by 6-12 billion tCO2e (Nepstad et al., 2009). This analysis benefits from models that can generate maps of potential profitability from the main land uses that replace the forest – livestock and soybeans – given scenarios of highway investments (which affect transportation costs) and prices of "commodities." These maps of potential profit extrapolated into the future ("net present value") are divided up according to forest carbon stocks, allowing the first mapping to be made of opportunity costs associated with tons of carbon dioxide (Figure 3; Nepstad et al., 2009). It should be noted that these opportunity costs do not incorporate those related to secondary and tertiary economies linked to the conversion of forests into pasture or soybeans, nor other expenses such as transaction costs. On the other hand, the estimates of the cost of reducing emissions from deforestation do not include calculations of the economic benefits of maintaining the forest.

30 In the literature consulted for this report, figures are often given in Euros (€). For the purposes of standardization, all such figures have been converted into American dollars at an exchange rate of €1.00 = US$1.50.

31 Many estimates of the costs of reducing deforestation emissions analyze the impact of the reductions on the economy as a whole without taking into account the economic benefits of such reductions. In the "budgetary" analysis, IPAM estimates the programmatic costs of implementing an effective strategy for reducing deforestation.

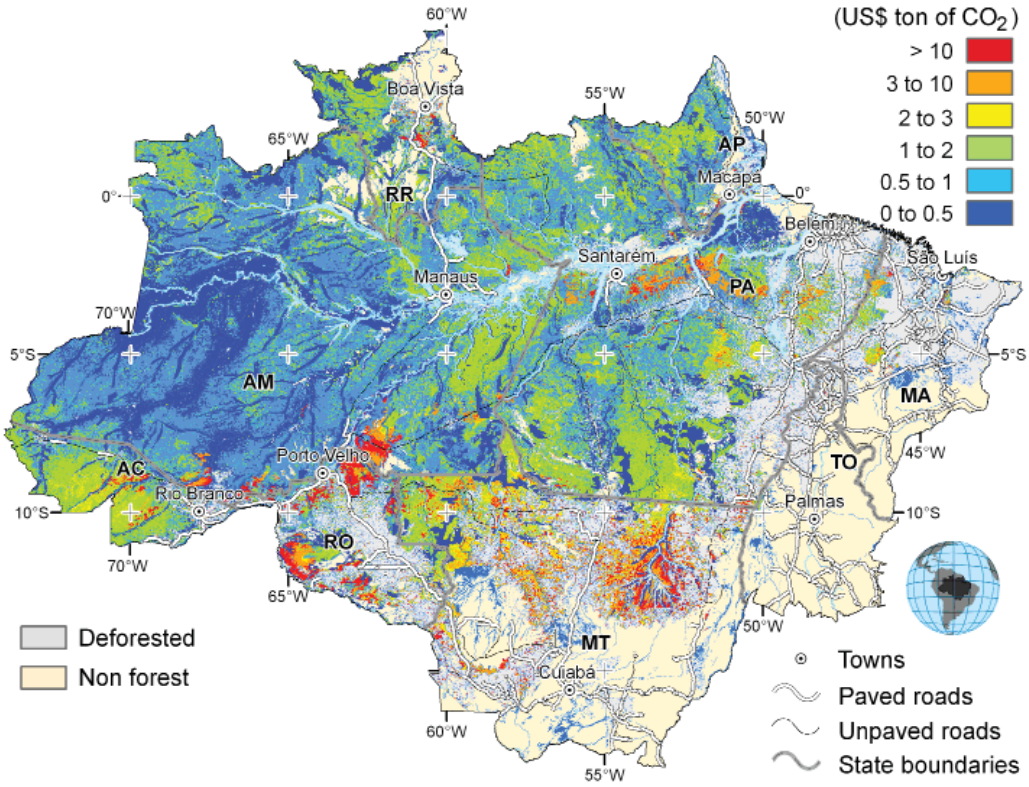

Figure 3. Spatial distribution of opportunity costs for forests in the Brazilian Amazon. Th e values shown in the upper right corner refer to the profi t foregone as a result of the decision not to convert the forest into soybean fi elds or pastures, expressed as the net present value divided by the forest carbon stock (US$/$tCO_{2e}$) (see Nepstad et al., 2009 for details). State abbreviations: AC - Acre, AMAmazonas, AP - Amapá, RO - Rondônia, MT- Mato Grosso, PA - Pará, RR - Roraima.

The apparent conclusion about the costs of reducing deforestation is that they are relatively low, making it economically feasible to cover them. Some of these calculated costs (see, for example, Nepstad et al., 2009) represent only a fraction of the budget for the Growth Acceleration Program (PAC). However, it should be emphasized that the opportunity costs are not indicative of the value of the forests, nor should they be considered as reference points, in a market logic involving REDD, of the value to be paid per ton of avoided carbon emissions from reducing deforestation. Given that the global carbon market traded close to US$126 billion in 2008 (Capoor & Ambrosi, 2009), the potential for a market for REDD is significant.

Brazil is in a privileged position to take advantage of the potential for a REDD market by the fact that it commands the technological, political, social, and business conditions to bring governance to bear on deforestation in Amazonia. However, the Brazilian government is still hesitant to embark on this discussion. This posture could result in the loss of an enormous and singular opportunity for the country to be compensated for the efforts it has already made and can continue to make in conserving its forests and reducing deforestation in the Amazon and other biomes.

Existing financial resources for REDD

The current amount of resources already available for REDD come to US$4 billion out of a total of US$38 billion directed toward mitigating global climate change. Another US$3.8 billion are being directed toward adaptation efforts (see Table 4). Such resources represent the sum total of multilateral and bilateral funds for REDD that are currently available. To coordinate the investment of these diverse public funds, the REDD+ Partnership was launched in May, 2010, at a meeting held in Oslo, Norway. The main objective of the Partnership, signed by fifty-eight countries, is as follows:

> *...to contribute to the global battle against climate change by serving as an interim platform for the Partners to scale up REDD+ actions and finance, and to that end to take immediate action, including improving the effectiveness, efficiency, transparency and coordination of REDD+ initiatives and financial instruments, to facilitate among other things knowledge transfer, capacity enhancement, mitigation actions and technology development and transfer.*[32]

Through the partnership, the governments agreed to adopt rules for REDD established by the United Nations Climate Convention for disbursing resources for tropical forests, without making these efforts mandatory. In Oslo, US$500 million were added to the US$3.5 billion previously committed by countries during the COP15 in Copenhagen. The Partnership was thus a product of the Copenhagen Accord, which, although not legally binding (since it did not establish mandatory emissions reduction targets), committed funds for the period 2010-2012 and emphasized the crucial role of REDD in the mitigation of climate changes. While the long-awaited Binding Climate Accord after 2012 has not yet been worked out and signed by the U.N., REDD discussions are at least moving forward, with the potential for multilateral cooperation. The Partnership also foresees the coordination of bilateral and multilateral initiatives for REDD, creating a transparent, accessible

32 See the text of the Interim Partnership of REDD+ adopted in Oslo at: http://www.oslocfc2010.no/pop.cfm?FuseAction=Doc&pAction=View&pDocumentId=25017.

database in order to better coordinate efforts among various global REDD initiatives (UN-REDD, FCPF, FIP; see Table 4), thereby preventing investments from overlapping with each other.

The main steps forward taken by the Partnership up to now include the launching of a website to hold the database[33] and a platform for sharing documents and information.[34]

The UN-REDD Secretary and the FCPF are providing secretarial services to the Partnership, since no new agency or institution was created. Coordination is currently in the hands of Guyana and Germany.

The United States, United Kingdom, Australia, France, Japan, and Norway have already committed themselves to disbursing US$3.5 billion up to 2012 for forest preservation (see Table 5). On May 26, 2010, Norway announced the availability of US$1 billion for Indonesia to keep its forests conserved, through an accord similar to one Norway already has with Brazil through the Amazon Fund.

The Oslo meeting also established a spending target of US$30 billion for forest conservation and other low carbon intensity projects up to 2012. To facilitate private financing, participating countries intend to solidify legislation and set up reliable market instruments. In addition, the meeting suggested that mechanisms such as cap-and-trade (see Box 1, below), and the establishment of carbon levels and taxes in the transportation sector should be extended where they already exist and created in countries that still do not have them.

33 See http://reddplusdatabase.org/.

34 See http://reddpluspartnership.org/en/.

Table 4 - Resources available for REDD and other actions for mitigation and climate change adaptation.

Resources	Responsible Institution	Amount (billions of US$)	Comments
Mitigation			
Clean Development Mechanisms (CDM)	GEF	18	
Global Environment Facility Trust Fund (GEF)		2.4	Funds disbursed
Climate Investment Funds		5.6	2009-2012
Forest Investment Programme (FIP) (1)	World Bank	0.55	If approved, Brazil may receive approximately US$50-70 million
Forest Carbon Partnership Facility (2)	World Bank	0.4	USD 160 milhões desembolsados
Forest Carbon Fund (3)	World Bank	0.5	USD 140 milhões desembolsados
UN-REDD (4)	United Nations Development Programme (UNDP), United Nations Environmental Programme (UNEP), Food and Agriculture Organization (FAO)	0.08	USD 87.102.782
Total funds for forest carbon (REDD+): 1+2+3+4+5+6		**4.03**	
Total mitigation		**38.08**	
Funds requested but unconfirmed for REDD:			
Governors` Climate and Forests Task Force (GCF)	United States Agency for International Development (USAID), World Bank	0.055	Amount requested for use in 2011-2012
Adaptation			
UNFCCC			
GEF	GEF	0.4	US$140 million disbursed
Adaptation Fund	Adaptation Fund Board (AFB)	0.3-0.6	2008-2012
Multilateral			
Climate Investment Funds	World Bank	0.6	
Bilateral			
Cool Earth Partnership	Japan	2	2008-2012
International Climate Initiative	Germany	0.2	
Total adaptation		**3.8**	
General Total		**4.8**	

Sources: The Little Climate Finance Book, Global Canopy Programme, Nov. 2009

UN-REDD: *http://www.undp.org/mdtf/UN-REDD/overview.shtml, http://www.unredd.net/, FCPF: http://www.forestcarbonpartnership.org/*

UN-REDD: *http://www.un-redd.org/*

FCPF: *http://www.forestcarbonpartnership.org/*

FIP: *http://www.climateinvestmentfunds.org/cif/*

FIP: The purpose is to mobilize more funds for REDD+ to "reduce deforestation and forest degradation and promote sustainable forest management [manejos], leading to emissions reduction and protection of carbon reserves," with US$540-550 million available.

GCF: *http://www.gcftaskforce.org*

Table 5 - Financial contributions to REDD by different countries through the Global Forest Partnership up to 2012.

Country	Financial contribution (in millions of US$)
Australia	120
Denmark	10 (beginning in 2010)
Finland	21
France	330
Germany	at least 438
Japan	500
Norway	at least 1000
Slovenia	2.5
Switzerland	63
United Kingdom	450
USA	1000

Figures based on an exchange rate of 1 € = US$ 1.24, cited in the Partnership text (p. 2)

Other sources of financing for REDD

Besides the provisional public funds described above, those coming from a possible mandatory market may emerge from the cap-and-trade system of California or from the Western Climate Initiative (WCI). These initiatives seek to share experiences from formulating and implementing regional cap-and-trade programs, follow the development of federal policy on climate changes, and take advantage of the potential for future collaboration. In this way, a national climate policy, involving the creation of a nationwide carbon market, is beginning to take shape in the U.S., at the same time as regional initiatives, described below, are moving forward in the search for feasible models for limiting GHG emissions. The process in the U.S. is very similar to what has been taking place in Brazil. The effort to link regional initiatives with national schemas, such as the cap-and-trade system currently being debated in the U.S. Congress, could raise the level of confidence in the effectiveness of emission compensations and create a consistent series of standards and regulations, thereby facilitating long-term financing mechanisms for subnational REDD programs.

REDD links between states and provinces (Governors' Climate and Forest Task Force)

Box 1 - Cap and Trade.

"Cap and trade" represents a market mechanism that creates limits on GHG emissions (or other pollutants) for a particular sector (for instance, industrial). Taking these limits into account, so-called "allowances" are issued. On this basis, each industry (to continue the example) decides how it will maintain its emissions within the limit imposed on it.

The soul of this scheme, therefore, is the trade in emissions. If an efficient industry manages to emit an amount of gases well below what was stipulated for it, that industry will have a surplus (quota) that can be "sold" to another industry that exceeded its emission limits, thereby allowing it to stay within its limits.

In the context of the Kyoto Protocol, a cap-and-trade system is established by Article 17. Carbon quotas, called Assigned Amount Units (AAUs), can be traded exclusively by Annex I countries of the Protocol (developed countries), which can trade only part of their emissions during the period 2008-2012.

The cap-and-trade system has been implemented successfully in the U.S. to limit sulfur emissions, which cause acid rain. In 2005, the E.U. launched its own market for GHG emissions, the European Trading Scheme (ETS).

Besides public investments in REDD (Tables 4 and 5), other initiatives for supporting the mechanism of REDD are underway. States and provinces that make up the Governors' Climate and Forest Task Force (GCF), for example, have been making great strides forward in articulating subnational efforts to develop policies aimed at preserving native forests through REDD. The projects they set up may eventually generate credits that can be utilized in compensating GHG emissions, such as cap-and-trade systems. Launched in November, 2008, through the initiative of the state of California, GCF is currently made up of five states in the Brazilian Amazon (Mato Grosso, Acre, Amazonas, Pará, Amapá), four provinces in Indonesia (Aceh, Papua, East Malimantan, West Kalimantan), three states in the U.S. (California, Illinois, Wisconsin), one state in Mexico (Campeche), and one in Nigeria (Cross River). The establishment of a joint Action Plan for the biennial of 2009-2010, elaborated by GCF member states and provinces, is aimed at ensuring that the preoccupations and questions involving forest carbon at the subnational level are transformed into climate policies at state, national, and international levels. The GCF has worked toward developing regulations for carbon accounting, financial structures, and the institutional framework for interconnecting REDD programs to subnational and national systems of cap and trade. Legislation passed in California, for instance, (known as Assembly Bill 32), which establishes the state's cap-and-trade program, encompasses

provisions for recognizing credits from REDD programs as eligible for compensation.[35] It is hoped that the development of such subnational REDD programs will help advance the debate on implementing a national cap-and-trade system in the U.S. and influence the ETS model prevailing in the European Union. The significance of progress made in state-level REDD programs in the Brazilian Amazon is illustrated by the states of Acre and Mato Grosso (discussed below).

The greatest potential for generating international resources for REDD beyond public funds will therefore come from the approval of legislative bills in the U.S. that set targets for emission reductions for sectors of the American economy. The schemas suggested in discussions surrounding such bills foresee international payments for "offsets" through REDD. Developing countries with forests, especially Brazil, would be the main beneficiaries. Below are described two bills currently being debated in the U.S. Congress which could lead to sources of financing for REDD.

The American Clean Energy and Security Act (ACESA) (Waxman-Markey Bill). The most impressive legislative bill regarding climate change was presented by U.S. Congressmen Henry Waxman and Edward Markey, and approved by the House of Representatives on June 26, 2009.[36] This bill proposed that, by the year 2020, 7% of the revenue collected from the sale of emissions allowances (in a cap-and-trade system) would be directed toward international aid for adaptation to climate change, the transfer of clean technology transfer, and the protection of tropical forests. In 2027, this percentage would reach 10%. Such policies would represent an annual financial flow to developing countries of over US$8 billion by 2020. Recent evaluations demonstrate that if an agreement between Brazil and the U.S. involving REDD were established along the lines of the Waxman-Markey Bill, allowing Brazil to trade 50% of its avoided emissions covered by its voluntary target for reducing deforestation in the Amazon (80% of the reduction by 2020), the Amazon Fund, for example, could receive not only millions, but billions of dollars in resources. The total transactions in carbon credits could be US$8-18 billion by 2030, derived from the trade of more than one billion tCO2e/year in credits that would be available on the international market (Piris-Cabezas & Lubowski, n.d.). Piris-Cabezas & Lubowski (n.d.) suggest that REDD carbon credits derived from Amazonia would be capable of decreasing the reduction costs in the U.S. to such an extent that the latter could increase its reduction target by 4-12% by 2020 without any additional cost.[37]

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35 More information is available at: http://www.gcftaskforce.org/documents/ARB%20PDR%20Background.pdf.

36 ACESA, submitted by Waxman and Markey through the Energy and Commerce Committee, was approved in 2009 as H.R. 2454. It set an emissions reduction target of 15% below 2005 levels to be achieved by 2020, and 73% by 2050. In comparative terms, this would be a reduction of 1% below 1990 levels by 2020, and 68% by 2050, making it more modest than the plan proposed by President Obama.

37 More specifically, this would be a reduction of emissions to 1990 levels by 2020, and an additional 80% by 2050.

Although the Waxman-Markey Bill has met resistance, it has been studied in the U.S. Senate since November, 2009, and there are hopes that it will be approved in the near future.

The American Power Act (APA) (Kerry-Leiberman Bill). A more conservative alternative to the bill proposed by Reps. Waxman and Markey was presented by Senators John Kerry and Joe Lieberman on May 12, 2010. Christened the American Power Act (APA),[38] it would establish a hybrid system for reducing GHG emissions by allowing corporations in the energy, industrial, and commercial sectors to participate in a cap-and-trade schema, while those in the transportation sector would pay taxes for emissions allowances according to market prices. Specialists calculate that, under these provisions, the value of one ton of carbon dioxide equivalent between 2013 and 2020 would be US$26. This value could be higher if it were based solely on supply and demand, but the APA provides for price controls. Through a U.S. Emissions Trade System proposed by the law, the volume of allowances would be limited to 2.5 billion tCO2e in 2013, when only the electric sector would be covered, and would reach 4 billion in 2016.[39]

Instituting a cap-and-trade system in the U.S. could lead to an increase in the cost of fuel, with refineries passing on to consumers the responsibility of paying for the sector's allowances. Therefore, to minimize the negative impact on the population, the APA has provisions for setting up various subsidies for many industrial sectors. However, the true price of electric energy or fuel remains unclear due to the lack of clarity over which subsidies will actually materialize.

The text of the bill proposed by Kerry and Lieberman contains many of the same figures and time frames for emissions reduction targets that were included in ACESA,[40] and states that the entities it covers can use "offset credits to demonstrate compliance for up to a maximum of 2 billion tons of greenhouse gas emissions annually" (§722).

As in the Waxman-Markey Bill, the APA differentiates between allowances (issued by the government) and offsets (created by an approved clean development project that measurably reduces emissions). Various potential sources exist for offsets, including a series of projects for forest offsets, such as afforestation/reforestation projects linked to REDD.

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38 See APA discussion draft, available at: http://kerry.senate.gov/americanpoweract/pdf/APAbill.pdf.

39 Idem.

40 The cap-and-trade system is scheduled to begin in 2013 with an initial reduction target of 4.75% of the 2005 emission levels. Annual licenses for emissions could be gradually decreased each year up to 2050, after which they would remain constant. The standards for reductions (all using 2005 levels) are, for their part, a reduction of 17% by 2020, 42% by 2030, and 83% by 2050. (If the emission levels are found to be different at some point, the bill identifies how the emission levels can be adjusted subsequently in order to correspond with the new data.

Forest offsets will require approval by the U.S. Department of Agriculture (USDA) and the U.S. Environmental Protection Agency (EPA) (§733 (a)(1)(B)(i), p. 379); once approved, they will be allowed in the system. The program credits created by EPA and USDA should be "supplementary, measurable, verifiable, and executable."

If one of these two laws being discussed in the U.S. Congress were approved, the first auction of emission allowances should occur no later than March 31, 2012, and, thereafter, take place every trimester. The U.S. Commodities Futures Trading Commission (CFTC) has been given clear authority/jurisdiction over carbon markets.

In the Waxman-Markey Bill, 5% of the value collected with the auction of carbon emission offsets should be "reserved" (US$3-5 billion/year) to protect forests in developing countries around the world. The ultimate objective is to promote emission reductions equivalent to 10% of the carbon emissions taking place in U.S. No provisions for this mechanism are found in the Kerry-Lieberman Bill, which is disconcerting for some, given that it adds more obstacles to the objective of reducing emissions, since the targets are the same as those contained in the Waxman-Markey Bill. The absence of these resources was disappointing to some environmental groups, energy corporations, and other companies.

One of the most commonly cited reasons for the current impasse in reaching an international climate accord is the lack of a commitment from the U.S. to take measures for reducing GHG emissions and combating climate changes. Perhaps now, even with inadequate measures, more steps will be implemented in the U.S. by legislation on behalf of the climate, with forests being a fundamental component. In the meantime, what is concrete in the Kerry-Lieberman Bill, as reflected directly in trade with developing countries, is that imported products that are highly carbon intensive can be taxed.[41] If the bill is approved, there could be a great opportunity for Brazil's development, since its energy mix is relatively clean (except in the agricultural and ranching sector, which is still very carbon-intensive), such that Brazilian products could enjoy advantages in comparison with those from numerous other markets. Nevertheless, everything will depend on upcoming discussions of the bill, which could just as soon pass it as bury it politically (as in the case of the Kerry-Boxer bill of October, 2009). Unfortunately, with the recent election of a Republican majority in the U.S. Congress in November, 2010, the American administration does not view the progress of the legislation on climate and energy as certain.

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41 For a comparison of the laws, see the table published by Science Magazine at: http://news.sciencemag.org/scienceinsider/2010/05/kerrylieberman-american-power-ac.html?rss=1.

The Kerry-Lieberman legislation, if passed, would still have to go through a process of reconciliation with the Waxman-Markey Bill passed in the House of Representatives in 2010. Nevertheless, a general itinerary seems to be laid out, which is good news for those supporting this legislation. On the other hand, some say this bill will not have any direct or significant impact on actors who do not take part in the U.S. market. For instance, the European carbon markets are firmly anchored in voluntary markets (for forest carbon) – with a more general interest in "charismatic offsets" – while the U.S. market would be based primarily on meeting the emission reduction targets. This might mean that, in the future, the two regions operate in "parallel universes."

PART III
A National REDD Strategy for Brazil: Elements in Place

Although efforts to reduce greenhouse gases from burning fossil fuels in developed countries are essential for mitigating global climate change, the mechanism of REDD, as laid out in the "Bali Road Map," represents an important part of this global strategy (Stern, 2008; Gullison et al., 2007). Therefore, REDD could soon become a reality and, as mentioned above, Brazil could benefit from such a mechanism if it gets prepared by formulating a national REDD strategy.

With the approval of Federal Law 12187/2009, which set up the National Policy on Climate Change (PNMC), Brazil assumed the vanguard and ensured its eligibility in a future REDD mechanism. In addition, members of Brazilian society (strongly influenced by socioenvironmental movements, the scientific community, and civil society organizations) share a growing perception that the economic and social costs involved in deforestation in the Amazon are much higher than those related to its conservation. Members of society are calling for the protection of forests and the reduction of deforestation as a way of contributing to the mitigation of climate changes (Moutinho, 2007).

Brazil can consider an array of elements, discussed in this chapter, that will allow it to consolidate its position as a world leader in confronting emissions from deforestation and to make a global REDD mechanism viable. The shift in the stance of the Brazilian government witnessed over the past several years, from a conservative posture on the relevance of deforestation reduction as a means of mitigating climate change (Moutinho, 2009a) to a more pro-active one, has brought positive results that are helping the country to implement a REDD strategy, if not at the national level, then at least at the Amazonian one. The Brazilian government officially launched the Amazon Fund (discussed in detail below). Beyond the National Climate Change Plan, which serves as the basis for the National Policy on Climate Change (PNMC) (in a later section, the difference between the plan and the policy are discussed in detail), several of the states of the Legal Amazon are launching their own plans for controlling deforestation, while some (Pará, Mato Grosso, Acré, and Amazonas) have even established quantitative targets for deforestation reduction and state REDD plans. This context confers on Brazil the ability to negotiate within the UNFCCC, including the establishment of more ambitious obligatory targets in a post-2012 international agreement, and to construct its own national REDD strategy.

Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAM)

The first plan with articulated actions for combating Amazonian deforestation was PPCDAM, which emerged as a response by the federal government to the increase in deforestation rates recorded in the early part of the 2000 decade and to pressure from civil society for control measures. The plan, created in 2004, is now in its second phase (2009-2011).[42] From the outset, the plan has involved the integration of thirteen federal government ministries and is directly coordinated by the Office of the Presidential Chief of Staff. Its objective is "the promote the continuous decline in the deforestation rates in the Brazilian Amazon, aiming toward zero illegal deforestation, through a set of integrated actions for territorial and land use planning, monitoring and control, encouraging sustainable productive activities, involving partnerships among federal agencies, state governments, prefectures, civil society entities, and the private sector." To attain this objective, its strategy falls along three interconnected axes: territorial and land use planning, environmental monitoring and control, and the encouragement of sustainable productive activities.

Over the years, PPCDAM accomplished important initiatives, among them: a) creating federal Conservation Areas (UCs) encompassing 25 million hectares in areas under pressure from expanded deforestation; b) supporting the creation of UCs by states in the region, covering another 25 million hectares; c) denying sixty thousand rural land titles that were not reregistered by the National Institute for Colonization and Agrarian Reform (INCRA); launching the Amazon Economic and Ecological Macrozoning program and supporting state-level Ecological-Economic Zoning (ZEE); d) homologating Indigenous Lands covering ten million hectares; e) creating new monitoring systems (DETER, DEGRAD, DETEX) and improving PRODES; f) conducting hundreds of enforcement operations by IBAMA, joined by the Federal Police, the Army, the National Security Force, and other enforcement agencies, using intelligence and monitoring tools; g) proposing the Public Forests Management Law, with the corollary creation of the Brazilian Forest Service and the licensing of the first forest concession area, in the Jamari National Forest (RO); and h) creating the Amazon Fund.

The Plan underwent evaluation in 2008, which led to revisions for the current phase (2009-2011). From the beginning, the Plan has overcome numerous challenges and created the conditions for effective inter-agency action. In its current phase, the emphasis in the Plan is centered on nationalizing strategies for reducing deforestation. As a result, seven of the nine Amazonian states already have their own plans for controlling deforestation. Along similar lines, actions were implemented in municipalities where deforestation reached critical proportions, through the application of Federal

42 See http://www.casacivil.gov.br/camaras/grupos/amaz_legal.

Decree 6321/2007 and Operation Green Arch. Agreements for reducing deforestation have been promoted and formulated for various sectors, such as grain agriculture (soybeans) and the logging industry, and for other biomes, giving rise to specific plans such as PPCerrado, which follows the same principles as PPCDAM, using a strategy adapted to the cerrado savanna biome.

Without disregarding the contribution of other factors (Soares et al., 2010), part of the reduction in the annual clear-cutting rate recorded over the past several years in the region can be attributed to PPCDAM. From a peak of 27 million km2 of deforested area in 2004, the rate receded to 6.541 km2 in 2010 (a reduction of 76%), according to the most recent estimate of INPE/PRODES. This does not, however, mean that the problem has been resolved. To the contrary, studies indicate that it is essential to have more significant impacts in actions aimed at encouraging sustainable productive activities and in those directed toward dealing with the land use problems associated with illegal deforestation. It is equally important to continue to apply environmental legislation, which seeks to increase the accountability of all the actors who directly or indirectly are associated with illegal clear-cutting of the forest.

An official evaluation conducted in 2008 of each of the three subgroup[43] of PPCDAM action (PPCDAM, Evaluation 2004-2007; Revision 2008)[44] considered the performance level of actions dealing with land use planning to be "average," and the actions encouraging sustainable activities to be "poor." Problems with the structure of official agencies, such as INCRA and IBAMA, and with resources for them to exercise effective enforcement and promote land use solutions were cited as reasons for their performance being less than desired. As a result of government campaigns for enforcement and the fight against deforestation, the best performance of the Plan had to do with monitoring and control. The evaluation also noted that no consensus exists in the government over the main causes of deforestation, which makes it difficult to undertake joint actions. The Plan is also going through a process of revision, even though the new period for planning actions is 2009-2011.

43 Subgroup 1: land use planning; subgroup 2: monitoring and control; subgroup 3: promoting sustainable activities.

44 See http://www.amazonia.org.br/arquivos/293596.pdf.

Sustainable Amazon Plan (PAS)

The Sustainable Amazon Plan (PAS), established by the federal government in partnership with the states of the Legal Amazon, was created with the objective of defining the guidelines for sustainable development in the Brazilian Amazon, proposing strategies and lines of action that further socioeconomic-environmental development in the region.

With the intention of establishing a new model of development in the Amazon, emphasizing the environmental potential, PAS prioritizes the creation of jobs and income for the population that lives off the forest by implementing new sustainable economic activities in the region and reducing social inequalities. The Plan has five lines of action, which seek the formulation of technical and economic bases for sustainable development, as well as solving the problem of land title irregularity found in various parts of Amazonia. The lines of action are: (1) sustainable production to promote innovation and competitiveness; (2) environmental management and land use planning; (3) governance, social inclusion, and citizenship; (4) implementation of infrastructure for development; and (5) establishment of local economic standards.

Since PAS is not an operation plan, but, rather, a strategic one, it encompasses various projects that involve the participation of states, municipalities, NGOs, and local communities, under the federal coordination of the Environmental Ministry (MMA). The program handles the differential treatment of forest and cerrado savanna regions within the Legal Amazon by establishing a system of Ecological-Economic Zoning (ZEE). Among the projects of PAS that are underway, some notable ones are: (1) the Sustainable Regional Development Plan for the Area Affected by Highway BR-163 (Cuiabá-Santarém); (2) the Sustainable Territorial Development Plan for the Marajó Archipelago; and (3) the Sustainable Regional Development Plan for the Xingu.

The development of environmentally viable activities that are economically favorable to smallholder farmers and extractivists, such as Brazil-nut gatherers, allied to the technical-financial support and implementation of offsets for preserving the standing forest, are extremely important topics in the process of socioeconomic and environmental development in PAS projects. This is because these areas are highly vulnerable to the illegal timber trade and the expansion of ranching.

PAS also plays a role as a policy of aligning the federal government to the international targets approved by Brazil. The results derived from PAS programs will influence not only trade in future carbon markets, but also the future demand for agricultural and livestock products at the point when the demand for sustainable products rises.

Amazon Fund

The Amazon Fund consists of a mechanism proposed by the Brazilian government during the COP12 meetings in Nairobi (2006). It seeks a voluntary contribution of developing countries for the reduction of greenhouse gas emissions resulting from deforestation and forest degradation.

Created on August 1, 2008, by Federal Decree 6527, the main objective of the Amazon Fund is to obtain resources for actions to prevent, monitor, and combat deforestation and to promote conservation and sustainable use in the Amazon biome. Furthermore, up to 20% of the Fund's resources can be used for developing systems for monitoring and controlling deforestation in other Brazilian biomes, as well as those in other tropical countries (MMA, 2008).

Projects submitted to the Amazon Fund are not reimbursable (that is, the resources cannot be returned) and they must be nonprofit. Eligible topics for these projects are:

1) Management of public forests and protected areas;
2) Environmental control, monitoring, and enforcement;
3) Sustainable forest management;
4) Economic activities based on the sustainable use of forests;
5) Ecological-economic zoning, territorial planning, and land titling;
6) Conservation and sustainable use of biodiversity;
7) Recuperation of deforested areas..

The Fund will help targets set by PNMC to be reached, especially its fourth objective: reducing the deforestation rate for the period of 2006-2010 by 42% in comparison with the average rate of deforestation from 1996 to 2005 (19,533 km2/1.95 million hectares), with additional reductions of 42% every five years in comparison with the rate of the preceeding ten-year period. This would result in a total reduction of 80% by 2020[45].

The administration of resources donated to the Amazon Fund is handled by the Brazilian Bank for Economic and Social Development (BNDES). This administration involves integrating the procedures and decisions of its three main agencies: the Steering Committee (responsible for defining the strategic guidelines and criteria for applying resources, and composed of government

45 In order to maintain compatibility with the period of five years defined by the Amazon Fund and with the intermediate objectives for 2020, an updated version of the National Climate Change Plan was presented at COP15 in Copenhagen ("Brazil's Contribution to Climate Change Mitigation, p. 19).

and civil society representatives); the Technical Committee (established by MMA to certify data and methods for calculating avoided emissions); and the Fund Administrator (BNDES).

To set annual funding limits, a parameter called the Average Deforestation Rate (TDM) was developed, which is determined by reductions in the emissions caused by deforestation in the Brazilian Amazon each year. The reduction verified for each year will be compared with the TDM of ten-year periods, which will serve as a baseline. This ten-year average will be updated every five years. For instance, the TDM for 1996-2005 will be compared with the annual Deforestation Rate (TD) for each year between 2006 and 2010. In subsequent periods, such as 2011 to 2015, the annual TDs will be compared with the TDM for the ten-year period 2001-2010 see Figure 4. Certificates ("diplomas") will be issued for any deforestation rate that falls below the TDM, but not for a deforestation rate above the TDM; moreover, amounts that exceed the reference average must be deducted from potential funding in subsequent years.

For methodological reasons, the Amazon Fund established an equivalence of 100 tons of carbon for each hectare of biomass (tC/ha), which equals 367 tons of CO_2e per hectare, based on the conversion factor of C to CO_2e (˜=3.67). Funding obtained for emissions avoided in calendar year 2006 would begin in 2008 and extend until July, 2009. For this first funding period, a standard value of US$5/t$CO_2$e was used. Future values will vary according to the dynamics of the Fund, mainly taking into consideration the needs of the projects.

As a concrete example, the first funding period would utilize the TD of 2006, which was 1,403,900 ha, and the TDM of the period 1996-2005, which was 1,950,785 ha. Given these figures, the Fund would receive resources for a deforestation reduction corresponding to 546,885 ha (the difference between the two values: the TDM of 1996-2005 and the TD of 2006). This means that the avoided emissions for the year 2006 would be approximately 54.5 million tons of carbon, or 200 million tons of carbon dioxide equivalent. Thus, based on the reduction in the rate of deforestation in the Amazon in 2006, the value of avoided emissions would allow the fund to collect up to US$1 billion during the first period of funding.

The donations to the Amazon Fund are voluntary and can be made by any corporation, multilateral institution, nongovernmental organization, or government agency. Upon receiving the donation, BNDES issues nominal nontransferable certificates, recognizing the donor's contribution. Since it is a voluntary strategy, the certificates issued do not convey rights to carbon offset credits. On March 25, 2009, the Amazon Fund received its first donation, US$110 million, from the Norwegian government. If the deforestation rates in the Amazon continue to decline until 2015, Norway will donate US$1 billion.

National Climate Change Plan

The general aim of the National Climate Change Plan, launched on December 1, 2008, is to incentivize the development of program actions and collaborate with the international effort to combat climate changes. The plan seeks to create internal conditions for confronting the social and economic consequences of climate changes and to elaborate actions and measures directed toward mitigating and adapting to the changing climate. It includes deforestation reduction targets for the Amazon and the cerrado savanna regions, as well as other efforts in the fields of electrical energy production, charcoal, biodiesel, ethanol, renewable energy sources, and recycling initiatives. The government proposes to reduce the deforestation rates in the Brazilian Amazon by 80% by the year 2020, as illustrated in Figure 4.

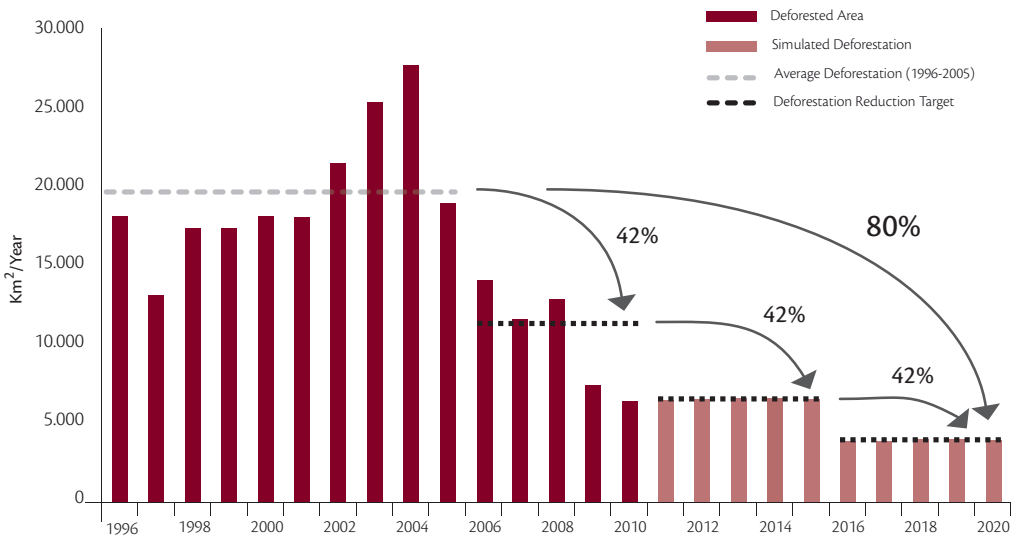

Figure 4. Brazilian government's target for reducing deforestation rates by 42% in each five-year period up to 2020, according to the voluntary commitment made in Copenhagen. The baseline of 1996-2005 will be revised every ten years. Source: MMA (2009).

The specific goals of the Plan are: (1) to promote the more efficient use of natural, scientific, technological, and human resources, seeking to reduce the carbon content of the gross national product (GNP); (2) to maintain high levels in the proportion of renewal energy in Brazil's electrical mix, from sources such as wind and solar energy and sugarcane fiber waste; (3) to sustainably increase the proportion of biofuels in the energy mix used in national transportation; (4) to sustainably

reduce the deforestation rates in all Brazilian biomes to the point of zero illegal deforestation; (5) to eliminate the net loss of the area of forest cover in Brazil until 2015 (which means not only conserving forests, but also doubling the area of plantations by 2020); (6) to strengthen and promote actions for reducing the vulnerability of populations faced with the effects of climate changes, and increase their ability for organizing themselves; (7) to strengthen the development of scientific research in order to outline a strategy that minimizes the country's socioeconomic costs for adapting to the impacts of climate change. The Plan has been, in effect, entirely incorporated into the National Policy on Climate Change (PNMC)..

National Policy on Climate Change (PNMC)

The Brazilian government took a historic step forward to creating the foundation for low-carbon development when, on December 29, 2009, it approved Federal Law 12187, which established the PNMC.[46] This policy is aimed at making socioeconomic development compatible with the protection of the climate system by reducing the anthropogenic emissions of GHG from different sources. Its objectives should be in consonance with sustainable development and incentivize the promotion and development of scientific-technological research, as well as the spread of technologies, processes, and practices directed toward mitigating climate change by reducing emissions at their source and expanding carbon sinks. PNMC also entails the establishment of environmental standards and targets that are quantifiable and verifiable for reducing emissions in Brazil. According to Article 12 of the law, Brazil will adopt, as part of a national commitment, actions to mitigate emissions, with the intent of reducing between 36.1% and 38.9% of its emissions projected up to 2020 (which is equivalent to a reduction of 17% compared to 2005 levels).[47] This objective includes the target of an 80% reduction in Amazonian deforestation, as defined in the National Climate Change Plan.

In relation to the final format of the law, three presidential vetoes were issued over its original draft. The first item be vetoed was the prohibition on the contingency of resources with actions facing climate change. Also vetoed, at the request of the Ministry of Mines and Energy, was the item that deals with stimulating development and the use of clean technologies, along with the gradual abandonment of the use of energy sources using fossil fuels. The third veto dealt with Article

46 See http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/l12187.htm.

47 Brazil presented its reduction targets based on a scenario of reducing GHG 36.1-38.9% by 2020, compared with the emissions that would have been produced had nothing happened, assuming a growth in the GDP of 5-6%, a number that is quite high considering the recent past. See: http://www.ipam.org.br/mais/blogpost?id=57.

10, which concerns the progressive substitution of fossil fuels and establishes ways in which this substitution will be made.

Two policy instruments for carrying out PNMC are recognized in the law: the National Climate Change Plan and the National Climate Change Fund, which was also instituted by law (Federal Law 12114 of December 9, 2009). PNMC initially takes place in five sectors: (1) the reduction of deforestation in Amazonia by 80%; (2) the reduction of deforestation in the cerr ado savanna biome by 40%; (3) actions in the energy sector (for example, improving the efficiency of electrical transmission and the better utilization of biofuels); (4) actions for agriculture and ranching; and (5) actions for the metallurgical industry (substituting mineral charcoal with vegetal charcoal in iron smelting. During the first phase (April-August, 2010), these five planes are in the midst of being elaborated and debated with the members of society in public arenas. Other plans, including one for the transportation sectors, will be elaborated and implemented throughout 2011. The Brazilian government foresees various laws to regulate different parts of the law (the first being discussed, below).

A point greatly-appreciated by Brazil's business community, finally included in PNMC, is the forecast of utilizing financial and economic instruments to promote actions for mitigating and adapting to climate change. Among the instruments of PNMC are fiscal and tax measures that stimulate the reduction of emissions and removal of GHG, including differentiated tax rates, exceptions, compensations, and incentives, to be established through specific laws, as well as credit lines and specific financing to be offered by financial, public, and private entities.

Other important instruments of PNMC are: the provision for specific allocations in the federal budget for actions dealing with climate change; financial and economic mechanisms in the national arena regarding mitigation and adaptation to climate change; documents, inventories, estimates, evaluations, and any other studies of GHG emissions and their sources, elaborated through information and data furnished by public and private entities; and sustainability indicators. PNMC also has provisions for operationalizing the Brazilian Market for Emissions Reduction (MBRE), in the commodities and futures markets, stock exchange, and organized marketplace entities, with the aim of negotiating securities representing avoided, certified GHG emissions.

To initiate the operation of PNMC, the Brazilian president at the time, Luiz Inácio Lula da Silva, issued Decree 7390/2010,[48] which lays out the means through which Brazil intends to reach its targets for cutting GHG emissions by the year 2020.

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48 See http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Decreto/D7390.htm

According to this document, the total emissions projected for 2020 will be 3,236 million tCO_{2e}, derived from the following sectors:

I – Changes in land use: 1,404 million tCO_{2e};

II – Energy: 868 million tCO_{2e};

III – Agriculture and ranching: 730 million tCO_{2e};

IV – Industrial processes and waste treatment: 234 million tCO_{2e}.

PNMC already indicates an emissions cut between 36.1% and 38.9%, based on a projection for the year 2020, which Decree 7390/2010 transforms into absolute numbers: "actions will be implemented that seek to reduce between 1,168 tCO_{2e} and 1259 tCO_{2e} of the total emissions estimated" for 2020. The actions listed to attain this target are described below in Table 6.

Table 6 - Mitigation actions described in Federal Decree no. 7390/2010.

Mitigation Actions
Reduction of 80% of annual deforestation rates in Legal Amazonia, relative to the average verified between 1996 and 2005;
Reduction of 40% of annual deforestation rates in the Savannah Biome, relative to the average verified between 1999 and 2008;
Expanded availability of hydroelectric power, alternative renewable sources (especially wind energy, bioelectricity, and small hydroelectric projects), biofuels, and increased energy efficiency;
Recuperation of 15 million hectares of degraded pastures;
Expansion of system of integrated farmland-ranch-forests to 4 million hectares;
Expansion of direct seeding practices to 8 million hectares;
Expansion of biological nitrogen fixing to 5.5 million hectares of cultivated areas, replacing use of nitrogen fertilizers;
Expansion of forest plantations to 3 million hectares;
Escalated use of technologies to treat 4.4 million cubic meters of animal waste; and
Increased utilization of pig-iron furnaces using charcoal drawn from forest plantations and improvements in efficiency of carbonization process.

source: http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Decreto/D7390.htm

It is important to note that the climatic context is intimately interlinked with the reality of the productive sector and the financial market. Corporations and investors throughout the world have endeavored to promote the sustainability of corporate activities.

On the part of corporations, initiatives such as the inventories of GHG emissions, environmental certifications, the dissemination of sustainable practices, and the awareness-raising of qualified manual labor have taken place quite often.

On the investors' side, organization, indexes, and parameters have been created so that investment analysis is not simply restricted to the question of risks and returns, but also includes other premises, such as environmental, in the corporate evaluation models. One example of this is the creation of corporate sustainability indexes, such as the Dow Jones Sustainability Index in the New York Stock Exchange, and the Corporate Sustainability Index in the São Paulo Stock Exchange, which has as its main mission examining how its member corporations deal with the topic of the triple bottom line,[49] an internationally recognized parameter of sustainability. This index measures the performance of corporations in various sectors in terms of clean technology, low impact production, and sustainable development. Corporations, investors, and governments are gradually taking steps to measure up to its standards as its adoption becomes inevitable.

To implement the strategies contained in the PNMC, it is crucial that economic instruments exist that can support them. One of the main instruments proposed by the government is the National Climate Change Fund (FNMC). Conceived as a proposal for redirecting the government tax on surplus production in the petroleum and natural gas industry, the initial suggestion for the Fund was that part of the profits derived from this industry, one of the highest emitters of GHG and major contributors to global warming, should be used to support and finance enterprises and projects or studies concerning the mitigation of, and adaptation to, climate change arising from the production and consumption of petroleum, natural gas, and other hydrocarbon derivatives.

Approved by the Brazilian Senate in November, 2009, and signed by President Luiz Inácio Lula da Silva on December 10, 2009, Federal Law 12014 created the FNMC. The Fund is an accounting entity and will be directed by an Administrative Committee associated with the MMA, with the goal of securing resources for supporting projects and studies that are directed toward mitigating climate change and adapting to its impacts.

The financial agency for the FNMC will be BNDES. The resources may be applied in analyzing the impacts of climate changes, adaptations by society and ecosystems to these impacts, projects for reducing GHG emissions, and projects for reducing carbon emissions from deforestation and forest

49 The "triple bottom line" refers to the foundation formed by the three component dimensions of the concept of sustainability: social, environmental, and economic. Enterprises that are based on the triple bottom line take into account not only economic aspects, but, of equal relevance, the social and environmental.

degradation, giving priority to natural areas threatened by destruction and relevant to biodiversity conservation strategies, among others.[50]

Amazonian States Task Force on REDD

Perhaps the most dramatic advance toward an Amazonian and national REDD strategy has been the effort made by the Climate Change Task Force, with emphasis on REDD, set up by the Amazonian states and the federal government in October, 2009. The report it issued[51] was also approved in the Fourth Forum of Amazonian Governors, also held in October of that year, in Macapá. Through the document presented, the governors make emphatic reference to the necessity for expanding the financing opportunities for REDD, considering the context of the UNFCCC, through three mechanisms: (1) government financing; (2) a carbon market without offsets (i.e., one that does not generate credits); and (3) an offset market (generating carbon credits) involving Annex I countries. This last mechanism still gives the federal government hesitation, but the report looks for a solution by affirming that a "quota" of additional reductions could be applied to the mandatory reductions of developed countries so it could be utilized by REDD. The mechanism of government financing would operate through Nationally Appropriate Mitigation Actions (NAMAs) of non-Annex I countries, applied through REDD programs of the federal, state, and municipal governments. The source of funds for NAMA could be, for instance, the Climate Change Fund recently approved by the Brazilian Congress.

State REDD Plans in Amazonia

As a consequence of the Plan for Prevention and Control of Deforestation in the Amazon (PPCDAM) and the results of the Task Force, the Amazonian states are now implementing their own programs for preventing deforestation (PPCD) as a way of helping the effort to reduce GHG emissions. This qualifies them to take part in the Amazon Fund and to have a vote on decisions in the Steering Committee (item II, Article 4, Decree 6527 of August 1, 2008, which created the Amazon Fund). The states are currently in different stages in formulating their own plans.

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50 See http://www.mma.gov.br/sitio/index.php?ido=conteudo.monta&idEstrutura=251.

51 See http://www.ipam.org.br/biblioteca/livro/id/248.

Since 2008, seven (of the nine) Amazonian states have initiated their plans (Amazonas, Pará, Mato Grosso, Acre, Tocantins, Amapá, and Rondônia). With the collaboration of IPAM and other institutions, the states of Amazonas, Pará, Mato Grosso, and Acre established their own voluntary targets for reducing deforestation, integrated with the objective proposed by PNMC to the Amazon region. Acre, Amazonas, and Pará are the first states to present plans considered by the Amazon Fund. The plans of Amapá, Mato Grosso, Tocantins, and Rondônia have been completed, while the plans of Maranhão and Roraima have not yet been issued.

The engagement of the Amazonian states, establishing a measurable goal for reducing deforestation, is vital for the success of PNMC in reaching national targets for emissions reductions. The fact that state-level PPCDs are harmonized with the guidelines and priorities of PAS and PPCDAM strengthens the policies of aiding sustainable development and valorizing the forest.

Description of the State Plans for Deforestation Reduction: The state plans for reducing emissions from deforestation are enabling the creation of a state structure for dealing with the opportunities opened up by the REDD mechanism. State laws geared toward the issue, actions coordinated by plans involving different state authorities, and joint actions such as that conducted in partnership with state governments in other countries (California and Indonesia)[52] are helping build the Amazonian foundations of a joint REDD system that could serve as a platform for a national system. The details and progress of the state plans for REDD and controlling deforestation are listed below. Together, they comprise around 80% of the GHG emissions from deforestation in the Amazon.

Table 7, below, shows the variation in the forest stock in each state, illustrating the vast differences among them, a fact that should be considered when formulating a national or regional strategy for REDD.

52 See the Governors' Climate and Forest Task Force website: http://www.gcftaskforce.org/.

Table 7 - Variations in forest stock from 2005 to 2008 in Amazon states (km² of forested area), according to PRODES data.

State	Year			
	2005	2006	2007	2008
Acre	138.423	138.100	137.916	137.694
Amazonas	1.386.880	1.386.100	1.385.490	1.385.011
Amapá	78.830	78.800	78.761	78.761
Maranhão	34.351	33.700	33.087	32.002
Mato Grosso	327.533	323.200	320.522	317.263
Pará	797.705	792.200	786.775	781.595
Rondônia	133.962	131.900	130.289	129.228
Roraima	132.231	132.000	131.691	131.121
Tocantins	10.324	10.200	10.137	10.025
Total	**3.040.239**	**3.026.200**	**3.014.668**	**3.002.700**

State Plan of Amazonas (AM)

According to the State Plan for Prevention and Control of Deforestation in the State of Amazonas (PPCD-AM), the government seeks to voluntarily achieve a reduction in deforestation of 38% by 2010 in comparison to the average rate over the reference period of 1996-2005. The government also commits to stabilizing the annual rate to a maximum of 350 km² over the coming years. This target will correspond to a total deforestation by 2020 of, at a maximum, 0.5% of all the forestland existing in the state in 2006, which will further correspond to a maximum of 0.2% of the deforestation occurring throughout the Amazon forest in the same year (see Figure 5).

The Amazonas state target submitted to the Ministry of the Environment (MMA) is represented graphically below (see Figure 5). Meeting the target proposed in the PPCD-AM by 2020 will mean a reduction in deforestation emissions of about 158 million tons of CO_2, ensuring that more than 1.33 million km2 of standing forests will be maintained.[53] This forest stock will represent more than

53 See:http://www.fundoamazonia.gov.br/FundoAmazonia/export/sites/default/site_pt/Galerias/Arquivos/Publicacoes/planofinal-desmatamentoxAMx.pdf.

40% of the entire remaining Amazon, which has a total stock of 50 billion tons of CO_2. This amount of carbon stock preserved by meeting the Amazonas state target corresponds to all emissions from deforestation in the Brazilian Amazon if the average rate verified between 2004 and 2008 were to be repeated for another 80 years.

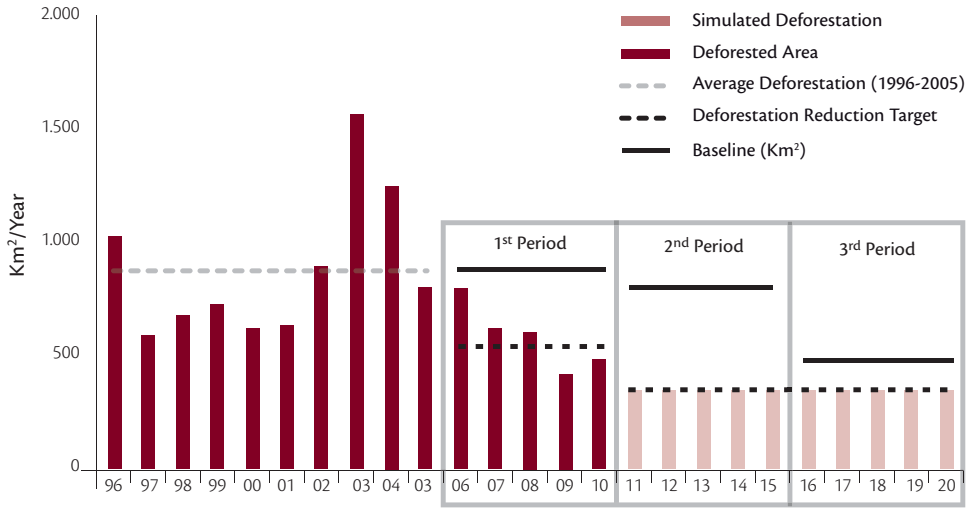

Figure 5. Proposed target for reducing deforestation in the state of Amazonas.

As part of PPCD-AM, the state government put into practice the Forest Allowance Program (PBF), which represents the first initiative in Brazil, under the new international certification system, for compensating traditional Amazonian populations for the services they perform in maintaining the ecological functions of the forest. The main objective of PPCD-AM is to reduce deforestation and valorize standing forests. This program is pioneering payments for environmental services made to populations that live in forest areas in the Amazon and that commit themselves to reducing deforestation. Instituted in September, 2007, by the Governor of the State of Amazonas through the Secretariat of the Environment and Sustainable Development (SDS), its aim is to valorize environmental conservation and to economically compensate families that pursue it in the Conservation Areas (UCs) of Amazonas.[54] The program is currently operated by the Sustainable Amazonas Foundation (FAS).

54 In the first phase (up to April, 2008), the UCs participating in this program were: the Uatumã Sustainable Development Reserve (RDS); the Uacari RDS; the Mamirauá RDS; the Cujubim RDS; the Catuá-Ipixuna Extractive Reserve (RESEX); and the Piagaçu–Purus RDS. In the second phase (up to December, 2008), the UCs were: the Canumã RDS; the Juma RDS; the Rio Madeira RDS; the Rio Gregório RESEX; the Maués State Forest, and the Amapá RDS. These UCs were chosen for having management plans that were completed or near completion. For more information on areas where PBF operates, see the website at: http://www.fas-amazonas.org/pt/secao/programa-bolsa-floresta/mapa_interativo_bolsa_floresta.

The program was instituted through Law 3135 on Climate Change, Environmental Conservation, and Sustainable Development in Amazonas, and Complementary Law 53 on the State System of Conservation Areas (SEUC), both issued on June 5, 2007. The laws are notable for their innovation as they seek to consolidate a legal framework in state legislation for structuring the economy of environmental services and forest products, thereby achieving social justice along with environmental conservation.

The Forest Allowance Program (PBF) involves a constant process of methodological improvement. This process has taken place in partnership with governmental institutions and NGOs. Deforestation within the reserves is measured annually through satellite images analyzed by partner institutions. Field monitoring is done in partnership with the Sustainable Amazonas Foundation (FAS), the State Secretariat of Sustainable Development (SDS), the State Center on Conservation Areas, and the State Center on Climate Change. One of the main developments of PBF was merging the Community Investment Plan (PIC) into the funding for Forest Income Assistance and Forest Social Assistance. This change occurred due to the need for clarifying the objectives of the component programs in relation to income and social issues. It also reinforced the notion that PBF should not be configured as a welfare program, but, rather, as an action aligned with the principles of sustainability, in line with the funding available from FAS.

All the beneficiaries of PBF participate in a workshop on climate change and sustainability. At the end of this workshop, they voluntarily sign a commitment to zero deforestation. The main beneficiaries are the residents of the UCs of the state of Amazonas. During a second stage, residents of other areas in the state could become beneficiaries. The person who receives Forest Allowance funds for each family is the female head of household (except in the case of widowers). The money for the payment of the assistance comes from the income of the permanent Fund of the Sustainable Amazonas Foundation, funded by donations.

By March, 2010, the program had already involved over 6,800 families living in conservation areas that totaled more than 10 million hectares, an area larger than Portugal.

State Plan of Acre (AC)

In its text, the State Plan for Prevention and Control of Deforestation in the State of Acre (PPCD-AC) states that it seeks "to ensure significant, consistent, and lasting reductions in deforestation rates in the state of Acre by means of strengthening the capacities of the government and society

for environmental management and consolidation of a clean, just, and competitive economy with a strong forestry base." Moreover, Acre has what is perhaps the most advanced REDD program, with a development agency for the program which operates with a certain degree of independence from the government.

To define its targets for deforestation reduction, Acre calculated the average annual deforestation in the state, as measured by PRODES, for the period 1999-2008. This totaled 530 km2, which the state used as a baseline for its commitment to reducing deforestation by 75% during the period 2009-2018. If this target is reached, the plan will prevent the emission of 14 million tons of CO_2 into the atmosphere (see Figure 6).

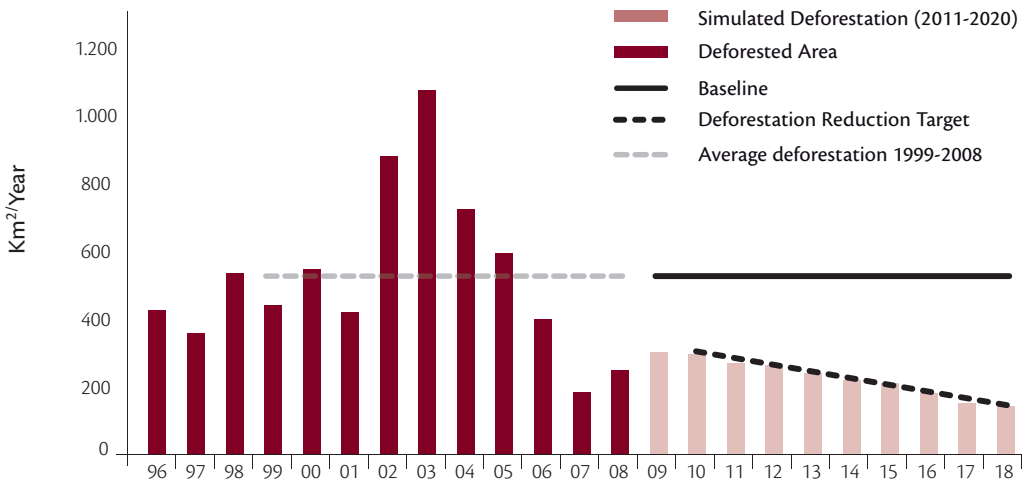

Figure 6. Proposed target for reducing deforestation in the state of Acre.

PPCD-AC calculated that, "in this way, deforestation will be stabilized even if landowners exercise the 'right' to convert 20% of the forests on their properties," alluding to the percentage defined in the Forest Code for rural property in the Amazon. The state government proposes to reach this target gradually, considering that, since 2006, a reduction has already occurred in the deforestation rate and that some of the state programs are already moving ahead, such as the Plantations Program, part of the Policy for Valorizing the Active Forest Environment, launched in September, 2008.

Notably, Acre recent sealed an agreement with the U.S. state of California and the Mexican province of Chiapas in the context of the GCF for a cooperation program involving emissions trading, including REDD.[55]

State Plan of Pará (PA)

Formulated during the first half of 2009, the State Plan for the Prevention, Control, and Alternatives to Deforestation in the State of Pará (PPCAD-PA) lists 64 actions to be implemented during the first phase of execution, covering the period between August 2009 and August 2012. Priority will be given to actions set up in the twelve municipalities that saw the greatest amount of deforestation, according to the MMA Directive 28/08. These actions are organized along three main lines:

- Territorial, land use, and environmental planning: establish priority actions for land titling and environmental regulation in the state;
- Encouragement of sustainable activities: establish a set of actions that should incentivize the adoption of new economic models, thereby contributing toward changing the development paradigm, preventing deforestation;
- Monitoring and control: establish the main actions for improving the efficiency of control over deforestation in the state.

The reduction targets contained in PPCAD-PA use an initial baseline the average deforestation rates occurring in the state between 1996 and 2005 (6,169 km^2), according to PRODES data (Figure 7). The targets are the following:

- 2006-2010: reduction of 42% of deforestation recorded for the baseline period;
- 2011-2015: reduction of 66% of the initial baseline rate, or 42% of the rate for the prior period (2006-2010);
- 2016-2020: reduction of 80% of the initial baseline rate, or42% of the rate for the prior period (2011-2015).

55 See http://www.gcftaskforce.org/.

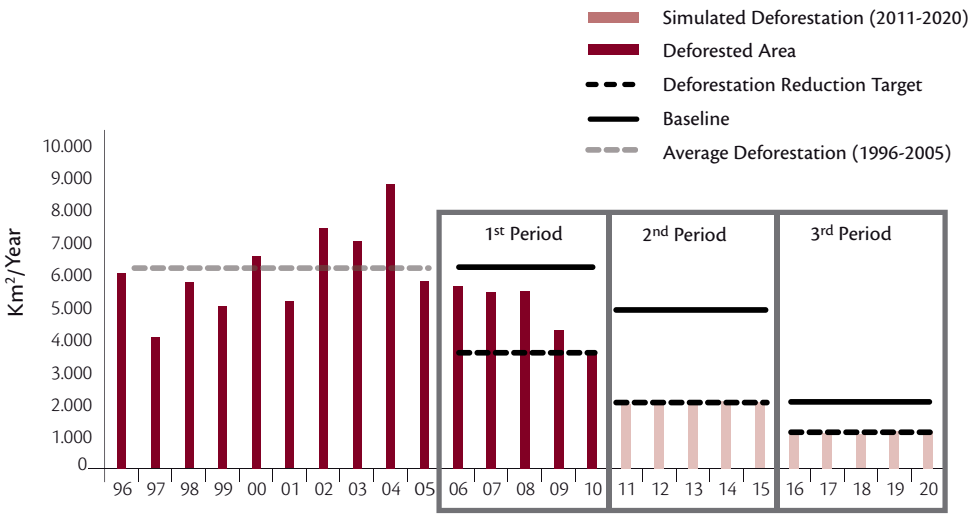

Figure 7. Proposed target for reducing deforestation the state of Pará.

If these targets are met, Pará will be responsible for 30% of the deforestation reduction anticipated in the PNMC, meaning that emissions of 583 million tCO_2e would be avoided. In a possible future carbon market, estimated a price of US$10 per ton of CO_2, the state could obtain up to US$5.8 billion through REDD if it were to meet its targets.

State Plan of Mato Grosso (MT)

The State Plan for Prevention and Control of Deforestation in the State of Mato Grosso (PPCD-MT) contains targets for reducing the illegal cutting of forests. The proposal was calculated on the basis of the period 1996-2005, when 7,657 km^2 were deforested in the state, emitting 2.8 gigatons of CO2e into the atmosphere. Using a baseline of 7,657 km^2, corresponding to the average annual deforestation over the ten-year period, the goals are the following:

- 1st period (2006-2010): reduction of 64% in comparison to the baseline;
- 2nd period (2011-2015): reduction of 75% in comparison to the baseline;
- 3rd period (2016-2020): reduction of 80% in comparison to the baseline.

The deforestation rate during the third period would correspond to a reduction of 89% in comparison to the original baseline of 7,657 km2 (see Figure 8). As a result of fulfilling these targets, the state could legally only deforest a maximum of 17 million km2 between 2009 and 2020, maintaining a forest stock of approximately 300 million km2. This stock corresponds to 10% of the remaining forest in the Amazon, and to 60% of its original forest cover, and is equivalent to the total forest cover in the states of Amapá, Acre, Maranhão, and Tocantins together..

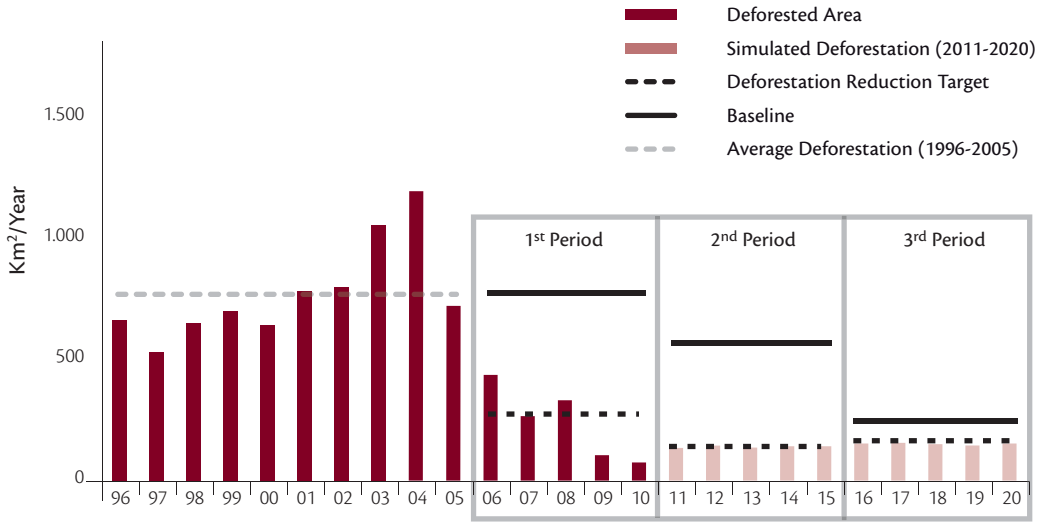

Figure 8. Proposed target for reducing deforestation the state of Mato Grosso

State Plan of Amapá (AP)

In Amapá, the responsibility for elaborating a plan lies with the State Special Secretariat for Economic Development (SEDE) and coordinated by the State Environmental Secretariat (SEMA), which, together with a Work Group formed by various government agencies,[56] will have the task of guiding

56 The Work Group assigned the task of elaborating a Plan for Prevention and Control of Deforestation and Forest Burning in the State of Amapá (PPCDAP) was created by State Decree 0843 of March 6, 2009, composed of the following agencies: the State Environmental Secretariat (SEMA), the State Secretariat for Science and Technology (SETEC), the State Secretariat for Industry, Commerce, and Mining (SEICOM), the State Secretariat for Rural Development (SDR), the Amapá Development Agency (ADAP), the Agency for Agricultural and Livestock Defense and Inspection (DIAGRO), the Amapá Institute for Scientific Research and Technology (IEPA), the Institute for the Environment and Territorial Planning in the State of Amapá (IMAP), the State Forest Institute of Amapá (IEF), the Amapá Rural Development Institute (RURAP), and the Environmental Battalion of the Military Police

the process of formulating the plan. In this undertaking, the state government will have assistance from partners in the Ministry of the Environment (MMA), World Wildlife Fund-Brazil (WWF), and the German Agency for Technical Cooperation (GTZ).

On September 21-24, 2009, SEMA in Amapá held a workshop focusing on public participation, entitled, "Workshop for the participatory formulation of PPCDAP." Its objective was to present and discuss proposals for the preliminary plan so it could be improved by making it meet the interests, knowledge, and experiences of various participants in the workshop. For this task, invitations were extended to representatives of government agencies, private initiatives, segments of society, and nongovernmental organizations. The work received methodological assistance from four co-moderators, one for each topic of action, and from a consultant with the role of moderator, who structured the workshop according to the logic of strategic planning, using tools for public participation.

Prior to this workshop, consultants elaborated a preliminary plan based on guidelines from PPCDAM, information derived from preliminary workshops,[57] and meetings with members of government and nongovernment institutions in the state. The preliminary plan was structured along four thematic lines: (i) Land Titling and Land-Use Planning; (ii) Monitoring and Control; (iii) Encouragement of Sustainable Activities; and (iv) Governance and Executive Management (which directed and monitored the plan). When the final workshop was held ("Workshop on the participatory formulation of PPCDAP"), the programs and actions proposed in the preliminary plan were adjusted and detailed in a participatory form. During the workshop, agreements were gradually constructed, first in thematic subgroups and then presented and debated in general assemblies with all participants. During the four days of the meeting, the participants produced analyses and proposals for aligning the objects and integrating the actions of the Plan, with the aim of consolidating it in line with the specific realities of the Amapá context. A report[58] was issued at the end of the workshop.

57 The preliminary workshops were held in all the municipalities in the state and identified the problems with deforestation and forest burning, as well as the sustainable activities in their respective regions.

58 See http://www.sema.ap.gov.br/publicacoes/ppcdap/pdf/relatorio_oficina_ppcdap_com_lista_presen%C3%A7a.pdf.

State Plan of Rondônia (RO)

The general aim of PPCDRO is "to gradually reduce the deforestation rates in Rondônia until reaching zero annual increase in 2015, ensuring the protection and supervision of special areas (Indigenous Lands and Conservation Areas) and the sustainable management of rural properties."

The Structural Program, associated with the Plan's Thematic Lines, will serve as the basic guideline for elaborating Priority Projects. The objective is to transform the Priority Projects into tools for carrying out the proposal for the prevention, control, and sustainable alternatives to deforestation in Rondônia. The foundation for implementing the Structural Program will be an updated version of the Socioeconomic and Ecological Zoning (ZSEE) of Rondônia, after more than ten years of revisions for redefining the territorial planning in the state based on new realities. According to the diagnostic data, ZSEE has been losing its focus and the special protected areas are at risk, including those that contain restricted forest habitats. As studies proceed for the third updated version of ZSEE, all of the environmental legislation should also be updated in the form of an environmental code for the state.

Legislative Bill 5586/2009 regulating REDD

The absence of a federal regulatory framework makes it difficult to give definitive answers to important questions about REDD: Who generates REDD credits? How and when are REDD credits generated? Who receives the resources derived from REDD credits? Those interested in buying credits would buy them from whom? Some regulatory frameworks are being discussed in the states, but only Amazonas has one in place. On the federal level, no clear answers exist. In part, this is because resistance can still be found within the government itself regarding the topic of carbon credits for the reduction of deforestation and forest degradation. Therefore, this section presents the ideas and proposals developed in the Brazilian National Congress (through public hearings and legislative bills) in discussions held with the Ministry of the Environment and state governments that are already moving forward in the design of their regulatory frameworks.

Contributing to the search for a regulatory framework for REDD is Federal Bill (PL) 5585/2009,[59] which is making its way through the National Congress. The PL proposes instituting certified reductions of emissions from deforestation and degradation (C-REDD) as titles representing a standard unit of GHG, corresponding to a metric ton of carbon dioxide equivalent (tCO2e) in an area of preserved forest.

59 The analysis here refers to the first and second versions of the PL.

This PL was structured to incentivize the conservation of forest stocks in private local projects through a mechanism similar to the CDM system, in which an interested party (limited by the project to private properties with forestland) submits an emissions reduction project, developed in accord with the methodology established and regulated, to a designated authority, via the federal government. The project qualifies for the registration of a defined amount of carbon through the issuance of a C-REDD. These C-REDDs thus serve as titles that can be transacted on the carbon market.

The Project has the merit of seeking to regulate activities that are already being developed primarily (but not exclusively) in the Brazilian Amazon in scattered private projects that are not articulated or integrated into a broader framework. Regulation of such activities is essential for lending credibility to REDD. Some comments regarding this PL will be offered below, reflecting key concepts for a national REDD strategy. The discussion of REDD in the National Congress reveals the praiseworthy efforts by the legislature to devise regulations through a dynamic that involves the actual participation of society at large.

REDD projects underway in Brazil

Seven REDD projects are currently underway in Brazil, in the phase of elaboration or implementation. These projects are detailed in Table 8 below.

Besides the projects presented in Table 8, there are others still in a preliminary phase of development, that is, with technical and methodological questions that have not yet been answered. However, many of these projects already utilize concepts and lessons learned from projects already underway. There follows an overview of some of these.

Table 8 - REDD projects in Brazil in planning or implementation stages (adapted from Cenamo et al., 2009).

Name of local project	Acre State Carbon -Payment for Environmental Services Project	Ecomapuá Carbon Project / Marajo Island, PA	REDD Project for Smallholder Producers in Amazonia (deforestation avoided on small rural properties in the region of Transamazon Highway) / areas bordering Transamazon Highway, between cities of Senador José Portírio, Pacajá, and Anapú, PA	REDD project for Juma Sustainable Development Reserve / Novo Aripuanã municipality, AM	(i) Atlantic Forest Restoration Project, (ii) Antonina Reforestation Pilot Project, PA, (iii) Guaraqueçaba Climate Chnage Action Project, PR	Suruí Project, Indigenous Territory of Sete de Setembro, in municipalities of Cacoal and Espigão d' Oeste, RO, and Rondolândia, MT	REDD Genesis Project in Serra do Lajeado Protected Area, Taquareussu District, TO
Proposing institution/ managers	State of Acre / World Wildlife Fund, Forest Trends, Amazon Environmental Research Institute (IPAM) (as investor)	Ecomapuá Conservation, in partnership with Sustainable Amazon Institute (IAS) (São Paulo, SP)	Amazon Environmental Research Institute (IPAM), Live, Produce and Preserve Foundation (FVPP), and Biodiversity Fund (FUNBIO)	Sustainable Amazonas Foundation (FAS) / State of Amazonas	Wildlife Research and Environmental Education Society (SPVS) / The Nature Conservancy (technical and accounting assistance)	Metareilá Association of the Suruí Indigenous People (Gamebey) / IDESAM (technical assistance)	Ecological Institute (IE)
Biome	Amazon Rainforest	Amazon Rainforest	Amazon Rainforest	Amazon Rainforest	Atlantic Forest	Amazon Rainforest	Cerrado savanna
Stage of development	Public consultation stage	Initial stage	In stage of revisions by Amazon Fund	Project validated under Climate Community and Biodiversity (CCB) standards, and is in process of validation under Voluntary Carbon Standard (VCS)	In implementation stage	Initial stage	Undergoing validation by CCB
Area (ha)	5.800.000	94.171	31.745	~ 590 million hectares; area of avoided deforestation until 2050: 62% = 366 million hectares	(i) 8,600; (ii) 3,300; (iii) 6,700	248.000	121,415 hectares
Estimated reduction	Over 15 years: 62.5 million tCO2e; per year: 4,167,000 tCO2e	300,000 tCO2e	Over 10 years: 3,136,953 tCO2e	Until 2050: 189,767,027 tCO2e; credits certified (2006-2016): 3,611,723 tCO2e	Over 40 years: (i) 181.095 tCO2e (ii) 65.456tCO2e (iii) 138.713 tCO2e	Over 44 years: 16.5 million tCO2e; per year: 375,000 tCO2e	Over 20 years: 57,389 tCO2e; per year: 2,869 tCO2e

REDD pilot project in northwestern Mato Grosso

Located in several municipalities in northwestern Mato Grosso, this project encompasses a total area of 10.5 million hectares, of which 8.6 million ha are surviving forestland. The project is being developed through a partnership involving the state government, The Nature Conservancy (TNC Brazil), and the Center of Life Institute (ICV). The project has three main strategies: (i) improve forest governance; (ii) promote the conservation of forests in private lands and protected areas; and (iii) compensate indigenous peoples and traditional communities for their efforts toward forest conservation in their territories. The estimates of emissions reduction for the entire region point to around 500 million tons of CO_2 between 2009 and 2018.

Calha Norte REDD Project in Pará

This project is located north of the Amazon River in the state of Pará, Brazil, in the Ecological Station of the Paru, Trombetas, and Faro Forests, covering a total area of 7.4 million hectares. It is being developed through a partnership of the State Environmental Secretariat of Pará (SEMA-PA), Conservation International Brazil, and the Amazon Institute of People and the Environment (IMAZON). The project seeks to impede the advance of deforestation and promote conservation of forest carbon stocks in Protected Areas (AP) in the state. The main threats are mining activities (including gold extraction) and the opening of new roads. At the same time, the project seeks to involve local residents in the planned activities, guaranteed that the communities directly receive the resources generated by carbon credits.

Greener Apuí Project, Apuí, Amazonas

Apuí is a municipality that covers an area of approximately 5 million hectares in southeastern Amazonas, Brazil. The Greener Apuí Project involves a total area of about 12,000 ha of farmland and ranches in Apuí, with the aim of recuperating water and soil quality and reducing carbon emissions resulting from deforestation and forest degradation (REDD). The project seeks to incentivize the restoration of 1,500 ha of riverine areas (Areas of Permanent Protection) that are degraded or unproductive, such as pastureland. The Institute for Conservation and Sustainable Development of Amazonas (IDESAM) developed the project with assistance in implementation and management from the Environmental Secretariat of Apuí. Local producers are invited to voluntarily take part in the project, choosing an area of at least five hectares of their property to be restored. The

project provides technical assistance and seedlings for planting, and, at the same time, requires that participants do not cut more areas of existing forests in their properties. Furthermore, the project will create a central nursery and assist in developing small nurseries for raising seedlings in Apuí. The project aims to provide an annual payment to producers who replant forests. Currently, plans are to reforest around 1,000 hectares, which represent 150 producers who voluntarily signed up for the project. The next step is to "geo-reference" the properties and areas to be restored, and to find investors in the voluntary carbon market.

Socioenvironmental Commitments Inventory Project, Xingu (CCSX), Mato Grosso

The Socioenvironmental Commitments Inventory Project is located in the headwaters of the Xingu River, Mato Grosso, Brazil, encompassing various rural private properties. It is being developed through a partnership between the NGO Land Alliance and IPAM.

The project's objective is to incentivize agricultural production based on social and environmental guidelines that include identifying and prioritizing best practices in land management, helping landowners to resolve conflicts between production and environmental protection. The benefits generated by CCSX are: (i) transparency in the socioenvironmental performance of the producers; (ii) promotion of best practices in land management; (iii) recognition of the efforts of participating producers toward conservation and natural resources management within their properties; and (iv) increases and improvements in access to the market for registered products. Furthermore, other benefits that are worth noting are: the incentive for the legal recognition of land ownership through certification (land titles) and the promoting of economic, financial, and policy incentives to benefit responsible producers.[60]

Pilot project in São Félix do Xingu, Pará

Located in southeastern Pará, the municipality of São Félix do Xingu covers 8.6 million hectares, of which 50% are in indigenous lands and 6% in protected areas. The project is being developed through a partnership of the state government, municipal government, and TNC Brazil. The main conduit for deforestation in the region is ranching. The strategies of the project are: to furnish tools for ranch owners and members of the beef industry to fulfill forest legislation; to make large-scale

60 More information can be found at: http://www.ipam.org.br/biblioteca/.

improvements in small-scale ranches; improve forest governance at the state and municipal levels; support sustainable activities, such as milk production and cacao; to develop practices for making payments to private landowners for environmental services, and to strengthen the management and protection of indigenous lands and protected areas.

Initiatives for social control: the REDD Observatory

The REDD Observatory is an initiative of the Amazonian Work Group (GTA), launched in August, 2010, which seeks to be a simple, practical, efficient, and creative instrument in accompanying REDD policies, programs, projects, actions, and activities in Amazonia and other Brazilian biomes.

Recently, the GTA announced that it will initiate discussions for undertaking partnerships for the immediate establishment of a REDD Observatory to monitor the Amazon Fund actions and other policies on REDD in Brazil.

The Observatory will be coordinated by the GTA national office in Brasília,[61] integrated by its network of organizations, social movements, and third-sector organizations that belong to the Committee of REDD Socioenvironmental Principles and Criteria.

The REDD Observatory will have the following functions:

a) Verify and monitor services provided to the state REDD programs and projects supported by the Amazon Fund in relation to their REDD Principles and Criteria, as well as monitor the approval, execution, and application of project resources approved by the Amazon Fund;

b) Research, organize, and publicize information, in a simple, easily understood format, related to actions of the Amazon Fund, its managing organization, BNDES, federal, state, and municipal government agencies, organizations of civil society and the private sector in the Amazon and Brazil;

c) Mobilize and strengthen organizations and social movements in the Amazon in order to follow them, give opinions, and influence public and private policies that have an impact on the quality of life in the forest;

61 The GTA, founded in 1992, brings together 602 affiliated entities and is structured in nine states of the Legal Amazon, divided in 18 regional collective. The GTA Network is made up of nongovernmental organizations and social movements that represent a various segments of society.

d) Pass along reliable information for policy decisions, the press, and other opinion-makers in order to also inform and mobilize Brazilian society as a whole;
e) Formulate positions, qualified personnel, and campaigns capable of influencing opinion trendsetters and decision-makers regarding REDD programs and policies;
f) Train leaders in the GTA network and partner entities in analyzing, participating, proposing, and influences REDD programs and policies in their states and for elaborating high-quality REDD projects.

Through these objectives, GTA proposes to make an investment in formulating mechanisms and actions that are adequate for generating the knowledge needed to encourage mobilization, participation, inclusion, and social control that forest peoples can exercise over REDD actions in Brazil, helping people who live and work in forest regions and other Brazilian biomes to get more involved in the process of formulating public policies in Brazil that directly impact biodiversity, the ecosystem, and life on earth as a whole.[62]

62 For more information, consult the site: www.gta.org.br.

PART IV
A National REDD Strategy for Brazil: Key Principles

REDD must be one of an array of tools comprising a national strategy for reaching the targets defined in Brazil's National Policy on Climate Change (PNMC) for reducing deforestation. Without a national strategy as the foundation, REDD could not be regulated under the law, since it would merely serve to legitimate various uncoordinated local projects that did little to benefit the social actors involved in conserving forests and combating deforestation and illegal burning. The major challenge, therefore, lies in the fact that Brazil has not yet defined its national strategy. There is no clarity in how a strategy for REDD fits into the National Policy on Climate Change or how such a system is likely to be regulated.

To meet this challenge, several principles should be followed when articulating and implementing a national REDD system. These principles would be useful in the formulation and operation of a system that could result in an effective implementation of the National Policy on Climate Change (PNMC), leading the country to a new economic dynamic based on low carbon emissions.

Principle 1: REDD should operate on a national scale

Financial compensation, whether from public or private sources or from the carbon market, will take place through REDD only if deforestation reductions take place on a national scale, accompanied by measurement methods that are also national. Little can be gained from initiating well-meaning local projects for reducing emissions from deforestation, as has been the tendency lately in the Brazilian Amazon and other tropical countries, if the national rate of deforestation increases in the country as a whole. No matter how much effort is put into a REDD project, it can only be judged successful if it is indeed encompassed within a national system for emission reductions.

For such efforts to be assessed on a national scale (or, initially, in the Amazon), Brazil has adopted a baseline or reference point for measuring emission reductions from deforestation, particularly in the Amazon. This baseline represents the average of the historic deforestation rates between 1996 and 2005, equivalent to 19.6 square kilometers (the same baseline utilized in the Amazon Fund and the National Policy on Climate Change, discussed earlier). Every five years, the baseline is revised

downwards. The same type of calculation is being used by the Amazonian states that are already pursuing measures for reducing deforestation (Acre, Mato Grosso, Pará, and Amazonas). Each state has established a historic baseline of deforestation and is measuring its performance by comparing the reductions occurring each year to the baseline.

The creation of robust baselines and a method for measuring emissions reduction on a national scale is directly related to the possibility of utilizing market mechanisms (generating credits) in a future national REDD system. If it were not possible to compare the reduction in emissions with a reference point (a national baseline or, in this case, an Amazonian baseline), there would be no principle guiding the issuance of REDD credits, even on the level of local projects. It is therefore crucial to evaluate how a national REDD strategy will encompass subnational actions (pursued by the states, for example) and small-scale projects.

Principle 2: REDD should be safeguarded by effective, permanent forestry legislation

Without a firm investment in environmental governance (by the states and the federal government) and without the support of federal forestry legislation, REDD actions will not offer even minimal guarantees to potential investors, either national and foreign. Several factors pose major obstacles to obtaining resources, whether from public funds or through the international market in forestry carbon: changes in the Forestry Code proposed by the rural wing of the Brazilian Congress;[63] the failure of the federal government to respond to the demands of environmental organizations[64], and of state governments to those of their environmental agencies; the international economic crisis; and the lack of regulation of the elements in the Climate Convention. Furthermore, corruption in government agencies may weaken the long-term actions of REDD, undermining the credibility and stability of a national system.

Not only is it is necessary to invest in economic mechanisms in order to valorize the standing forest, thereby promoting the conservation of forests and of inhibiting deforestation, it is also necessary that governance in forest regions be strengthened.

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63 See the article with information on such changes at: http://www.ipam.org.br/blogs/Apagao-Ambiental-seria-comico-nao-fosse-tragico/67.

64 See the comment by NGOs on the critical situation of Brazilian environmental policy at: http://www.ipam.org.br/noticias/Politica-Ambiental-no-Brasil-a-beira-do-abismo/630.

Principle 3: A national REDD system should incorporate state-level plans for reducing deforestation in the Amazon

The role of the Brazilian states in the composition of a national REDD strategy and system is key. The Public Forest Management Law (Federal Law 11.248/06), for example, charges the states with the responsibility for enforcing, monitoring, and licensing deforestation within their boundaries, as well as supervising forest management activities and the transportation of forest products. Therefore, if forest management is handled by the states, they will play a crucial role in the environmental governance of a national REDD system. It would be unreasonable to assign the tasks for controlling and combating deforestation to the states if they could not generate economic benefits derived from the implementation of such tasks. The efforts invested so far in formulating state plans for combating deforestation (as targets), and, in some cases (such as Acre), creating REDD plans, demonstrate the legitimate interest of the states in contributing to the formulation of a national system.

Principle 4: The benefits of REDD should encompass both emission reductions (flow) and forest conservation (stock)

The mechanism of REDD, on its own, only deals with the reduction of emissions (flow) of greenhouse gases into the atmosphere. Once a reduction in the flow is demonstrated in comparison with a historical baseline, the benefits for the climate can be calculated. This principle forms the basis of REDD and is the most firmly accepted in discussions of the United Nations Climate Change Convention. Therefore, from the perspective of a future international REDD system, countries that demonstrate national reductions in emissions (flow reduction) caused by deforestation will receive some type of financial compensation or incentive. This is how REDD should operate globally during the first phase. However, such a principle could generate what is known as a perverse incentive: awarding compensation for emission reductions only to those countries that had high emissions (deforestation) in the past, even if they are now promoting reduction efforts. From this perspective, no compensation would be made to countries that have always made efforts toward forestry conservation (of stock). This situation is also reflected in the states of the Brazilian Amazon. For example, considering only compensations for flow reduction, the state of Mato Grosso, responsible for the conservation of 50% of the entire forest, would receive merely a small slice of these benefits, since the deforestation rates in this state have been historically low. The mechanisms for dealing with this problem of the value assigned to flow to the detriment of that assigned to stock will be discussed later.

Principle 5: From the start, a REDD system must identify its beneficiaries

Who owns carbon? This has been a frequent question among those who debate how to operationalize REDD mechanisms, not only on a national level but also in the international context. Moreover, some position papers have already questioned the link between the rights of certain social sectors (such as farmers and indigenous populations) to the use and possession (title) of their lands, on the one hand, and ownership rights to carbon, on the other (Valle et al., 2009). The argument is straightforward: affirmation of land ownership directly confers ownership of forestry carbon.

Although the reasoning about the ownership rights to carbon reveals a certain logic, perhaps a better way to deal with the issue would be to start with a clear definition of who will be the beneficiaries of REDD. Instead of discussing ownership rights related to REDD, the beneficiaries would be those who legitimately bear the responsibility to conserve or use forests in a sustainable manner, contributing in a tangible and demonstrable way to reductions in emissions from deforestation or forest degradation. This definition enlarges the vision of rights to the benefits of a REDD system, since, on this basis, the beneficiaries would be not only the owners of lands with the requisite titles, but also, more fundamentally, indigenous peoples, extractivist and traditional communities, settlers, family farmers (with or without land titles), and government entities (which, in the case of protected areas, are municipal, state, and federal agencies).[65]

If a REDD system is enacted based on market mechanisms that generate carbon credits, it must be clear that entitlement is not simply linked to the element of "territorial ownership," which pertains to the forest, but also to the responsibility and the rights of access to forest resources. That is, the standpoint should be that the beneficiaries of REDD are rightful entities that bear the responsibility (and even the obligation) to maintain standing forests. Entitlement to credits may vary according to the nature of the area where REDD programs and projects are implemented. This standpoint would be valid even if REDD credits were defined as abstract in nature, which would reinforce the public, diffuse character of their entitlement. In uninhabited public lands, this responsibility would fall entirely to the government, which therefore would possess exclusive title to credits that might be derived from projects or programs taking place within these lands. On the other hand, entitlement would belong to forest peoples (indigenous peoples, traditional extractivist communities, and small farmers) in relation to actions aimed at reducing deforestation or conserving forests (including their management) in territories guaranteed protection by the legal creation of protected areas or by the recognition of the rights held by forest peoples. However, the notion that entitlement

65 Regarding this issue, see the article available at: http://www.ipam.org.br/biblioteca/livro/Desafios-juridicos-para-a-governanca-sobre-as-emissoes-de-CO2-por-desmatamento-e-a-titularidade-do-carbono-florestal/511.

to the territories of traditional populations is shared with the government body responsible for the administration and protection of these areas is debatable. This does not apply to the case of indigenous territories, given the establishment of their exclusive usufruct to natural resources, despite the abstract or nonmaterial quality attributed to carbon credits.

In summary, those who receive most of the financial compensations for REDD credits should be identified as the beneficiaries who, by law, have the responsibility for maintaining the forests and who fulfill this duty in a manner that indeed contributes to emissions reduction as measured on a national scale.

The issue of entitlement to carbon was also raised in the Congressional bill (PL 5.586/09) mentioned above. In its early drafts, the bill restricted the eligibility of REDD projects to those who could prove their ownership of the land (with legal titles). This condition was later amended, since it would have excluded more than 70% of the Amazon territory, composed of indigenous lands, conservation units, and certain categories of private property, from the right to obtain credits. This would have meant overlooking the crucial role of the populations that occupy these areas in conserving forest carbon stocks and reducing deforestation.

Principle 6: The benefits of REDD should be shared in a just, equitable, and rigorous manner

One of the issues that is among the most difficult to address in the formulation of a national REDD strategy or system concerns the sharing of benefits (whether public or private in origin and whether involving carbon credits or not) derived from implementing such a system. This arises, first, because the actual amount of the (financial) benefits has still not been defined. The Copenhagen Conference of Parties (COP15) stated that developed countries should invest a minimum of US$4 billion by 2012 (see Table 4) and possibly another US$10 billion by 2020, considering all the sectors involved in mitigating climatic changes (UNFCCC, 2009). At present, Brazil has succeeded in raising around US$110 million, through the Amazon Fund, from donations by the Norwegian government, which has promised to give another US$1 billion over the next ten years. Second, even though the resources for REDD worldwide are expected to increase, little has been said about how the benefits they generate will be shared or which sectors of society should be considered.

In order to guarantee the success of any REDD strategy in Brazil, the criteria for the equitable sharing of financial benefits it generates should be discussed in an open and participatory manner.

Furthermore, the identification of the beneficiaries of these resources must be made before an operational structure of a REDD system is instituted. For example, it will be necessary to discuss the role in conserving the forests and reducing deforestation played by the populations that live in the forests, such as indigenous peoples and traditional communities, as well as the role of private property and other land use categories (such as protected areas).

Principle 7: A REDD system should respect the rights of forest peoples

One of the main fears regarding REDD is that, in compensating actors who have rights to the forests, the mechanism might stimulate land speculation and land grabbing in Amazonia, to the detriment of the traditional populations and indigenous peoples whose rights to their territories have not yet been recognized by the government. This preoccupation arises mainly in countries with tropical forests where these rights have not yet been secured. However, this is not exactly the case in Brazil. Although numerous areas still lack homologation or demarcation, Brazilian legislation, through the Federal Constitution, ensures the rights of these populations.[66] These rights, however, should be reaffirmed through clarifications and consultations taking place with leaders of social movements. This will ensure their active participation in developing principles and criteria that affect their interests. In Amazonia, initiatives for wide-ranging consultation are already underway (Gomes et al., 2010),[67] but various REDD initiatives are going forward without observing the measures of consultation and participation of those who live in the forest.

Principle 8: A REDD strategy should not ignore the potential for investments through the carbon market

Historically, the Brazilian government has been cautious about the possibility of generating carbon credits through REDD, since they might be used by developed countries or corporations to fulfill part of the (mandatory) targets for emissions reduction (see Table 3). This would entail reducing

66 On this issue, see the following article: http://www.oeco.com.br/convidados/64-colunistas-convidados/23587-sem-direitos-sem-redd-ou-sem-redd-menos-direitos.

67 Regarding these principles and criteria, see the news item at http://www.ipam.org.br/revista/-p-Principios-e-Criterios-para-REDD-passam-por-consulta-publica-p-/174,and the document submitted to public commentary at http://www.reddsocioambiental.org.br .

emissions in developing countries in order to continue allowing emissions in developed ones. As noted in Table 3, the idea of "reducing here to allow emissions there" is not entirely true. Most of the reductions (perhaps 80-95%) by developed counties take place within their own borders. Moreover, the use of potential REDD credits could be retained at the source if developing countries set more ambitious mandatory targets than those announced at COP15. The advantage of market mechanisms over those based on donations or public funds rests on the fact that the former is economically more attractive and is capable of generating more benefits for the forests and the populations that live in them, besides being more likely to support larger and more constant financial resources over the long run.

Given the need for regulation in Article 12 of the PNMC, which establishes emissions reduction targets by 2020, it is important to consider mechanisms, including market-based ones, that will yield financial incentives for achieving them. Considering that REDD is the easiest and fastest way to reduce global emissions of greenhouse gases, the market, duly regulated, may be more attractive, generating potentially greater resources than those obtained through donations. The ability and willingness of developed countries to continue to donate resources toward the conservation of tropical forests in the future is doubtful, especially if the demand increases for investments to mitigate and adapt to climate change within their borders. In the context of a national REDD system, it is crucial to find means for maintaining the diversity of investments in REDD. To do this, there must be room enough for projects aimed at a mandatory but complex market, without excluding projects aimed at the voluntary, less complex market. One of the most important components of any financial mechanism is that which attracts private investors.

Principle 9: A national REDD system should set up a procedure for documenting, confirming, and reporting carbon emission reductions

As required in the European Trading Scheme (Box 2), a national REDD system in Brazil should set up a procedure for documenting, confirming, and reporting changes in carbon emissions. This should be conducted in a transparent, consistent, comparable, and precise manner, that is, through a mechanism for measuring, reporting, and verifying (or, for short, MRV). Without a MRV system in place, the credibility of any system will be compromised from a market perspective. A national MRV system should be robust and adequate to meet the requirements of the Intergovernmental Panel on Climate Change (IPCC), as proposed by the Food and Agriculture Organization of the United Nations (FAO).[68]

68 See http://www.un-redd.org/Newsletter8_MRV_System_Recommendations/tabid/4551/language/en-US/Default.aspx .

With the implementation of the Amazon Fund, Brazil has taken a step forward in a MRV system, involving, for instance, annual deforestation monitoring by the National Institute for Space Research (INPE), considered to be one of the best such programs in the world, enjoying high credibility.

Two other basic criteria that must be addressed in a MRV system are leakage and double counting. Leakage refers to the emission of greenhouse gases, specifically through deforestation, beyond the boundaries of the project as a consequence of undertaking the project itself. In other words, the reduction of deforestation in one area might increase deforestation in another. This type of problem is greater in small-scale projects and has already been observed on several occasions. The larger the scale of the project, the smaller the possibility of leakage. To deal with this issue, an alternative is to measure the reduction in deforestation throughout the biome (in this case, the Amazon biome), rather than making this calculation individually for each project or program. Once measurements are taken in the entire biome, utilizing a system such as PRODES (the Program for Monitoring Deforestation in Amazonia), reductions of emissions from deforestation can be clearly monitored, reported, and verified, fulfilling the basic requirements of a REDD project aimed toward generating carbon credits for the mandatory market.

Double counting takes place when two different entities benefit from financial incentives or engage in the trade in credits (operating through the carbon market) from a volume of avoided emissions that occurs in the same area or as a result of the same action, project, or program for reducing carbon emissions. For instance, a project set up in the state of Amazonas might sell credits to the market at the same time that the Amazonas government might sell the same reductions on a statewide scale. In theory, the federal government might do the same thing on a national scale. To avoid this, it is necessary to institute a verification system that allows nationwide accounting. The national accounting of emissions reduction guarantees that double counting will not take place.

Although not directly tied to the formulation of a national REDD structure, the issue of the time frame of REDD credits should be taken into consideration. Historically, forest projects have been considered to be "back-up" measures in the Climate Convention. For instance, in the main carbon credit markets in the world, such as the European Trading Scheme (ETS) (box 2), forest credits from REDD or Clean Development Mechanisms (CDM) cannot be traded. Using CDM projects as an example, technically these function in the same way as projects covered by the ETS. The emissions avoided as a result of actions such as substituting fossil fuels for renewable energy or increasing the energy efficiency of a process are calculated, measured, and monitored. While the avoided emissions due to the substitution of a liter of diesel gas with a renewable source of energy are irreversible, the same does not occur with forestry projects. The main activity in CDM projects for generating forestry

credits is reforestation. In this type of project, carbon is captured from the atmosphere and stored in the form of biomass in a forest structure. Thus, the conversion of deforested areas into forests is the means by which CDM projects generate forest carbon credits. However, these projects are not irreversible, but depend on the "permanence" of carbon stocks to be effective. A forest fire, for example, returns all of the carbon that had been absorbed in forest growth back into the atmosphere.

Because of such issues, forest credits have been considered time-bound and treated differently than other certified emission reductions (CER), better known as carbon credits. Forest credits may be deemed long-term carbon credits (LCER) or temporary (TCER), depending on the characteristics of the project to which they are linked. In both cases, however, these credits must be periodically substituted for others, and for this reason they are considered to be limited in time. Once the necessary criteria are defined for the formulation of a system that operates in both the voluntary and the mandatory markets, the next step will be to include concepts that encourage all the states in Amazonia to become engaged in a national REDD program.

Box 2 - The European Trading Scheme (ETS)

A good example for understanding the dynamics of a mandatory market in carbon credits in the ETS. This scheme, which encompasses more than 12,000 corporations spread across 25 countries of the European Union (EU), was created to fulfill the EU commitments in the Kyoto Protocol. It represents an overarching system for trading carbon dioxide emission credits among large corporations in the European bloc, and is considered to be an economically efficient means for the EU to reach its Protocol targets. One of the main entities created to structure the ETS is the Community Independent Transaction Log (CITL), which documents, transfers, issues, and insures all the carbon certificates traded in the ETS. Each member state is obligated to have a national registry system reporting to CITL. These registries ensure the accounting of the trade in certificates, allowing control to be exercised in fulfilling the commitments of the Kyoto Protocol as well as the participation of countries and corporations that comprise the system. Thus, projects geared toward the mandatory market should meet a set of criteria that enable them to be monitored, to have a registry system, and to be verified. These three basic criteria of monitoring, recording, and verifying are key for any project or program oriented toward the mandatory carbon market. This entire process makes sense only if the credits generated by these projects can be used by countries and corporations that must meet requirements limiting greenhouse gas emissions. Unfortunately, the ETS does not yet encompass REDD projects..

Principle 10: The resources stemming from a REDD system should be invested in coordinated actions and policies for reducing deforestation, conserving forests, and improving the system

The funding commitments for REDD announced during and after COP15 are crucial for ensuring on-going progress in the advances attained so far in elaborating and implementing REDD programs. The importance of these funds is underscored by the delays shown by the U.S. government in approving a set of laws for cap-and-trade compensation that would generate demand for REDD, and by the failure of COP15 to reach a global climate agreement. Under these circumstances, there will probably be a delay of one to three years in getting agreement on a climate treaty after 2012, including the definition of the framework to be adopted for REDD and its ties to the carbon trading market. Because of this lag and uncertainty, public financing for REDD through donations has the potential in the meantime to catalyze a transition from incipient and fragmented activities to a national or subnational[69] (state-level) system for deforestation reductions, which, in the future, could be linked with the emerging markets in emissions reduction compensation. Nevertheless, this opportunity could be easily lost if the public resources for REDD were to be poorly managed.

The investment of these resources should be follow the recommendations made at the international level for the gradual development of REDD (Meridian Report OAR, 2008). In this approach, investments should be made in stages. Initially, efforts should concentrate on developing capacities at the national level for handling REDD programs. In a second stage, policies should be implemented for regulating specific activities that will form the foundation for the final phase, a national REDD system. This system should be sufficiently flexible to adapt to different possible scenarios for regulation, whether they are constructed from top to bottom (for example, through an obligatory international accord) or from the bottom up (such as the existence of various interconnected carbon markets permeated by bilateral agreements or even between states within the same country). Despite the importance of a gradual investment of public resources following these phases, there has been little analysis so far of how the transition between each stage should take place and how these can coexist in the same country. To do so, it will be necessary to consider the national and subnational realities and to evaluate possible regulatory frameworks that a national REDD program would require.

Although several national frameworks have been suggested for facilitating REDD mechanisms, few will allow the transition from a REDD system supported by public resources to one linked

69 The term "subnational" is often used in a broad sense to encompass various levels of REDD programs that operate below the national level. For the purposes of this text, "subnational" refers to states and municipalities.

to markets in carbon emission reductions. No matter what framework is implemented, however, the success of REDD strategies in Brazil will depend on the ability of the country to reorient rural development toward paths or models that are based on the maintenance of the forests. For this, REDD must provide the motivation for government agencies, civil society, and the private sector to systematically formulate investments, environmental policies, institutional structures, and rural services (education, rule of law, health, and technical assistance), with the goal of allowing a non-traumatic replacement of economic activities that depend on deforestation. As we have seen, a REDD program should also (i) reduce the risk of emissions leakage, (ii) diminish transaction costs, (iii) involve a wide range of forest actors, (iv) simplify the system of monitoring, reporting, and verifying (MRV) the loss of forest cover, and (v) increase the probability of a global reduction of greenhouse gas emissions. Finally, the reasoning underlying the negotiations of the UNFCCC and of national and subnational legislative processes is based on REDD initiatives focused on nation-wide systems. Thus, REDD financing using public resources should be directed, first and foremost, at helping to move countries toward successful REDD programs at the national level.[70] Table 9 provides a summary of the recommendations on how public resources should be utilized, if Brazil decides to access them.[71]

Table 9 - Recommendations for investments of extant public resources (see Table 5) in formulating a strategy for a national REDD program in Brazil.

	Assumption	Where to invest REDD resources
National REDD strategy and program	If the country wants to implement a compensation system for deforestation reductions, it should be credible, transparent, and attractive. Given the advances made so far, the country could formulate and implement such a strategy within one year.	To formulate a national REDD strategy and, subsequently, a national program, investments should support: (1) a process for consulting civil society, (2) the pursuit of policy analysis, (3) the institutional framework necessary for maintaining a REDD program, and (4) improvements in systems for monitoring deforestation emissions.
State/subnational REDD programs	Most of the Brazilian forests are currently found in states (AC, MT, and PA) and municipalities that have begun developing REDD programs. These subnational programs seek to develop REDD programs capable of meeting the requirements of compensation systems emerging in the U.S. and other countries. State REDD programs serve as the foundation for integrating activities within a national REDD program.	"Investing in the coordination of state REDD programs should be a priority as a strategy for seeking regional consensus that lends political and technical support to a national REDD program. Also, investments should incentivize the transferral of experience from Amazonian states to those in the cerrado savanna."

70 FCCC/AWGLCA/2009/L.7/Add.6. 15 December 2009

71 Up to now, the Brazilian government has not accessed any of the funds listed in Table 5.

	Assumption	Where to invest REDD resources
Private sector investments	A REDD strategy will be successful only if it is attractive to private investors, since they represent the foundation (through the market) of the long-term success of a national REDD program. A national and/or subnational (state) program offers greater environmental integrity than isolated projects, but this approach is still viewed as high risk by private investors.	"The investment of public resources in REDD should serve to incentivize future private investments in REDD activities at the national and state/municipal levels. This will be crucial for gaining investor confidence in broad REDD programs, not simply individual projects. Proper investments through public funding could reduce risks for private investors, creating a secure climate even if REDD activities do not fulfill expectations. This situation would promote private-public partnerships that would give private investors the right to a bundle of future REDD credits. Furthermore, extant public resources should support the development of policies and institutional capacities so that REDD activities, operating through subnational and national programs, can connect with the regulated carbon markets currently being developed."
Low carbon emission rural development	The long-term sustainability of a national REDD program is threatened by the tendency of world demand for grains and meat to rise (Nepstad et al., 2009). The guarantee of a sustainable national REDD will depend on investments in formulating policies that stimulate low carbon emission rural development.	Public investments should be made in developing systems that use certification methods to compensate farmers for following good agricultural practices and preventing deforestation on their property. Certification criteria should include prohibiting crops in recently deforested lands. However, these certification systems run the risk of failing due to the high cost of their implementation and compliance by farmers. They should therefore be promoted in the short run.
Indigenous and traditional populations	"A national REDD strategy will be sustainable only if incentives exist for programs that compensate populations that live in and from the forests. Indigenous and traditional populations and other local communities that serve as guardians of vast areas of forests should receive compensation. "	"Public investments can promote institutional reforms and policies necessary for providing systematic, lasting improvements for forest-dependent populations. Programs for productivity and investments in improving the quality of life of these populations, as well as the protection of their lands, will be crucial for keeping a large part of Amazon carbon stocks intact. Flexible financing will be necessary for promoting the capacity-building of these populations so they can adequately deal with climate change and develop their own programs for adapting to the problem."
Organized civil society	A strategy that leads to a sustainable and fair national REDD program will be possible only with an organized civil society capable of participating in processes for formulating such a program.	"Prior funding arrangements should help to create, sustain, and bolster nongovernmental organizations and associations representing social movements, both local and national, which can assist with innovative, objective, technically competent contributions and lend legitimacy to the processes of consultation and participation of society in discussions of a national REDD program. This support should also be applied to strengthening emerging networks among interest groups in various jurisdictions in order to foster connections among different actors in a coordinated fashion to develop REDD activities."

There are several points where public resources that are currently available (Tables 4 and 5) could be applied to support the development of a national REDD system (see Figure 9). Each country, depending on the stage of maturity and capacity it has reached in relation to REDD, will require a different balance of financing on the basis of distinct points of entry. However, as a general rule, coordination among the levels of activity should increase according to how far a country has advanced in developing a REDD strategy.

Financing through public funds should be set up as part of a strategy oriented toward supporting the three points of entry shown in Figure 9, bearing in mind the development of a national REDD system. In summary, to ensure that the subnational activities and individual projects of REDD contribute toward this aim, they should:

- Be compatible with a national REDD system, which, for its part, should be congruent with the policies of regional development and with the goals of PNMC;
- Be recognized by national governments through appropriate approvals, registration, and authentication;
- Provide guidelines that demonstrate integrity and consistency, whether by means of direct links to structures situated at the national level, credit allocations or accounting systems (such as the system proposed for the states in the Brazilian Amazon) or through government endorsement in transition to independently verified baselines and carbon accounting;
- Build the capacity for monitoring, reporting, and verification, which contributes to the consolidation of national systems;
- Encourage policies and programmatic links that deal with those responsible for deforestation and the risks of leakage through integrated approaches or transfers of financing that would enable broad, consistent strategies to be formulated;
- Contribute toward strengthening safeguard systems that are compatible with the rights of indigenous peoples and local communities.

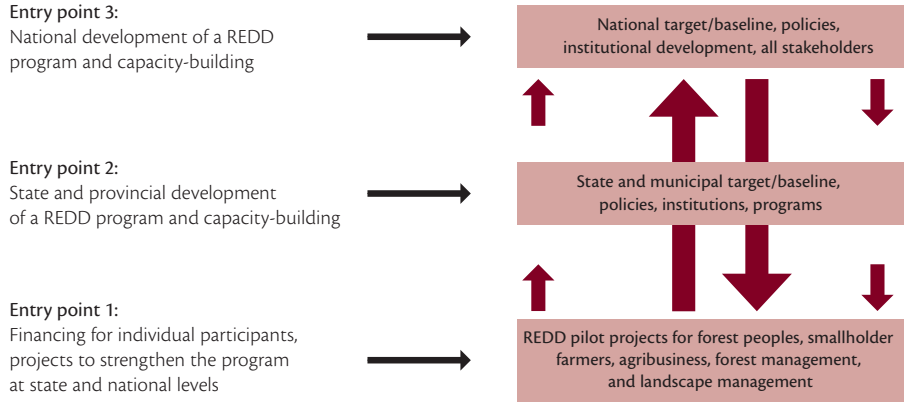

Figure 9. Coordination of financing between different scales and "entry points" of an action. Financing is necessary for activities that will push forward legislation of a REDD development program at the national, state, or municipal level, entailing policy alignment, promoting institutional innovation, involving stakeholders, and furthering the lessons of successful projects in order to help expand the levels of governance on stronger foundations.

PART V
A National REDD Strategy for Brazil: Models and Institutional Structures

The global REDD mechanism is, most notably, a means for providing financial compensation to developing countries that, through their own efforts, implement national structures for monitoring, recording, and verifying (MRV) (Principle 9) and thereby demonstrate reductions of carbon emissions within their borders. As such, Brazil is positioned to be the country best prepared to take advantage of this mechanism. Given the implementation of the National Climate Change Plan and the PNMC, a great potential now exists for an advanced REDD strategy in Brazil to be formulated, based on an Amazonian perspective. This strategy should be capable of integrating various sectors of society and levels of government in working toward a common objective of reducing deforestation (Principle 10). For such a strategy to be effective, however, it will be crucial to find a political consensus that integrates national actions related to the PNMC with the emission reductions resulting from plans and programs established by the Amazonian states (subnational level) and from local projects carried out by social actors directly responsible for conserving the forests (rural producers, indigenous peoples, and traditional populations) (Principle 3).

To increase the likelihood of success in a national REDD strategy, it is also necessary to pay close attention to the avenues through which the potential financial benefits of REDD are distributed (Principle 4). It is not enough to distribute benefits solely according to the contribution made by social sectors or states toward reducing emissions in the Amazon; it will also be necessary to valorize efforts made to conserve forest stocks, even those located in remote areas and not under immediate threat of deforestation. Otherwise, the benefits of REDD would be directed mainly to those who deforested a great deal in the past and who are now reducing their emissions. For example, if financial compensations from REDD were directed to the states as a function of the contribution of each one toward reducing deforestation in the Amazon as a whole, the states with historically high rates of deforestation would be the greatest beneficiaries. Between 2006 and 2010, more than 50% of the reduction in deforestation in Amazonia took place in Mato Grosso (MT), meaning that, according to this logic of distribution, an equivalent proportion in REDD compensations would be given to this state. On the other hand, Amazonas, the state that contains the majority of the forests in the region and which historically has shown low rates of deforestation, would be given less than 10% of the potential compensations. Obviously, the contribution of Mato Grosso toward reducing

deforestation in this period was very good news, since maintaining standing forests in this state is more costly than in Amazonas. Moreover, comparatively speaking, the profitability of agriculture and ranching was two times greater in Mato Grosso (Nepstad et al., 2009), which explains, to a large extent, the high historical rate of deforestation. However, maintaining forest stocks in remote areas is equally crucial, since in the future these could be threatened with destruction.

Obviously, insistence on a model for distributing REDD benefits based on a "pure" criterion, taking into account only the reduction in emissions flow, would encounter strong political resistance among the Amazonian states. To avoid this problem and fulfill the basic principles of a REDD system, this section presents two models for structuring and operationalizing such a system. The purpose of these models is to contribute toward the formulation of a national REDD strategy based on the Amazonian context, but it does not represent a finished proposal. Both are designed to accommodate resources coming from public funds (donations) (see Table 5) as well as from a mandatory or voluntary market (using carbon credits).

National REDD System: Model I

Emerging from the active participation of the states in Brazil's Legal Amazon region, this model proposes that a "state REDD system" be implemented in each one (administered by its state registry agency, or AER). Each AER would be regulated and monitored by the federal government through a "federal REDD system" established in line with the aims of the PNMC. States would receive financial compensation based on emission reductions in the Amazon region according to three basic criteria: (1) their contribution toward emission reductions (flow) within a given time frame; (2) the amount of forest stock in their territory; and (3) their performance in fulfilling their promised state targets for reducing deforestation. Each state would have to complete four stages before compensations, via REDD, would be granted to its programs and projects:

First stage (Model I): Calculation of reductions in emissions from Amazonian deforestation

In this stage, the federal government, using PRODES/INPE data, would calculate reductions in Amazon deforestation (and, later, in other types of biomass) that occurred during a particular period. Based on these figures, the amount of avoided emissions would be calculated by subtracting the amount of deforestation recorded by PRODES for a particular year from the historic average amount

of deforestation calculated by PNMC as a baseline for a given period (average deforestation of the ten previous years). The first period would extend from 2006 to 2010 and would be compared to a baseline derived from the average rate of deforestation in 1996-2005 (19,625 km2). For five-year periods after that, the baseline would be revised downwards, as determined by the National Climate Change Plan and the PNMC (Table 10). Thus, if Brazil fully achieved its targets for deforestation reduction in the Amazon by 2020, the potential amount of reduced emissions would be on the order of 5.7 billion tCO_2 (Table 10).

Second stage: Conversion of reduced emissions from deforestation into REDD certificates (C-REDDs)

After determining the amount of avoided emissions (in this case, 5.7 billion tons of CO_2 by 2020), a portion (for instance, 50%)[72] could be made available to the Amazon states in the second stage, following certain criteria that would allow states to issue "certificates of reduced emissions" (C-REDDs, or REDD certificates).[73] The remaining 50% of avoided emissions could be allotted to federal government programs, such as the Amazon Fund, or could be used for obtaining public resources and donations seeking to invest in forest sectors or in traditional and indigenous communities. The Brazilian government could also assume responsibility for this part as a voluntary national contribution to the mitigation of climate change. In this example, half of the avoided emissions would not be made available to the markets in carbon trading or offsets.

According to the calculations in this second stage, if 50% of the emissions avoided during the period 2006-2020 were allocated in REDD certificates (totaling 2.85 billion C-REDDs), which were then traded for carbon credits at a ratio of 1:1, the potential amount of financial resources from the trade of these credits would be somewhere in the range of US$ 13- 41 billion by the year 2020[74]. This would obviously represent a much higher sum than the potential amount committed to the Amazon Fund up to now (around US$1 billion promised so far).

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72 This percentage is merely illustrative. The federal and state governments could arrive at a proportion by applying a certain criterion or by consulting members of society.

73 1 C-REDD = 1 tCO_{2e}.

74 This calculation uses a value of a minimum of US$ 5/tCO_2 and a maximum of US$15.

Table 10 - Baseline established by PNMC, rate of deforestation (in km2), reduction in deforestation (in km2), and reduction in CO_2 emissions (in millions of tons) in the Amazon biome (2006-2020)**.

	2006*	2007*	2008*	2009*	2010*	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	*Total*
Baseline	19.625	19.625	19.625	19.625	19.625	16476,1	16476,1	16476,1	16476,1	16476,1	8577,3	8577,3	8577,3	8577,3	**8577,3**	**223.392**
Rate of deforestation	14286,0	11651,0	12911,0	7464,0	6451,0	6602,0	6602,0	6602,0	6602,0	6602,0	3829,2	3829,2	3829,2	3829,2	**3829,2**	**104.919**
Reduction in deforestation	5.339	7.974	6.714	12.161	13.174	9.874	9.874	9.874	9.874	9.874	4.748	4.748	4.748	4.748	**4.748**	**78.609**
Reduction of CO_2 emissions	259,0	386,8	325,7	589,9	639,1	479,0	479,0	479,0	479,0	479,0	230,3	230,3	230,3	230,3	**230,3**	**5.747,24**

*Rates of deforestation recorded by PRODES. Other figures (from 2010 on) are projections, assuming that the country will reach the reduction target. Baseline for the period of 2006-2010 is the average deforestation of the period 1996-2005. The baseline of following periods are the average deforestation of their previous 10 years. Decree 7390/2010 establishes 132,3 ton of carbon per hectare.

**Adopting the methodology proposed by the Amazon Fund, the central message of the REDD book remains unaltered, but some of the target figures has changed. The methodology is now the same one adopted by the Federal and State governments.

Third stage: Distribution of C-REDDs

As soon as a decision was made about how many REDD certificates should be distributed to each state, the latter could then allocate its certificates to state REDD programs and projects. The distribution would follow the three criteria mentioned above: (1) the state's contribution toward emission reductions (flow); (2) the amount of existing forest stock; and (3) the fulfillment of state targets for reducing deforestation. Achieving this last criterion would generate a "bonus" in C-REDDs for its performance in reaching its target. A minimum target for emission reductions would be stipulated for each state according to the proportional contribution it made toward fulfilling the target set for the Amazon by the PNMC (80% reduction below the historic baseline up to 2020). The total amount of avoided emissions (2,85 billion tCO_2) to be converted into C-REDDs would depend on Brazil fulfilling its target for reducing Amazonian deforestation. If all of the three preceding criteria were applied, the distribution of the certificates among the states would be more balanced than if only the reduction in deforestation rates were taken into account. Table 11 and Figure 10 illustrate a hypothetical distribution of 2.85 billion C-REDDs among the states. It uses the hypothetical proportions of 30% of the total for emission reductions (flow), 50% for forest stock each state maintains, and 20% as a bonus for states that completely fulfill their reduction targets. These proportions in the distribution of C-REDDs could be altered, of course, in response to political negotiations. This flexibility would likely make the system more acceptable to the Amazonian states.

Table 11 - Distribution of REDD certificates (in millions of tons of CO_2) to Amazon states, based on criterion of contribution to reduction in emissions (flow), considered singly and in combination with criteria of forest stock and fulfillment of state targets for emissions reductions. Values are calculated for the period 2006-2020 (see text for more details).

State	Compensation for flow reduction		Compensation for flow reduction, forest stock, and target achievement	
	$MtCO_2$	%	$MtCO_2$	%
Acre	77	3	159	6
Amapá	0.7	0	88	3
Amazonas	108	4	767	27
Maranhão	137	5	88	3
Mato Grosso	1172	41	584	20
Pará	894	31	683	24
Rondônia	421	15	258	9
Roraima	30	1	125	4
Tocantins	31	1	108	4
Total	**2,87**	**100**	**2,87**	**100**

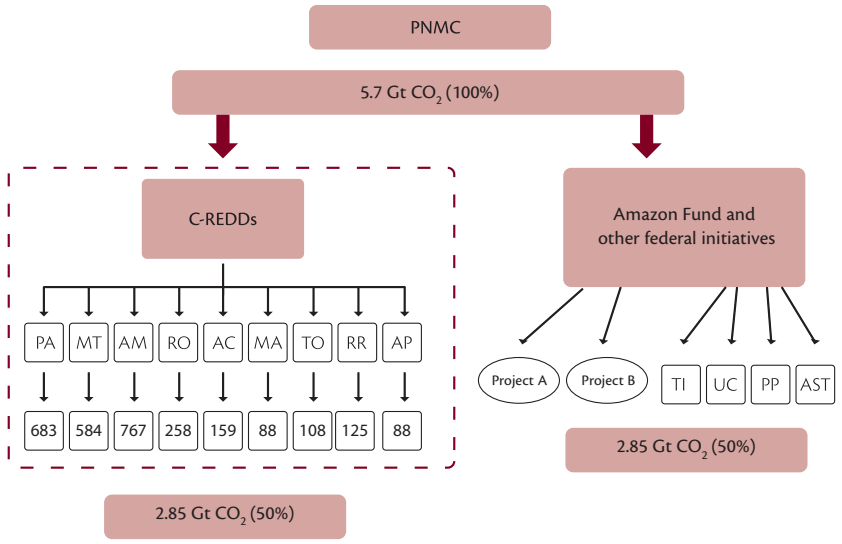

Figure 10. Model of distribution of REDD certificates (C-REDDs), based on the fulfillment of targets for reducing emissions from deforestation (5.7 billion tons of CO2) in the Brazilian Amazon for the period 2006-2010, established in the National Policy for Climate Change (PNMC). State abbreviations: PA – Pará; MT – Mato Grosso; AM – Amazonas; RO – Rondônia; AC – Acre; MA – Maranhão; TO – Tocantins; RR – Roraima. The distribution of C-REDDs (2.85 billion tons of CO2) among the states would be made according to the contribution of each one toward reducing deforestation in the Amazon, the forest stock present within their borders, and their performance in fulfilling state targets for reducing deforestation. The rest (50%) of the emissions avoided through the PNMC would be allocated to projects of the Brazilian government and to the maintenance and protection of protected areas, specifically: TI – Indigenous land; UC – Conservation Units; PP – private properties; AST – Forest Settlements). See text below for more details.

Fourth stage: Registration and certification of REDD programs and projects

Once the C-REDDs have been distributed (in the previous stage), the states can allocate them to their REDD programs and projects, after registering them through the state AER. Those projects or programs demonstrating compatibility with the principles and strategies defined in the State Plan for the Prevention and Control of Deforestation (PPCD) would be given priority for registration and for receiving REDD certificates. Through the national REDD system, the federal government would create an agency open to the participation of civil society and the states for defining the general parameters and principles for integrating the subnational (state) strategies of REDD with the PNMC. This agency would also mark some of the C-REDDs as a "reserve" or "security" to cover possible leakages or an unexpected increase in future emissions.

The registration of projects and programs would take place in two stages:

a) **Pre-registration:** To get pre-registration, proposals for programs or projects should be submitted to the state REDD office or relevant state agency, containing information about the amount of emission reductions to be achieved for a particular period. The REDD office would evaluate the methodological consistency of the proposal and its potential for reaching its targeted emission reductions. It would also consider how well it fits into the strategies defined in the PPCD. In this way, projects and programs would compete among themselves during the same commitment period. Once approved by the state agency, these projects and programs would be entitled, through pre-registration, to find investors.

b) **Final registration:** The final registration would take place as soon as information about the reductions achieved have been reported and verified, after the pre-registration commitment period is over. This is the point at which a REDD certificate becomes concrete, corresponding to the reduction actually verified and registered in the state system (see figure below, with a description of the stages in the process). These certificates can then be converted into carbon credits.

The brief discussion of these four stages outlines a proposal for a confederated agreement that can integrate subnational REDD projects, programs, and plans into a national system negotiated by the federal government, states, and civil society (see Figure 11). This agreement would address: (1) the institutional structure, (2) the economic instruments to support the national strategy; (3) the criteria for recognizing and validating subnational actions as part of the National Policy on Climate Change; and (4) an equitable arrangement for benefit-sharing that uses a nation-wide accounting system based on reductions in emissions from deforestation and forest degradation and national targets for emission reductions. This would allow subnational actions (programs and projects) to have fair access to REDD resources, including those coming from public funds as well as those from the emerging carbon market.

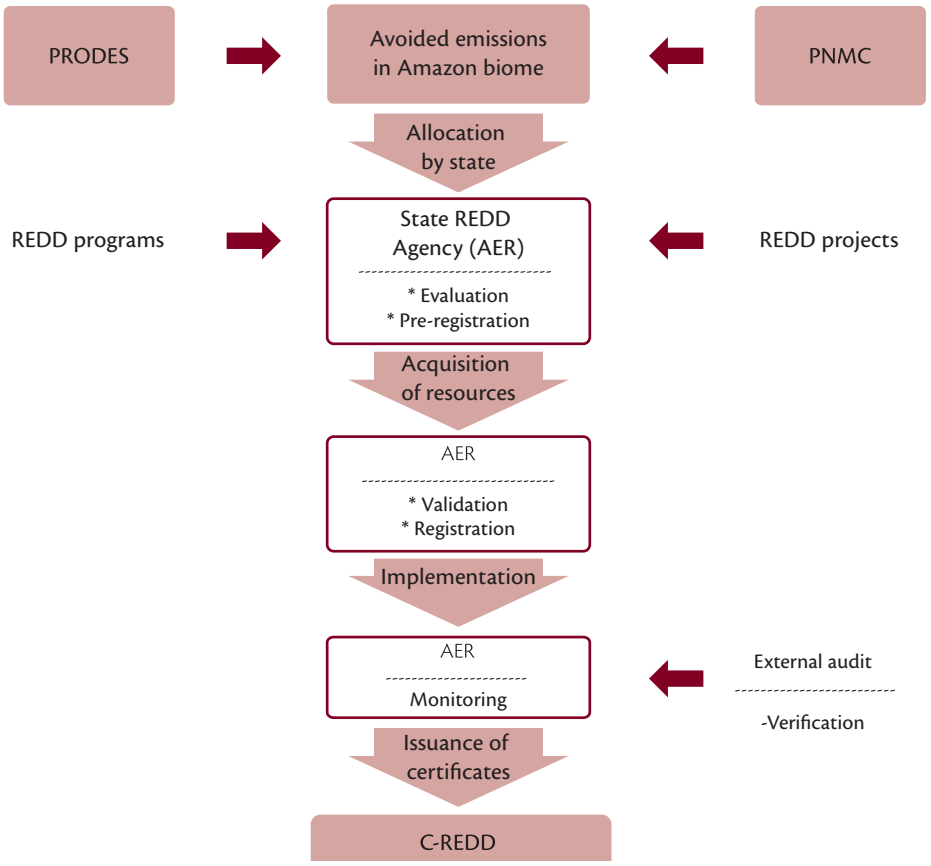

Figure 11. Phases in the REDD project/program cycle in Model I.

National REDD System: Model II

As an alternative to Model I for a national REDD system, Model II offers a different structure for sharing the benefits derived from REDD. The focus is on the contribution of different land-use categories, rather than the states, to the reduction in emissions from deforestation. The model assumes that different land-use categories exercise differing degrees of influence over deforestation and forest conservation. The categories chosen for this model are: indigenous lands (TIs), conservation areas and extractive reserves (UCs), rural settlements (AR),[75] and, together, unassigned public lands and private properties (TP/PP) (see Table 12). (The combination in this last category is due to the high

75 This covers all rural settlements implemented by INCRA.

level of uncertainty in land titling in the Amazon, which does not make it easy to clearly separate public and private lands.) The geographic distribution of these four land-use categories is illustrated in Figure 12, and the forest carbon stock of each category is listed in Table 12. The total area covered by the four categories corresponds to the total area of the Amazon biome. Appendix I contains details on the data and analyses utilized to define the various parameters for the contribution of each land-use category to deforestation reduction and forest conservation.

As in the first model, the second one follows certain stages, described below, that allow a national REDD system to be implemented.

First stage (Model II): Calculation of reductions in emissions from deforestation

As in the previous model, the historical reference (baseline) uses the rate of deforestation taking place in the Amazon during the period 1996-2005 (19,625 km^2) in order to measure reductions in emissions from deforestation for the years 2006 to 2010. As outlined in the PNMC (see Figure 4), this baseline would be adjusted for each five-year period (2011-2015 and 2016-2020). For each period, the corresponding baseline would be divided up by land-use category. The resulting contribution to the reduction in the annual deforestation rate for each particular land-use category would be obtained by subtracting the deforestation rate recorded by PRODES for that category from its historical rate of deforestation. Thus, the avoided deforestation per year for each land-use category would be calculated by reducing the baseline amount by the current deforestation (up to 2009), or by the target set by PNMC (starting in 2010). In this case, considering the fulfillment of PNMC targets, the total of avoided emissions up to 2020 would be 5.7 billion tCO_2, the same figure obtained in Model I above..

Table 12 - Forested area (in millions of ha) and forest carbon stock (in tons), by land use category in the Brazilian Amazon.

"Land use category"	"Total area (hectares) "	Area of original forest (hectares)	Area of forest in 2008 (hectares)	Area of non-forest (hectares)	Area of deforested forest up to 2008 (hectares)	Carbon stock in forest (tons)	Carbon stock in non-forest (tons)	Total carbon stock (tons)	Average density of carbon (tons per hectare)
Public lands and private property	268,376,425	184,336,566	128,845,154	74,644,253	55,491,412	17,330,981,528	2,694,570,642	20,025,552,170	98
Indigenous Lands	101,561,076	88,471,279	87,217,211	12,502,989	1,254,068	12,090,011,243	850,903,364	12,940,914,606	130
Sustainable Use Conservation Area	53,011,489	51,103,145	49,784,935	1,204,782	1,318,210	7,622,713,913	178,747,219	7,801,461,132	153
Full Protection Conservation Areas	37,304,345	31,233,655	30,820,237	5,547,700	413.418	4,477,771,778	441,152,116	4,918,923,894	135
Settlements	33,291,961	30,019,412	17,096,973	2,839,826	12,922,439	2,317,756,613	190,499,536	2,508,256,149	126
Quilombos	930.204	854.676	768.963	67.592	85.713	138,998,715	6,740,510	145,739,225	174
Overlap between protected areas*	6,817,603	5,893,953	5,861,020	900.976	32.933	857,545,268	73,679,370	931,224,638	138
Total	**501,293,103**	**391,912,686**	**320,394,493**	**97,708,118**	**71,518,193**	**44,835,779,055**	**4,436,292,758**	**49,272,071,813**	**136**

See Appendix I for details on methodology used to calculate stocks.

Second stage: Determination of carbon stocks by land-use category

As in Model I, the distribution of REDD benefits among land-use categories should take into consideration the forest carbon stock contained in each one. The remaining forest stock would be calculated using data from PRODES. To find out the forest stock in subsequent periods of reduced deforestation, as specified in the PNMC, this amount would be subtracted from rates of current deforestation (up to 2009) and future deforestation (starting in 2010), in light of the fulfillment of Brazilian targets set by the PNMC by 2020.

Third stage: Allocation of C-REDDs to sector funds established for each land-use category

If the PNMC targets were fully met, the amount of avoided emissions would be 5,7 billion tCO_2, as noted earlier. The value of this amount would then be distributed among four funds set up by the federal government, matching each of the land-use categories previously identified (see Figure 12). This distribution would be made according to the proportional contribution of each category to the deforestation reduction as well as to forest stock conservation. If the distribution were made considering only one of these criteria (flow reduction or stock reduction), discrepancies would result, as demonstrated in Table 13. A more balanced distribution would allow a situation in which all the land-use categories in the Amazon could participate more actively in a national REDD system. After the distribution took place, the amount of avoided emissions allocated to each fund could be converted into C-REDDs and distributed to programs and projects related to the activities for deforestation reduction and forest conservation, grouped according to land-use category.

The proposals for these projects and programs would first be submitted to a process of pre-registration and final registration, as described for Model I. Figure 13, below, summarizes how Model II would be operationalized. The funds would be set up within a federal REDD system through a committee or commission made up of representatives from the public. Each fund would be created in a different way, depending on the social sectors (representative entities, social movements, businesses, etc.) involved in each land-use category.

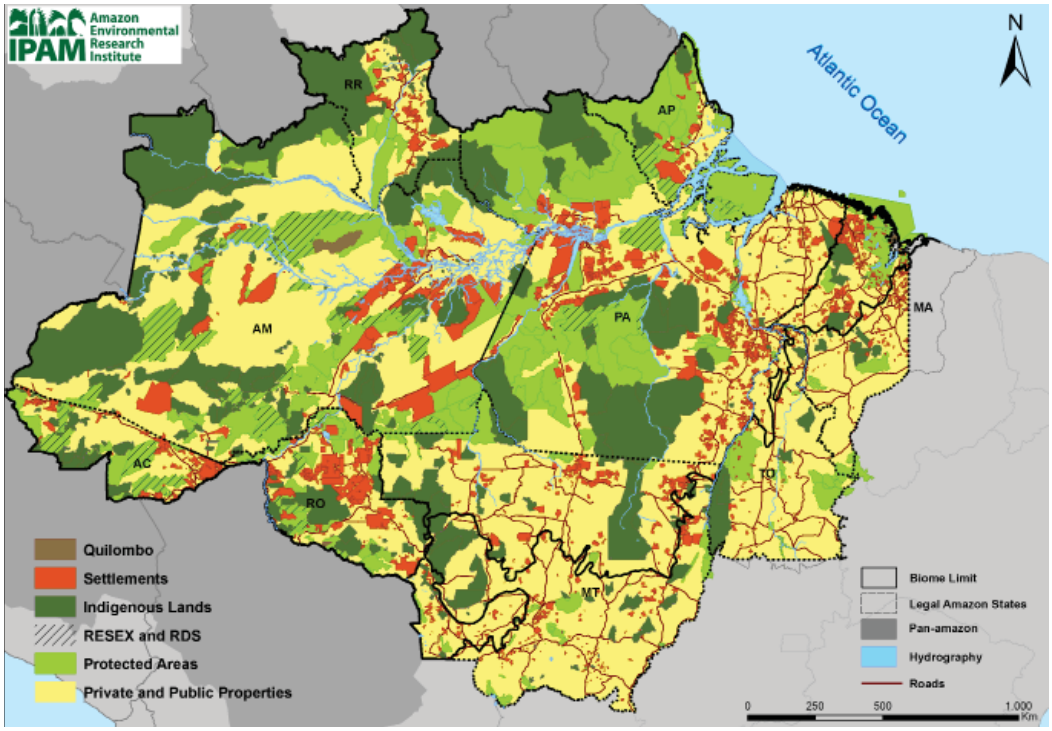

Figure 12. Land-use divisions in the Legal Amazon (see details in Appendix I on methodology, mapping, and forest carbon stock for each land-use category).

Table 13 - Distribution of C-REDDs (in millions of tons of CO2) among different land use categories considering the criterion of contribution to reduction of emissions (flow) and its combination with forest stock. Values are calculated for the period 2006-2020 (see text for more details)..

Land use category	Compensation for flow reduction only		Compensation for conservation of forest stock only		Compensation for both flow reduction and stock conservation	
	$MtCO_2$	%	$MtCO_2$	%	$MtCO_2$	%
Indigenous lands	128	7	1539	27	855	15
Conservation areas	276	9	1425	25	855	15
Rural settlements	1.176	25	285	5	855	15
Nonassigned public lands and private property	3.108	59	2394	42	3078	54
Total	5.700,00	100	5.700,00	100	5.700,00	100

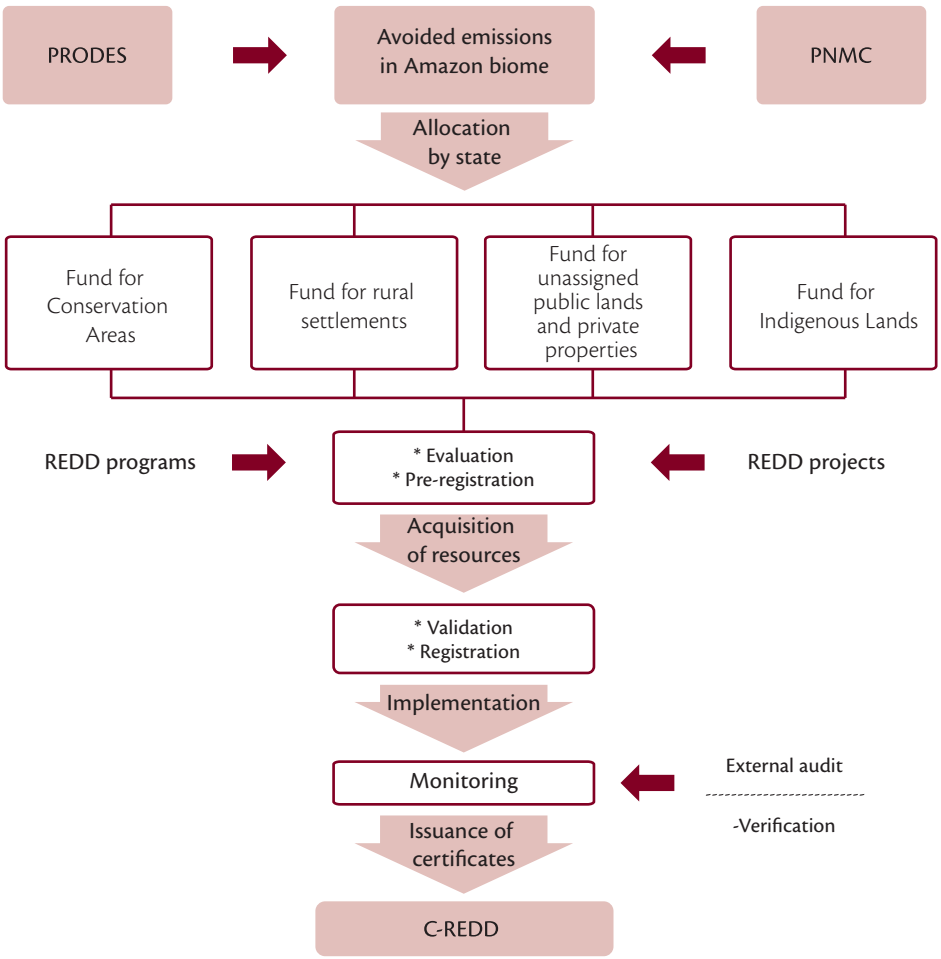

Figure 13. Phases in the REDD project/program cycle in Model II.

A third and final alternative model for a national REDD system could be developed from combining the two models discussed above. In this case, Model II would be incorporated into Model I, with the former serving as a criterion for distributing resources to the AERs within the states. In other words, the distribution of C-REDDs within the states would take place according to the contribution toward deforestation reduction and forest conservation in each land-use category identified in the state. This model, however, will not be analyzed here.

The models discussed above follow a "nested approach," that is, they refer to a structure in which the REDD programs and projects are compensated to the extent that they lead to reductions on both the subnational and national levels (Pedroni et al., 2007). This nested approach is gaining wide acceptance in the international context. Furthermore, the two models are supported by the PNMC objectives and, consequently, operate within a framework for partially or fully reaching the target reduction in emissions from deforestation, as established for the Amazon. It is not the intention here to offer a detailed analysis of the pros and cons of the two models presented above, since this can be freely discussed in other contexts. However, it can be noted that Model I has encountered resistance from various social sectors, especially among social movements, which consider the power given to the states to be excessive, even if society participates in decision-making on the allocation of C-REDDs. Model II, on the other hand, concentrates the power of regulating and distributing C-REDDs in the federal government without necessarily involving the states. This situation risks running into political difficulties with the states, since the federal government has been implementing a policy of decentralizing actions that deal with the environment, passing more decision-making power to the states and requiring them to elaborate their own plans for reducing deforestation. Problems would arise if the states were not also granted the power to allocate certificates. Model II would be more acceptable to those who make efforts to conserve forests, regardless of the location of their areas. The combination of the two models would perhaps represent a conciliatory solution. However, none of them would work if no firm guarantee exists for the participation of society in elaborating and applying the criteria for distributing C-REDDs. Much can be learned in this regard from the Amazon Fund.

A national REDD system inspired by Models I and II, or some variant of the two, would not only facilitate the implementation of a financial mechanism for giving financial value to the Amazon forest, but would also contribute greatly toward fulfilling the objectives of the PNMC. This is especially true regarding the Sector Plan for reducing deforestation, elaborated by the federal government as a framework for implementing the PNMC. The proposal for a national REDD system to be initiated in the Amazon region should thus be considered a crucial avenue for attaining the desired targets.

Final Considerations

Future perspectives for REDD in Brazil

To evaluate the situation in the Amazon today in terms of the transition to a sustainable model of development, it is necessary to recognize a basic reality that is not always perceived in the common view of the problem, even at the international level. This concerns the fact that the struggle to save the Amazon rainforest is not in its final stages, but, rather, in its initial ones. The current phase is a historic moment in which it is still possible to work toward the conservation of more than 80% of the original forest and, at the same time, to make use of the 70 million hectares (of which 20 million are abandoned) that have already been deforested. Continued deforestation, combined with the threat of climate change, puts the country at risk of losing its centuries-old treasure in a relatively short time.

Understanding that the destruction of the forest is still in its early stages and that the recent reduction in deforestation rates in the region can be threatened by infrastructure investments, the world demand for grains and beef, and changes in legislation should serve as a warning to Brazilian society. Without an economic mechanism that valorizes the forest and compensates efforts on behalf of its conservation, it will be difficult to keep them standing.

The most comprehensive and immediate mechanism that recognizes the value of the forest and benefits from the engagement of the national and global communities is REDD. If Brazil seizes the chance to utilize it, the country will have to acknowledge four essential issues: (1) the crisis in the climate system is an unprecedented one, which can compromise the possibility of life on earth and bring inconceivable consequences to future generations; (2) such climate change will be permanent; (3) the reduction of Amazonian deforestation does not represent a threat to the country's growth or an undesirable economic cost, but, rather, a prime opportunity to mitigate greenhouse gas emissions at a low cost with high future economic returns; and (4) reducing deforestation and conserving forests can invert the economic logic of the region in which economic growth, which currently requires deforestation, can be sustained by a system of payments for environmental services performed by the forests, preventing a wide array of harmful consequences in the future.

In the international context, Brazil must also pursue discussions on the mechanism of REDD, so that it can take advantage of the opportunities that open up, as well as generating more optimism in other countries about the viability of implementing REDD. In general, there is substantial political and financial uncertainty surrounding the development of a coherent, comprehensive approach to confronting climate change. No consensus emerged at the COP15 meetings for an accord among the various nations. Despite these uncertainties, REDD was the topic of the most successful discussions, which have continued to move forward and attract investments. Within the U.S. and specifically the state of California, substantial opposition and obstacles lie in the way of implementing an internal system of cap-and-trade for reducing GHG. This system could create a significant market for carbon credits from REDD, but the discussions in the U.S. Congress are far from over, leading possibly in the near future to approval of limits on emissions using approaches that may include REDD. Many nations are showing a high level of enthusiasm and interest in REDD, as exemplified in the financing initiatives and debates mentioned earlier. Various countries are already involved in processes to formulate REDD strategies and initiate national reforms, such as promoting the engagement of their citizenry, encouraging pilot programs, and creating monitoring systems. Among these countries, Brazil is the most prepared, as we have seen, but it has also made the least progress, considering the potential it has in this arena. A national REDD system in Brazil must be geared toward building foundations at the level of the states or particular sectors of society. In the absence of a carbon market grounded in mandatory emission reductions, a relatively rapid disbursement of the US$4 billion available in public funds could encourage private investors to move forward, creating funds (by sector) in partnership with public funds, following the public-private model.

To take advantage of the opportunity for development within a new economic order of low carbon emissions, promising future benefits to a warming climate, developing countries with forestlands should be institutionally prepared to formulate national REDD systems in an effective and transparent manner. There is no point in Brazil promoting the development of numerous REDD projects if these are not regulated and incorporated into a national system that gives them room to operate in an orderly manner. The planning of a national development strategy that takes advantage of resources flowing from REDD should not only give priority to investments in programs involving payments for environmental services, but also in other areas, such as the education and capacity-building of populations that historically have already contributed toward the fight against deforestation and its resultant climate changes. REDD resources will be vital for altering the logic of production in previously deforested areas, through investments in technical assistance, policies for price support, local infrastructure, adaptation to climate changes, and others. This opportunity is unique and, perhaps, the last.

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Appendix

To show how Model II applies to the distribution of REDD benefits (Figure 13), calculations were made of the contribution of different land-use categories to the reduction of emissions from deforestation, using the following categories: indigenous lands (TI), sustainable use and full protection conservation areas (UC), rural settlements (AR), and a combination of unassigned public lands and private properties (TP/PP) (the combined nature of this last category is due to the uncertainty surrounding land titles in the Amazon). The amount of forest carbon was calculated for each category. Details on the procedures used in these calculations are provided below.

Description of selected land-use categories

The land-use categories listed above were composed of different types of protected areas. Areas considered as protected are: (1) conservation areas, (2) indigenous lands, and (3) quilombos (settlements composed of descendants of escaped slaves). Military areas are excluded here, although some studies include them in protected areas.[76] In Brazil, conservation areas are currently divided into twelve categories in the National System of Nature Conservation Units (SNUC), and are initially separated into two broad categories: sustainable use conservation areas and full protection conservation areas. In the former, the objective is to reconcile conservation with the sustainable use of natural resources, while in the latter, the aim is to conserve biological diversity. The full protection category of UCs includes Biological Reserves (REBIO), Ecological Stations (ESEC), National Parks (PARNA) , Natural Monuments, and Wildlife Refuges. On the other hand, the sustainable use category of UCs encompasses Environmental Protection Areas (APA),[77] Areas of Relevant Ecological Interest (ARIE), National Forests (FLONA), Extractive Reserves (RESEX), Fauna Reserves, Sustainable Development Reserves (RDS), and Private National Heritage Reserves (RPPN). In these areas, diverse interests are linked to nature conservation, such as ecological processes and environmental services. Indigenous lands, for their part, are intended to offer social and cultural protection to indigenous peoples, and are included here as protected areas (Maretti, 2005) since they exercise a positive effect

76 The decision was made here not to classify military areas as protected areas since, although these areas are under the protection of the military and are therefore not deforested, they are not legally considered to be areas of environmental protection.

77 The decision was made not to consider APAs since they do not have restrictions on occupation and since the level of governance in these areas is not yet as high as that observed in other UCs.

on the conservation of Amazonian biodiversity (Nepstad et al., 2006). Until the end of the 1980s, full protection UCs constituted the majority of APs. Since 1986, the federal government made a great effort to change this situation, creating some 40 million hectares of sustainable use UCs and homologating almost 100 million hectares of TI (Soares-Filho et al., 2009). Currently, "43% (180 million ha) of the Amazon biome is protected under various designations, covering 51% of the remaining forest. Among these, 54% are TIs and 44% are UCs. Of the total number of conservation areas in the Amazon, 26% are supported by the program for Protected Areas of the Amazon" (Soares-Filho et al., 2009; see Table 1 of the annex, below).

Table 1 - Categories, number, and size of protected areas, indigenous lands, and military areas in the Amazon biome, and their proportions of the biome through the end of 2007.

Category		Number	Area (km²)	Proportion of Amazon Biome (%)	Proportion of Protected Areas supported by Amazon Protected Areas Program (ARPA)
Military Areas		6	26.235	0,6	-
Indigenous Lands		282	987.219	23,4	-
Full Protection	State	44	137.385	3,3	22,5
	Federal	37	231.072	5,5	80,6
Sustainable Use	State	72	201.918	4,8	13,2
	Federal	80	233.523	5,5	26,2
Total		**521**	**1.817.352**	**43,0**	-

Calculation of carbon stocks by land-use category

The carbon stock in each of the selected land-use categories was calculated by utilizing data that was "spatialized" in maps of forest carbon in the Amazon, published by Saatchi et al. (2007). These data were superimposed on data on deforestation from PRODES/INPE[78] and on the map of protected

78 This data included information on the amount of forested land, non-forested land, and deforested land for each of the Amazonian states, as well as for all of the protected areas in the Legal Amazon.

areas produced by the Socioenvironmental Institute (ISA, 2010),[79] making it possible to show the amount of carbon stock for each land-use category. Moreover, for each state, it is possible to show the areas that were deforested by 2008, along with the areas of forest cover and non-forest (cerrado savanna) in 2008, and to superimpose the outlines of the states in the Legal Amazon (IBAMA, 2010)[80] on the images of deforestation from PRODES. By superimposing the outlines of protected areas on the PRODES images, it was possible to show the deforested area in each land-use category under consideration. All the analyses were produced using ArcGIS software, version 9.2.

On the basis of data from Saachi et al. (2007), the final amounts of carbon stocks for each land-use category were obtained, including the areas of overlap among categories, and creating a new category for the areas of overlap among protected areas. In total, 380 TIs and 313 UCs were analyzed. The results obtained from the calculations described above are summarized in Figure 11 and Table 12 in the main text, and, in part, Table 2 in this appendix.

The compilation of the data indicates that the composition of protected areas in the Amazon encompasses 380 Indigenous Lands, 19 Quilombos, 125 Conservation Unit under federal jurisdiction (48 Full Protection and 77 Sustainable Use Conservation Unit), and 144 Conservation Unit under state jurisdiction (59 Full Protection and 85 Sustainable Use Conservation Unit) (see Table 2 in this Appendix). Within the Sustainable Use Areas, 70 are found in the RESEX category. The area covered by the set of these areas totals 199.6 million hectares (including 6.7 million hectares of overlap among protected areas). To obtain data on rural settlements, 2,139 projects were considered, using INCRA data (2010), which covered a total area of 33.3 million hectares.

79 The database of protected areas was updated and made available by ISA in February, 2010, through an agreement for assigning rights to the use of cartographic material, signed in 2006 by ISA and IPAM.

80 See http://siscom.ibama.gov.br/shapes/.

Table 2 - Conservation units described by jurisdiction, use, category, and forest carbon stock (including savannah) in the Legal Amazon.

Protected Areas				
Federal Jurisdiction		Total Area (in hectares) in 2008	Total Carbon Stock	Total Number of Areas
Use	Category			
Full Protection	ESEC (Ecological Station)	6.244.832	764.173.691	14
	PARNA (National Park)	20.412.909	2.905.648.858	24
	REBIO (Biological Reserve)	3.407.327	503.674.012	9
	RESEC (Ecological Reserve)	-	-	1
Sustainable Use	ARIE (Area of Notable Ecological Interest)	26.857	4.968.968	3
	FLONA (National Forest)	15.655.933	2.330.754.025	32
	RDS (Sustainable Development Reserve)	63.367	11.131.614	1
	RESEX (Extractive Reserve)	9.917.453	1.430.280.185	41
State Jurisdiction		Total Area (in hectares) in 2008	Total Carbon Stock	Total Number of Areas
Use	Category			
Full Protection	ESEC (Ecological Station)	4.568.323	669.184.896	10
	MONAT (Natural Monument)	32.646	499.822	2
	PES (State Park)	6.832.970	830.616.998	38
	REBIO (Biological Reserve)	1.278.868	194.782.964	5
	RESEC (Ecological Reserve)	117.199	17.506.550	2
	RVS (Wildlife Refuge)	118.424	3.759.143	2
Sustainable Use	ARIE (Area of Notable Ecological Interest)	26.189	2.863.268	1
	FES (State Forest)	13.097.641	2.076.689.932	17
	FLOREX (Extractive Forest)	984.998	146.474.631	2
	RDS (Sustainable Development Reserve)	10.538.275	1.736.767.890	18
	FLORSU (Sustainable State Forest)	880.822	122.045.020	18
	RESEX (Extractive Reserve)	2.928.508	416.304.644	29

**Not included are the 39 Environmentally Protected Areas (APA) and five categories that do not fit into the National System of Nature Conservation Units (SNUC), but are included in the database of protected areas listed by the Socioenvironmental Institute (ISA, 2010)..

The Legal Amazon refers to the total area of the states of Acre, Amazonas, Amapá, Mato Grosso, Pará, Rondônia, Roraima, Tocantins, and part of the state of Maranhão. Below is a brief description of the area under forest protection in each state within the selected land-use categories, as well as their respective forest carbon stocks. These data are also summarized in Tables 3 to 10 of this Appendix..

Acre

Acre covers an area of 15.2 million hectares, in which 47% lie in protected areas. The APs of Acre represent 14% of the APs of the Legal Amazon, which is 1.4% of the total area in the Legal Amazon. Of the total forested area in 2008, 53% was found in protected areas, 40% in private properties and unassigned public lands, and 7% in settlements. The amount of forestland that was deforested by 2008 in the state was 1.8 million hectares, representing 3% of the total deforested area in the Legal Amazon. Of the total carbon stock in the state, 16% was found in TIs and 35% in UCs. The state has an average carbon density of 110 tons per hectare..

Amapá

Of the total area of 14.2 million hectares encompassed by the state, 11 million hectares lay in forested area and 2.6 million in non-forested area in 2008. Eighty-two percent of forest area was found in protected areas. The state of Amapá revealed the lowest amount of deforestation by 2008 in forested area of any of the states in the Legal Amazon, representing 0.3% of the total deforestation. The total carbon stock represents 4% of the stock in the Legal Amazon. The state has an average density of 137 tons of carbon per hectare.

Amazonas

Amazonas is the state with the largest area, representing 31% of the Legal Amazon. Of the total area of forested area found in Indigenous Lands in the Legal Amazon, 43% was found in Amazonas. The state represents 45% of the forested area in all of the Legal Amazon. Of the total deforestation in the state by 2008, 2% lay in TIs, 9% in sustainable use UCs, 3% in full protection UCs, 0.33% in quilombos, 20% in rural settlements, and 66% in private properties and unassigned public lands (PP/TP). The total carbon stock of the state exceeded 23.6 billion tons, revealing an average density of 161 tons of carbon per hectare.

Maranhão

In the state of Maranhão, 79% of its total area is included in the Legal Amazon. Within this area, 8% is found in TIs, 5% in full protection UCs, 0.3% in sustainable use UCs, 0.4% in quilombos, 8% in settlements, and 78% in PP/TP. The state had 11.5 million hectares of non-forested area and 4 million hectares of forested area in 2008. The deforestation occurring in forested area by 2008 represented 14% of the total deforestation in the Legal Amazon. The carbon stock in the state is only 1% of the total stock in the Legal Amazon, representing an average density of 68 tons per hectare.

Mato Grosso

Of the total area in Mato Grosso of 90.2 million hectares, approximately 38.4 million were found in non-forested area and 31.2 million in forested area in 2008. Eleven percent of the deforestation in the state by 2008 had occurred in rural settlements, 87% in PP/TP, and only 2% in protected areas. The TIs, sustainable use UCs, and full protection UCs in Mato Grosso represented 27%, 1%, and 22%, respectively, of the total deforestation in these land-use categories in all of the Legal Amazon. The carbon stock in Mato Grosso represents 8% of the total stock in the Legal Amazon, with an average density of 78 tons per hectare.

Pará

The area of Pará represents 25% of the total area of the Legal Amazon. In 2008, 62% of the forested area of the state lay in protected areas. Twenty-four million hectares in Pará had been deforested by 2008, representing 34% of the deforestation in the Legal Amazon. The carbon stock in the state is approximately 12.6 billion tons, which equals 26% of the total stock in the Legal Amazon. The average density of its carbon stock is 133 tons per hectare.

Rondônia

Of the 23.7 million hectares in the state of Rondônia, 12.7 million were in forested area, 2.5 million in non-forested area, and 8.1 million had been deforested by 2008. Sixty-two percent of the forested area lay in protected areas. The deforested area represented 11% of the total deforestation in the

Legal Amazon. The carbon stock in Rondônia represents 4% of the total stock in the Legal Amazon, revealing an average density of 130 tons per hectare.

Roraima

Roraima covers an area of 22.3 million hectares, equivalent to 4% of the area of the Legal Amazon. In 2008, protected areas represented 58% of the forested area, 36% of PP/TP, and 6% of rural settlements. The state has 6% of the non-forested area in the Legal Amazon. Ninety-four percent of the deforestation by 2008 in the state occurred outside protected areas. The carbon stock of Roraima represents 5% of the stock in the Legal Amazon, with an average density of 119 tons per hectare.

Tocantins

The state of Tocantins has an area of 27.6 million hectares. In 2008, it had 980 million hectares of forested area, while it had deforested 2.9 million hectares, representing 4% of the deforestation in the Legal Amazon. The state has a large area of non-forest, representing 24% of the Legal Amazon. The carbon stock of Tocantins is approximately 600 million tons, with an average density of 40 tons per hectare.

Table 3 - Total area (in hectares) in 2008 of different land use categories, by state.

Total Area (ha) in 2008									
Land use category		Private property & public lands	Indigenous Lands	Sustainable Use Conservation Units	Full Protection Conservtion Units	Settlements	Quilombos	Overlap between protected areas	Total
States	Acre	6.368.954	2.252.785	3.209.382	1.546.430	1.657.078	-	143.064	15.177.693
	Amapá	3.071.088	1.174.617	4.124.624	4.708.139	1.120.834	30.699	10.537	14.240.538
	Amazonas	72.555.922	38.552.239	22.884.745	10.335.054	7.747.167	719.750	4.192.562	156.987.439
	Maranhão	20.505.060	2.148.481	76.161	1.286.554	2.063.265	97.522	150	26.177.193
	Mato Grosso	69.217.086	13.469.837	131.844	2.988.506	4.231.420	17.284	207.431	90.263.408
	Pará	55.165.794	28.167.689	18.456.810	12.535.205	10.232.301	17.510	144.569	124.719.878
	Rondônia	8.753.258	3.658.363	3.696.778	1.808.257	4.299.985	47.439	1.459.975	23.724.055
	Roraima	9.232.608	10.124.780	422.167	1.060.183	1.371.383	-	113.818	22.324.939
	Tocantins	23.506.655	2.012.285	8.978	1.036.017	568.528	-	545.497	27.677.960
Total		**268.376.425**	**101.561.076**	**53.011.489**	**37.304.345**	**33.291.961**	**930.204**	**6.817.603**	**501.293.103**

Table 4 - Area (in hectares) of forests in 2008 in different land use categories, by state.

	Area (ha) of forest in 2008								
	Land use category	Private property & public lands	Indigenous Lands	Sustainable Use Conservation Units	Full Protection Conservtion Units	Settlements	Quilombos	Overlap between protected areas	Total
States	Acre	5.306.331	2.226.906	3.130.618	1.530.307	954.640	-	142.174	13.290.976
	Amapá	1.065.495	945.206	4.008.530	4.024.330	952.712	13.459	10.448	11.020.180
	Amazonas	62.993.825	37.397.592	22.070.941	9.489.960	6.722.480	716.502	4.120.506	143.511.806
	Maranhão	2.020.798	1.355.656	30.467	200.179	442.653	19.664	34	4.069.451
	Mato Grosso	19.951.644	8.426.731	109.667	1.767.924	827.925	401	146.911	31.231.203
	Pará	28.027.529	25.905.299	17.273.256	11.939.237	5.133.990	1.628	141.306	88.422.245
	Rondônia	3.450.089	3.109.359	2.834.985	1.198.954	1.071.184	17.309	1.044.400	12.726.280
	Roraima	5.452.479	7.722.359	326.447	594.065	947.051	-	99.854	15.142.255
	Tocantins	576.964	128.103	24	75.281	44.338	-	155.387	980.097
Total		**128.845.154**	**87.217.211**	**49.784.935**	**30.820.237**	**17.096.973**	**768.963**	**5.861.020**	**320.394.493**

Table 5 - Area (in hectares) of non-forest in 2008 in different land use categories, by state

Area (ha) of Non-forest in 2008									
Land use category		Private property & public lands	Indigenous Lands	Sustainable Use Conservation Units	Full Protection Conservtion Units	Settlements	Quilombos	Overlap between protected areas	Total
States	Acre	191	63	43	61	-	-	519	877
	Amapá	1.544.452	224.718	89.891	635.825	117.077	16.436	26	2.628.425
	Amazonas	3.706.569	512.894	244.568	482.518	323.288	71	47.818	5.317.726
	Maranhão	9.660.849	599.704	703	1.014.948	217.717	1.778	8	11.495.707
	Mato Grosso	31.413.327	4.652.393	8.549	1.044.904	1.225.682	15.374	57.371	38.417.600
	Pará	4.354.458	1.838.718	571.876	412.202	409.917	4.112	103	7.591.386
	Rondônia	781.427	488.046	194.978	553.872	98.597	29.821	400.281	2.547.022
	Roraima	3.095.550	2.332.815	92.969	451.199	132.893	-	13.763	6.119.189
	Tocantins	20.087.430	1.853.638	1.205	952.171	314.655	-	381.087	23.590.186
Total		**74.644.253**	**12.502.989**	**1.204.782**	**5.547.700**	**2.839.826**	**67.592**	**900.976**	**97.708.118**

Table 6 - Area (in hectares) of deforestation in 2008 in different land use categories, by state.

Area (ha) of Deforested Forest in 2008									
Land use category		Private property & public lands	Indigenous Lands	Sustainable Use Conservation Units	Full Protection Conservtion Units	Settlements	Quilombos	Overlap between protected areas	Total
States	Acre	1.035.341	22.865	78.418	15.996	702.020	-	890	1.855.530
	Amapá	160.835	3.981	21.133	7.255	49.620	804	27	243.655
	Amazonas	2.307.997	256.716	136.141	38.792	484.925	883	12.899	3.238.353
	Maranhão	8.308.771	192.269	41.069	71.427	1.395.714	73.737	108	10.083.095
	Mato Grosso	17.365.881	344.576	10.480	91.263	2.175.636	1.509	1.453	19.990.798
	Pará	18.827.523	312.622	385.493	133.970	4.489.852	8.478	1.518	24.159.456
	Rondônia	4.253.498	55.292	636.626	48.155	3.124.504	302	14.430	8.132.807
	Roraima	513.032	47.560	1.101	4.277	290.904	-	176	857.050
	Tocantins	2.718.534	18.187	7.749	2.283	209.264	-	1.432	2.957.449
Total		**55.491.412**	**1.254.068**	**1.318.210**	**413.418**	**12.922.439**	**85.713**	**32.933**	**71.518.193**

Table 7 - Forest carbon stock in different land use categories, by state

		Forest Carbon Stock (tons)							
	Land use category	Private property & public lands	Indigenous Lands	Sustainable Use Conservation Units	Full Protection Conservtion Units	Settlements	Quilombos	Overlap between protected areas	Total
States	Acre	596.442.045	236.762.295	352.229.033	170.841.713	107.124.293	-	15.094.260	1.478.493.638
	Amapá	133.441.770	137.184.120	659.758.568	601.697.828	153.090.848	1.892.355	1.718.835	1.688.784.323
	Amazonas	10.077.198.120	5.956.575.330	3.554.460.893	1.511.131.148	1.005.534.630	133.016.820	643.050.060	22.880.967.000
	Maranhão	126.313.395	184.901.663	2.062.748	31.212.030	29.340.435	1.370.078	4.913	375.205.260
	Mato Grosso	1.679.734.680	871.411.395	17.436.068	230.136.383	57.072.653	3.008	13.296.555	2.869.090.740
	Pará	3.635.020.073	3.343.974.293	2.578.789.980	1.677.117.683	719.819.355	164.378	23.606.850	11.978.492.610
	Rondônia	370.628.655	394.016.730	418.708.395	175.264.380	115.332.495	2.552.078	134.249.400	1.610.752.133
	Roraima	685.831.815	957.693.930	39.267.533	71.694.660	128.231.205	-	12.046.125	1.894.765.268
	Tocantins	26.370.975	7.491.488	698	8.675.955	2.210.700	-	14.478.270	59.228.085
Total		**17.330.981.528**	**12.090.011.243**	**7.622.713.913**	**4.477.771.778**	**2.317.756.613**	**138.998.715**	**857.545.268**	**44.835.779.055**

Table 8 - Non-forest carbon stock in different land use categories, by state.

		Non-forest Carbon Stock (tons)							
Land use category		Private property & public lands	Indigenous Lands	Sustainable Use Conservation Units	Full Protection Conservtion Units	Settlements	Quilombos	Overlap between protected areas	Total
State	Acre	130.623	10.324	7.118	9.726	-	-		157.790
	Amapá	108.350.640	26.978.777	10.410.491	87.117.072	10.036.802	998.683	2.655	243.895.120
	Amazonas	547.694.938	69.864.551	46.723.784	62.083.196	55.751.098	20.114	5.974.110	788.111.790
	Maranhão	203.717.210	13.081.682	88.941	13.749.170	7.248.765	107.132	60	237.992.959
	Mato Grosso	834.611.621	247.074.544	790.939	80.782.153	38.614.632	188.068	4.878.263	1.206.940.219
	Pará	296.829.825	180.435.267	75.489.510	45.146.180	42.933.547	352.869	9.428	641.196.627
	Rondônia	16.701.852	72.258.134	32.958.647	83.168.255	9.070.781	5.073.645	41.686.013	260.917.325
	Roraima	296.754.064	135.542.466	12.232.314	56.399.273	15.372.676	-	649.980	516.950.773
	Tocantins	389.779.870	105.657.619	45.475	12.697.092	11.471.236	-	20.478.863	540.130.155
Total		**2.694.570.642**	**50.903.364**	**178.747.219**	**441.152.116**	**190.499.536**	**6.740.510**	**73.679.370**	**4.436.292.758**

Table 9 - Total carbon stock in different land use categories, by state

Total Carbon Stock (tons)									
Land use category		Private property & public lands	Indigenous Lands	Sustainable Use Conservation Units	Full Protection Conservtion Units	Settlements	Quilombos	Overlap between protected areas	Total
State	Acre	596.572.668	236.772.619	352.236.150	170.851.438	107.124.293	-	15.094.260	1.478.651.428
	Amapá	241.792.410	164.162.897	670.169.058	688.814.900	163.127.650	2.891.038	1.721.490	1.932.679.442
	Amazonas	10.624.893.058	6.026.439.881	3.601.184.676	1.573.214.343	1.061.285.728	133.036.934	649.024.170	23.669.078.790
	Maranhão	330.030.605	197.983.344	2.151.689	44.961.200	36.589.200	1.477.209	4.973	613.198.219
	Mato Grosso	2.514.346.301	1.118.485.939	18.227.007	310.918.535	95.687.285	191.075	18.174.818	4.076.030.959
	Pará	3.931.849.898	3.524.409.560	2.654.279.490	1.722.263.863	762.752.902	517.247	23.616.278	12.619.689.237
	Rondônia	387.330.507	466.274.864	451.667.042	258.432.635	124.403.276	7.625.722	175.935.413	1.871.669.458
	Roraima	982.585.879	1.093.236.396	51.499.847	128.093.933	143.603.881	-	12.696.105	2.411.716.041
	Tocantins	416.150.845	113.149.106	46.173	21.373.047	13.681.936	-	34.957.133	599.358.240
Total		**20.025.552.170**	**2.940.914.606**	**.801.461.132**	**4.918.923.894**	**2.508.256.149**	**45.739.225**	**931.224.638**	**49.272.071.813**

Table 10 - Average density of total carbon.

Average density of total carbon (tons per hectare)									
Land use category		Private property & public lands	Indigenous Lands	Sustainable Use Conservation Units	Full Protection Conservtion Units	Settlements	Quilombos	Overlap between protected areas	Total
State	Acre	112	106	113	112	112		106	110
	Amapá	93	140	164	148	152	97	164	137
	Amazonas	159	159	161	158	151	186	156	161
	Maranhão	28	101	69	37	55	69	118	68
	Mato Grosso	49	86	154	111	47	12	89	78
	Pará	121	127	149	139	138	90	167	133
	Rondônia	92	130	149	147	106	162	122	130
	Roraima	115	109	123	123	133		112	119
	Tocantins	20	57	38	21	38		65	40
Média		**88**	**113**	**124**	**111**	**104**	**103**	**122**	**108**

Maps of carbon stock and density by land-use category

Maps of the carbon stock for indigenous lands and conservation areas[81] were produced for all the protected areas in the Legal Amazon, based on data concerning the remaining forested area in 2008.

Considering that the total carbon stock is the sum of the carbon present in the living biomass above the ground plus the carbon present in the underground living biomass, the maps below were produced as follows: carbon above the ground was calculated using data in the map in Saatchi (2007), while underground carbon was calculated to be 20% of that above the ground (Houghton et al., 2000, 2001), and 71% in cerrado savanna areas (Castro & Kauffman, 1998).

To demonstrate the spatial variation of carbon found in each AP, and to reproduce the characteristics of the biomass in the different phytophysiognomies, the APs (both UCs and TIs) were superimposed on the map of the carbon density created from the biomass map produced by Saatchi et al. (2007), presented in Appendix Figures 1 through 7.

81 Carbon stock in the category of Environmental Protection Areas (APA) was not calculated.

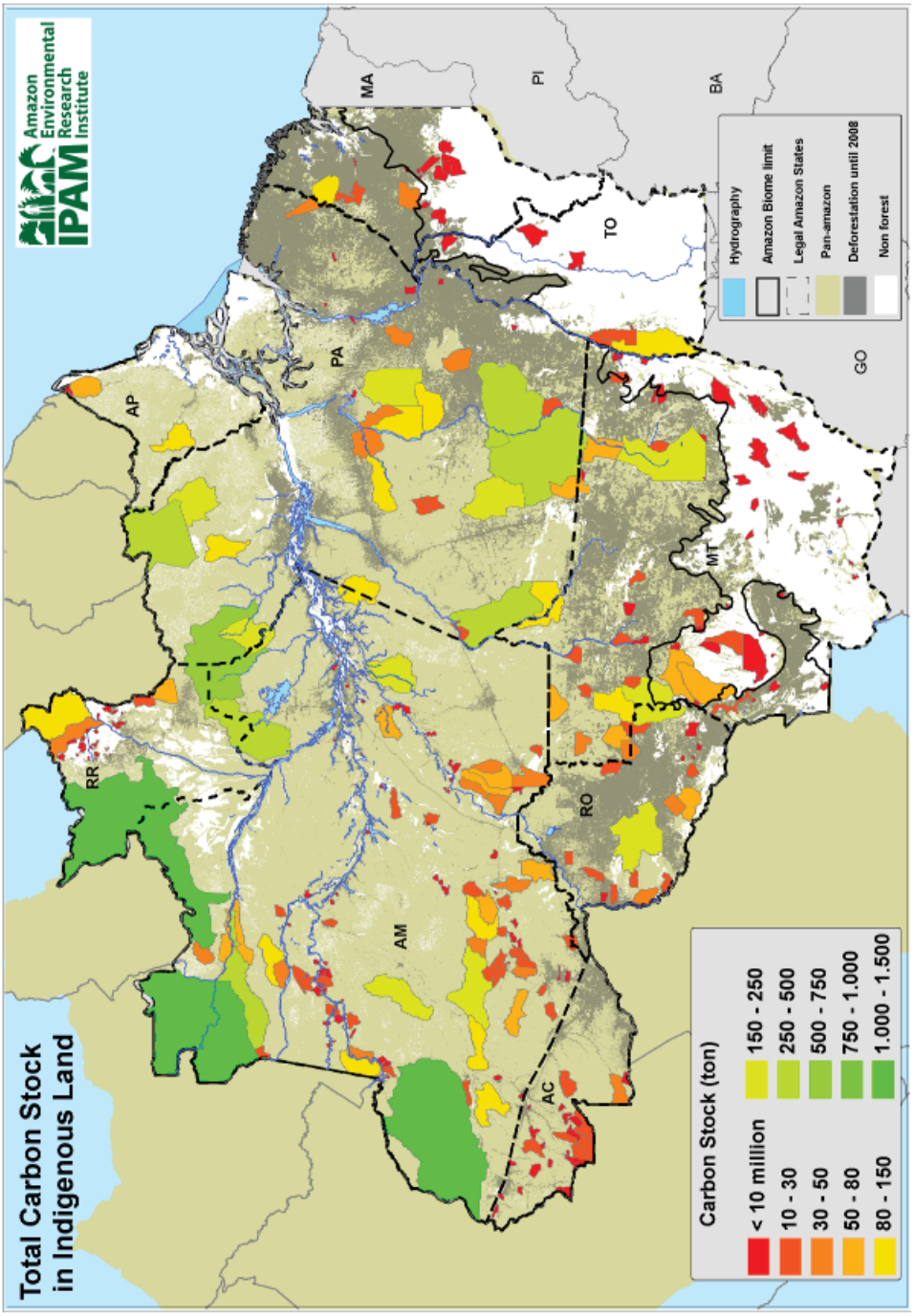

Figure 1. Total Carbon Stock in Indigenous Lands in tons

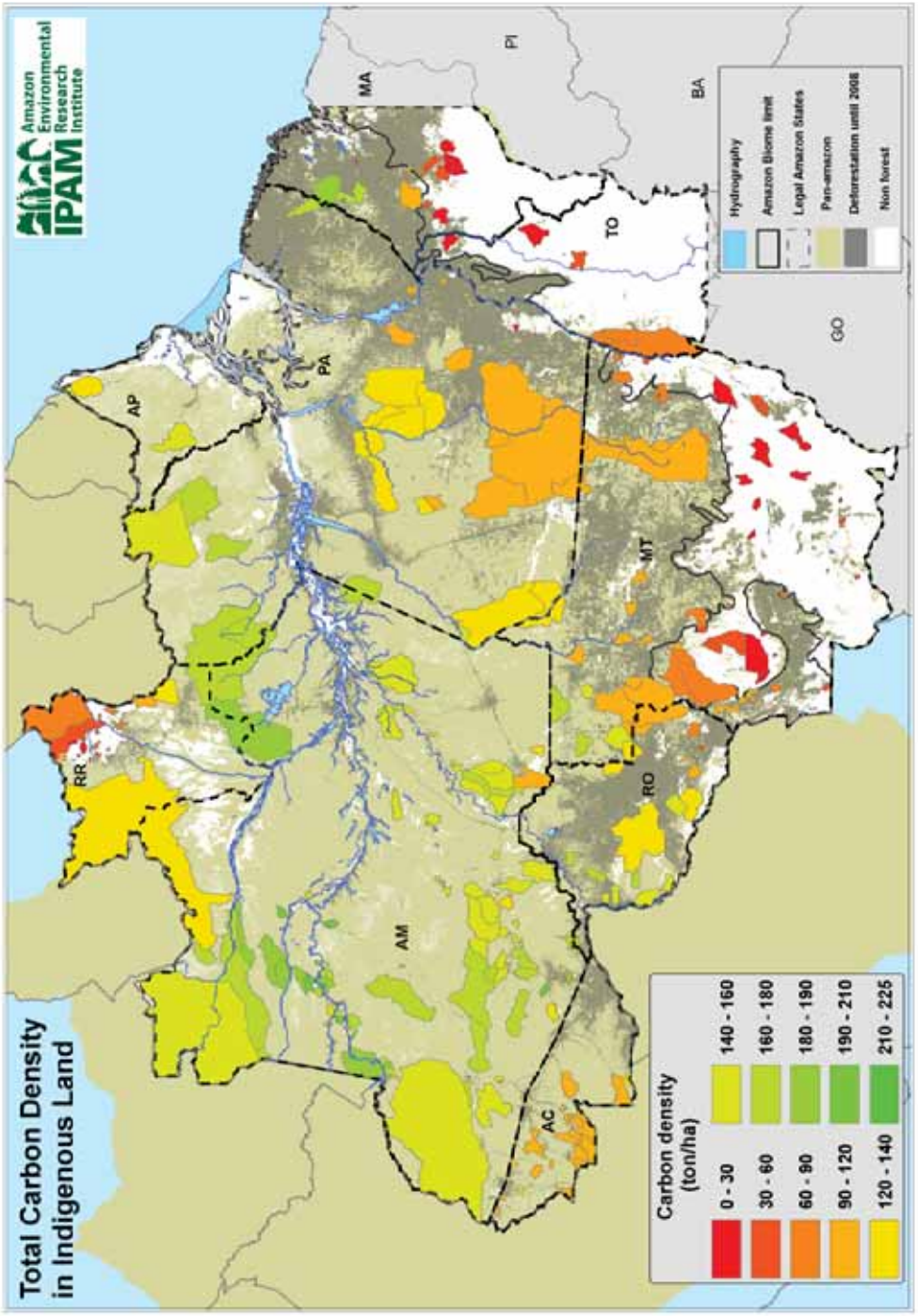

Figure 2. Total Carbon Density in Indigenous Lands in tons per hectare

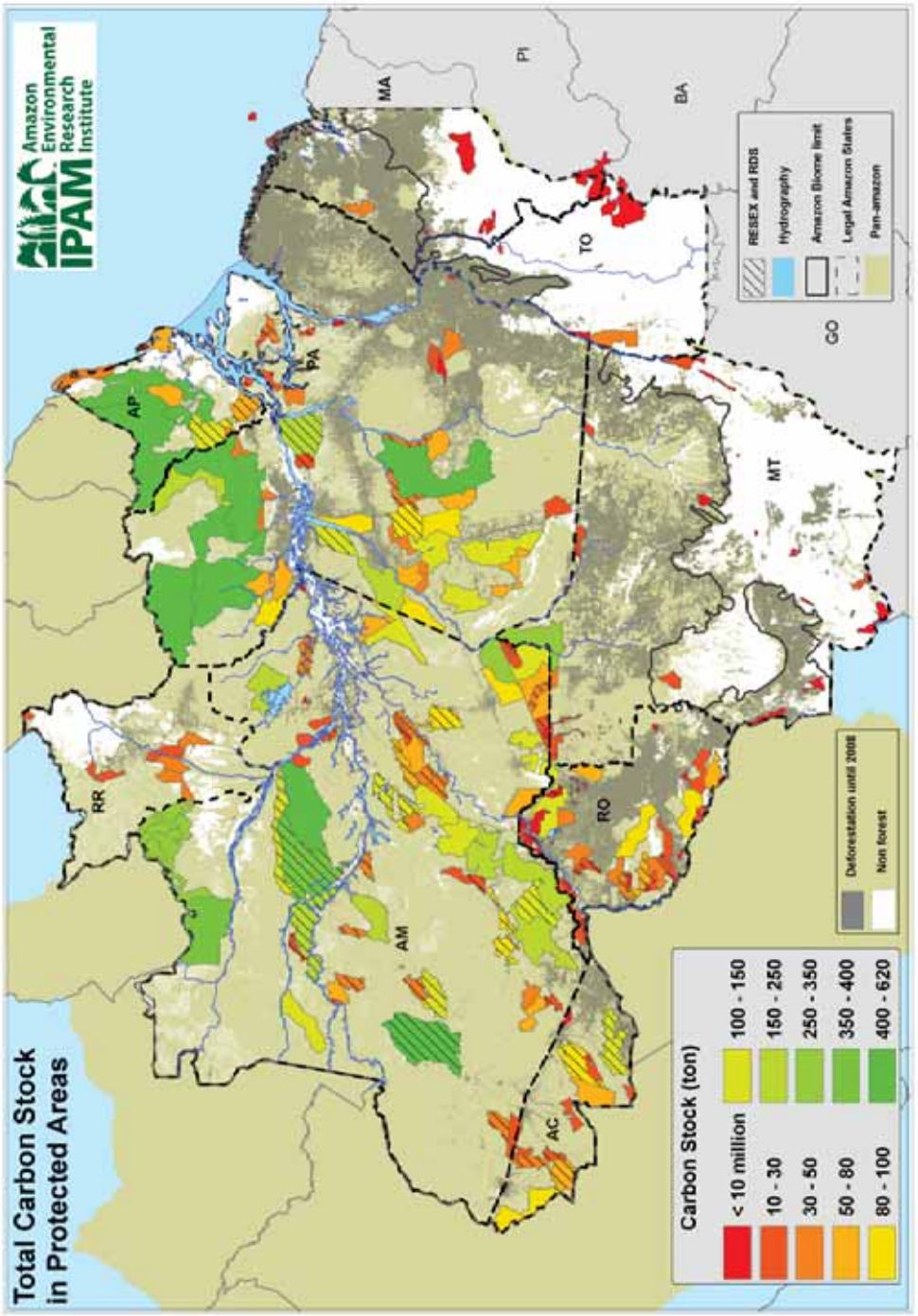

Figure 3. Total Carbon Stock in Protected Areas in tons

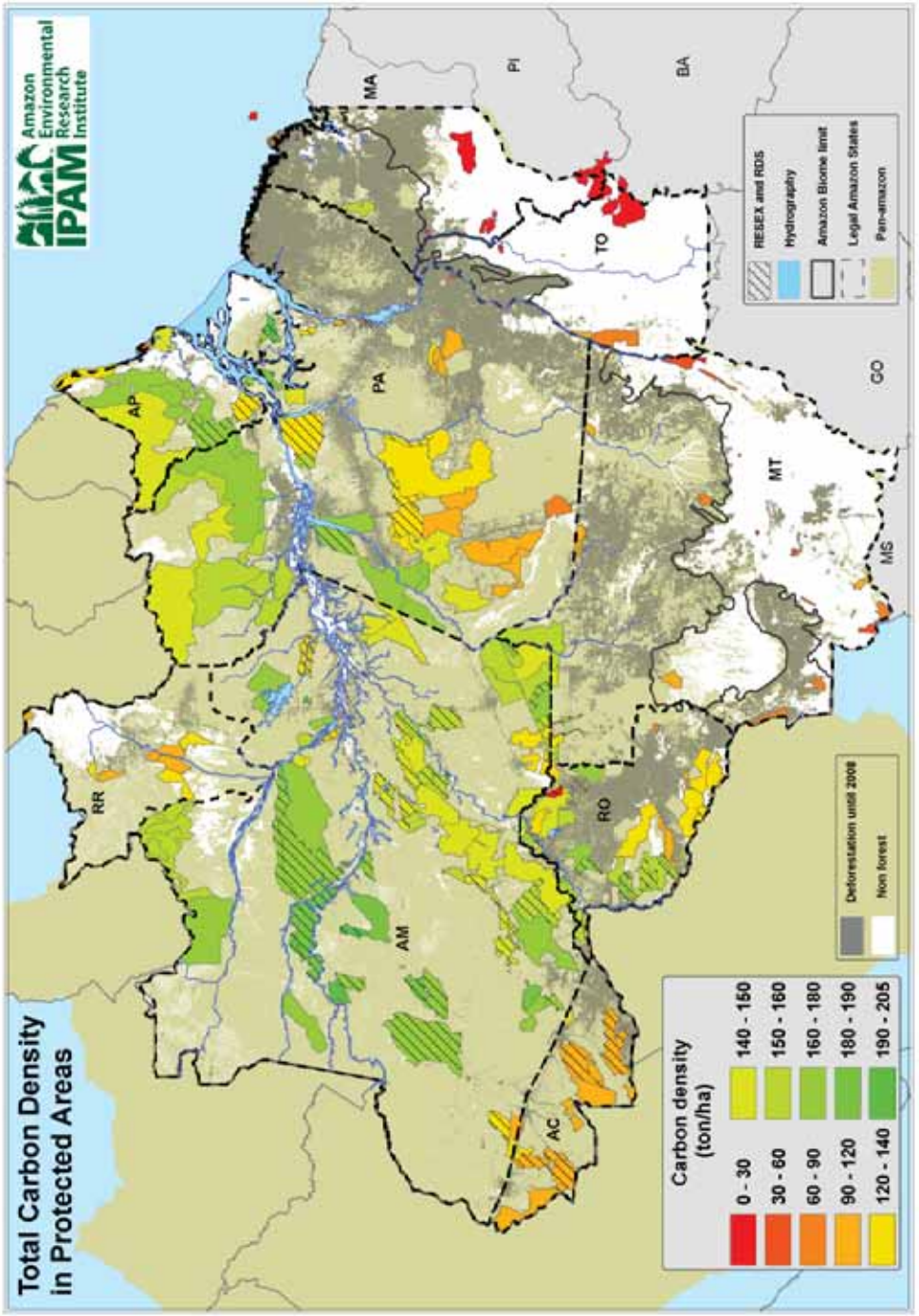

Figure 4. Total Carbon Density in Protected Areas in tons per hectare

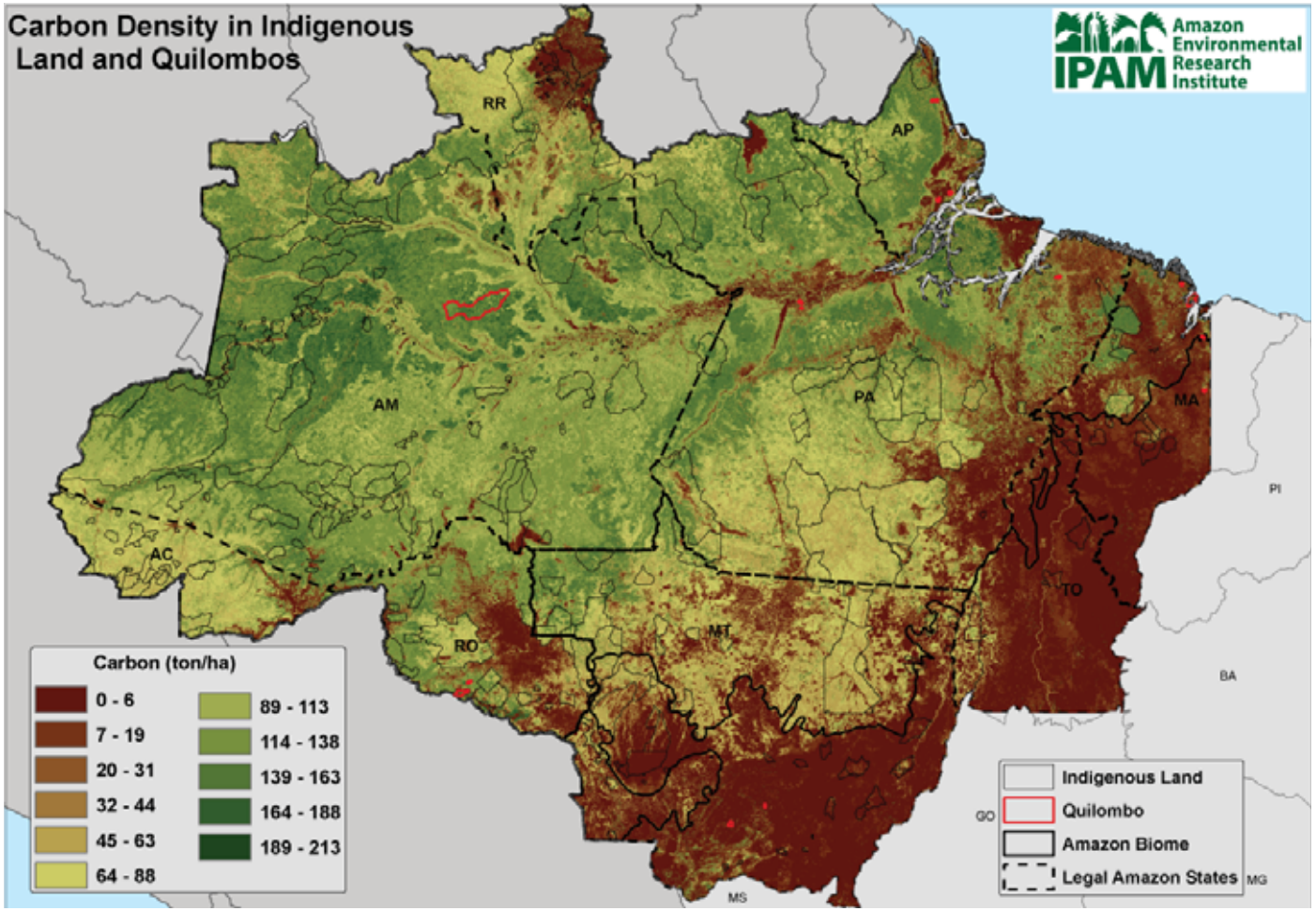

Figure 5. Total Carbon Density in Indigenous Lands and Quilombos in tons per hectare

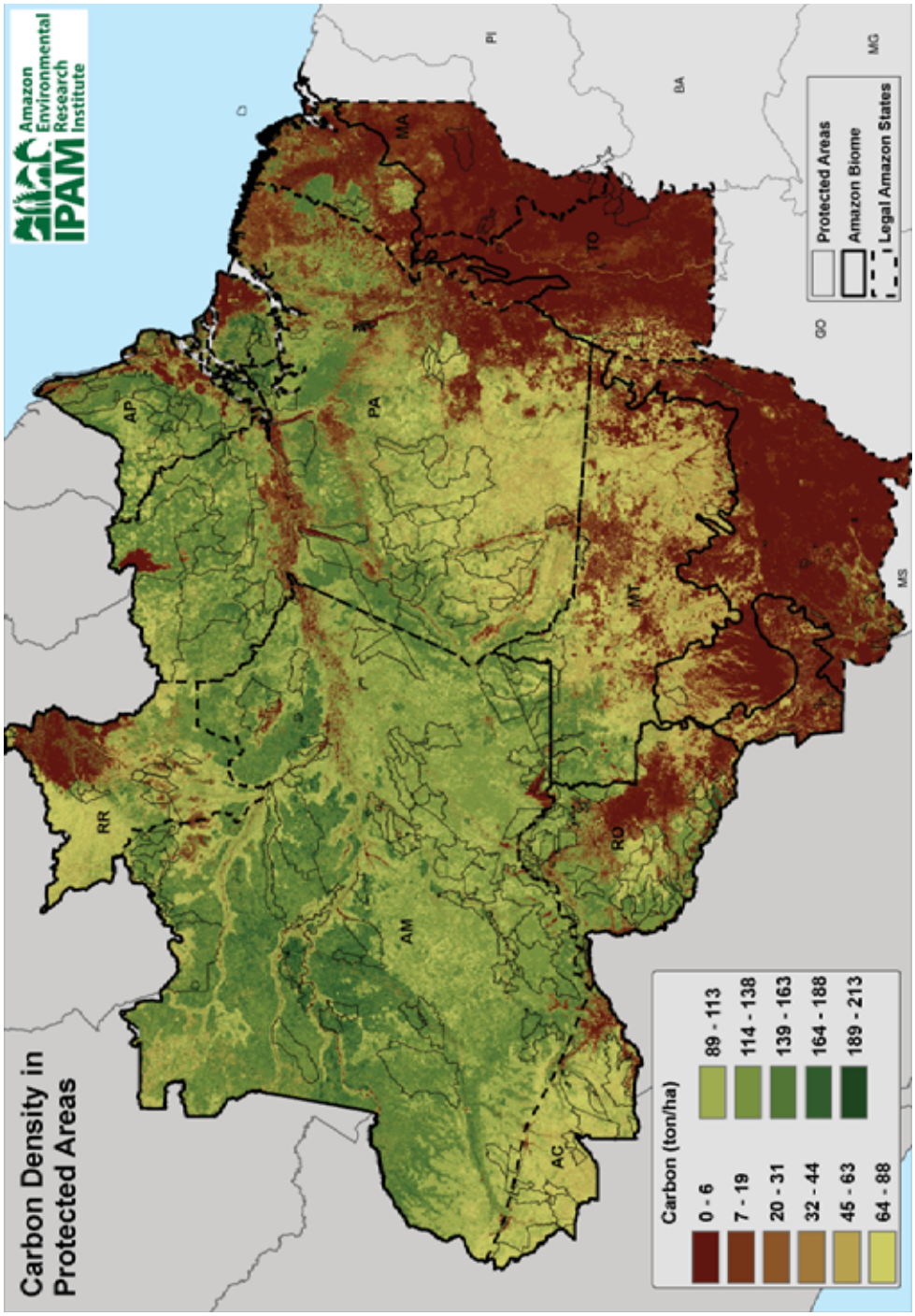

Figure 6. Spatial Variation of total Carbon Stocks in Protected Areas

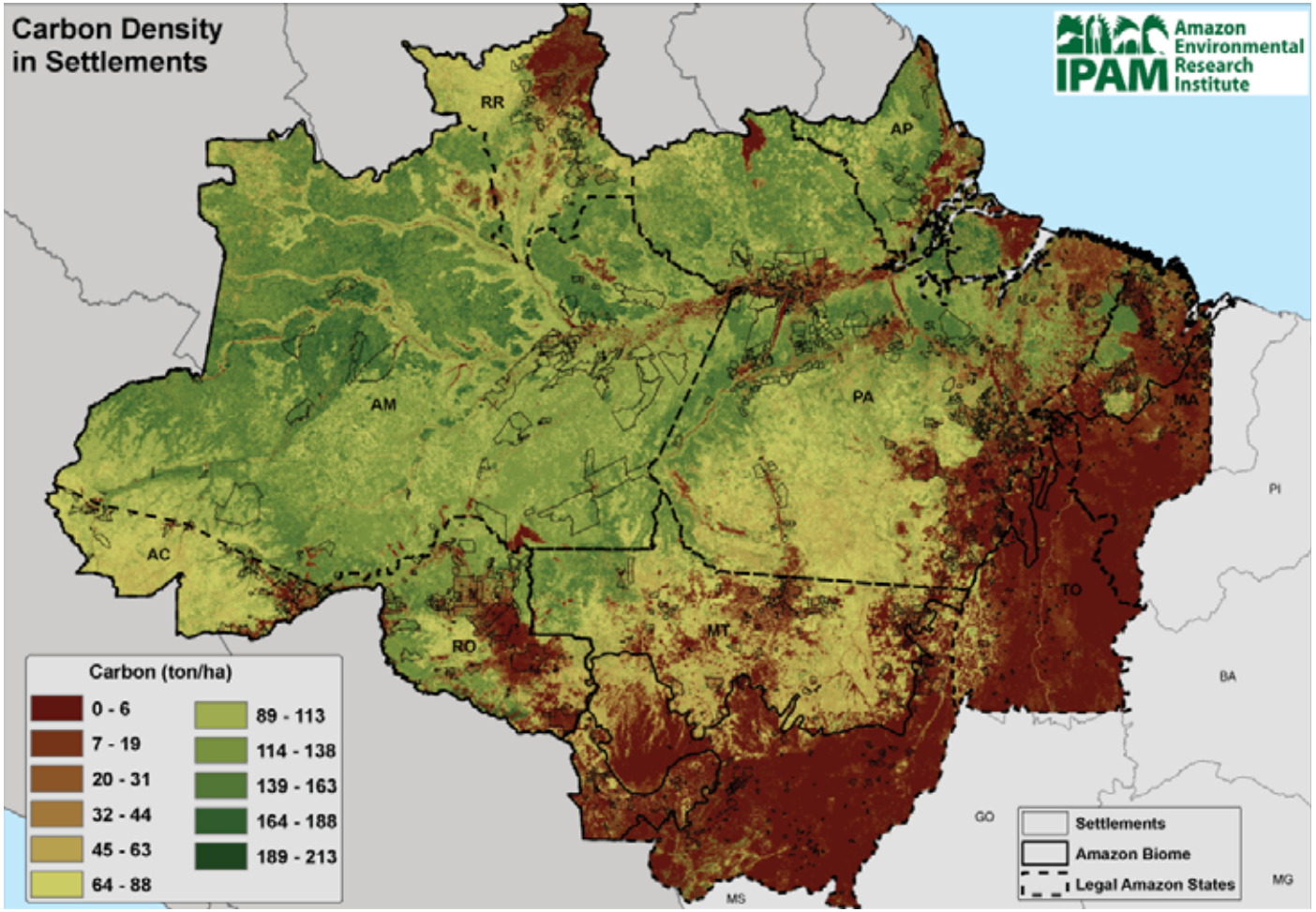

Figure 7. Spatial Variation of total Carbon Stocks in Settlements

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