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Brazil's Emerging Sectoral Framework for Reducing Emissions from Deforestation and Degradation and the Potential to Deliver Greenhouse Gas Emissions Reductions from Avoided Deforestation in the Amazon's Xingu River Basin

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Cover Photo: Forest clearing and destruction in Brazil's Amazon region.

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Technical Update, October 2010

EPRI Project Manager

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Tropical Forest Group

Instituto de Pesquisa Ambiental da Amazônia

Forest Trends

This is an EPRI Technical Update report. A Technical Update report is intended as an informal report of continuing research, a meeting, or a topical study. It is not a final EPRI technical report.

NOTE

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PRODUCT DESCRIPTION

Tropical deforestation and forest degradation contribute approximately 17% of global greenhouse gas (GHG) emissions to the atmosphere. Because of the comparatively large role of these emissions globally, the issue of how to address them has become prominent in international negotiations to develop a post-2012 global climate treaty under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC). A mechanism designed to compensate developing nations that succeed in reducing emissions from deforestation and degradation, REDD+ (i.e., REDD plus forest regeneration and restoration activities), has cleared many technical aspects of the international negotiations process and attracted $4 billion in interim "fast start" financial commitments through 2012 from developed nations, including the United States. REDD+ could become an important international GHG emissions offset mechanism in national climate and energy policies evolving in the United States and potentially other nations. REDD+ is also evolving as an important element in the implementation of the GHG emissions offsets program now being designed in California as part of the overall implementation of the state's Global Warming Solutions Act (AB-32) that created a statewide program to reduce GHG emissions.

Many questions remain regarding how REDD-based GHG emissions offset programs and projects will work and how they might be used to create a large supply of low-cost GHG emissions offsets that may be available to U.S. electric companies and other entities responsible for reducing their GHG emissions under potential future carbon constraints.

Results and Findings

This technical update highlights the results of research conducted by Woods Hole Research Center (WHRC) for the Electric Power Research Institute (EPRI) in 2009 and 2010 to support research on the development of a potential GHG emissions reduction project to reduce deforestation in the Xingu River basin in Brazil's Amazon region. The report summarizes research and analysis conducted on the emerging market for GHG emissions offsets derived from activities to reduce deforestation and forest degradation. It presents analysis of the potential for large-scale emissions reductions in the Xingu River basin of the eastern Amazon region. The report provides insights on the issues of property rights to carbon offsets, calculation of emission baselines for potential future REDD-based projects, carbon offset program registration, the development of a new sectoral "nesting" architecture through which pilot forest carbon projects could link to state- and national-level REDD programs, and the financial architecture that could link REDD-based projects to emerging cap-and-trade policies.

Challenges and Objectives

This technical update provides senior managers and environmental staff of U.S. electric companies and others with a comprehensive understanding of the important role that GHG emissions offsets derived from REDD-based activities might play in mitigating global climate change and reducing the costs of complying with future requirements to reduce GHG emissions.

Applications, Value, and Use

While debate continues regionally, nationally, and internationally about how to respond to global climate change, it is becoming clear that U.S. electric companies might face future requirements to reduce and/or offset their GHG emissions. The extent to which domestic and international

offsets—and REDD-based offsets in particular—might be used to comply with emission reduction requirements that might be incorporated into evolving U.S. domestic climate policies has become increasingly controversial as policymakers seek to design robust, cost-effective climate change policies. To date, policy discussions in the United States have focused on potential development of economy-wide GHG emission caps, which imply that most offsets necessarily would come from international sources outside of a U.S. emissions cap. Globally, REDD-based projects and activities are considered to be one of the largest potential sources of low-cost GHG offsets.

EPRI Perspective

EPRI-member companies have a keen interest in the potential role of GHG emissions offsets in climate policy and the role of REDD-based offsets. Over the past decade, EPRI members have supported fundamental research and development related to evaluating and implementing GHG offsets, such as forest carbon sequestration and nitrous-oxide (N_2O) emissions reductions associated with altered crop production practices. As U.S. climate policy continues to evolve at state, regional, and federal levels, electric companies are likely to play a role in designing offsets policies and determining the role of offsets and REDD-based offsets in climate policy. We hope a better understanding of REDD-based offsets and their potential role in climate mitigation will lead to more thoughtful and productive public policy deliberations on these issues.

Approach

The analyses presented in this report were conducted using information from the project team's participation in institutional processes underway in Brazil to develop a REDD framework. These processes include ministerial- and congressional-level discussions about a national REDD policy framework and working groups involved in the design of state-level REDD policy frameworks in Mato Grosso, Acre, and Amazonas states in Brazil. The carbon registry section was developed by reviewing and analyzing pertinent literature and websites and conducting phone interviews. The analysis of the legal rights of indigenous people to carbon stored in the forests they inhabit was informed by reviewing three recent legal analyses of this topic and a recent position paper released by the Brazilian federal government agency responsible for indigenous people affairs. The reference-level analyses of forest carbon stocks for the Xingu River Basin were conducted using a geographic information system database and a sophisticated spatial simulation model developed for this project.

Keywords

Offsets
Greenhouse gas
Carbon market
Climate change
Reducing emissions from deforestation and degradation (REDD)

EXECUTIVE SUMMARY

Rapid reductions in global greenhouse gas (GHG) emissions will be needed if the nations of the world are to succeed in minimizing the risks of climate change. Globally, tropical deforestation and land-use change causes approximately 17% of global GHG emissions. Most scientists, economists and policy makers agree that stopping tropical deforestation has the potential to reduce significant GHG emissions cost-effectively. The Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report states, "Reduced deforestation and degradation is the forest mitigation option with the largest and most immediate carbon stock impact in the short term per hectare and per year globally." In short, REDD is thought by many experts to be one of the largest sources of relatively low-cost mitigation by an order of magnitude compared to any other sector of economic activity.

While projects and activities that successfully reduce emissions from tropical deforestation have the potential to generate very large volumes of comparatively inexpensive international GHG emissions offsets, a variety of implementation challenges are likely to reduce these volumes substantially and increase the potential costs of REDD-based offsets.

This report examines the potential for GHG emissions offsets to be developed and generated through investments in programs designed to reduce deforestation in the Brazilian Amazon. The development of an international architecture to support the issuance of offsets for "Reduced Emissions from Deforestation and Degradation" (i.e., REDD) still is not completed, but it is progressing forward within the international climate negotiations being held under the auspices of the UN Framework Convention on Climate Change (UNFCCC) for the post-2012 period. The concept of REDD-based offsets also has been incorporated into different legislative approaches under discussion in the U.S. Congress as part of potential future comprehensive energy and climate legislation. REDD also is a key component of some state-level GHG emissions reduction policies in the U.S. (e.g., California's AB-32 program). Despite the ongoing uncertainty that plagues the overall UNFCCC negotiation process, REDD+ (i.e., REDD plus forest regeneration and restoration activities) continues to progress and to attract significant interest and international donor funding. Within the U.S. and in California, substantial opposition and roadblocks remain to implementing GHG emissions cap-and-trade programs that would create a demand for international offsets such as REDD, but the legislative and regulatory processes continue to progress and to provide some level of support for REDD.

Many nations have exhibited high levels of interest and enthusiasm for REDD+. This interest is best exemplified by the substantial pledges made by developed nations to support REDD capacity building efforts in the near term. Several developing tropical forest countries have initiated legal reform processes, stakeholder engagement activities, and pilot processes to map and monitor their forests so they will be prepared to implement a future REDD+ policy regime.

In all areas of REDD design and implementation, the drive to move to large-scale implementation continues to grow. In Brazil and Indonesia, state- and province-level REDD programs and large-scale REDD projects nested within government programs are crucial to implement in the next two to three years. States and provinces are actively engaging with their federal counterparts on linking programs to develop national REDD strategies. Policy and financial architectures that can drive private sector investment to support reducing deforestation at multiple scales have not yet been created but are actively being pursued.

At the 15th meeting of the Conference of Parties to the UNFCCC (COP15) held Copenhagen, Denmark in 2009, the Brazilian delegation announced Brazil's national commitment to reduce its domestic GHG emissions 36-39% below "business-as-usual" (BAU) levels by 2020. Most of the emissions reductions necessary to achieve this target are expected to come from the 80% reduction in Amazon deforestation in conjunction with a 40% reduction in clearing of the Cerrado, the savanna-woodland formation to the south of the Amazon region. Since Copenhagen, Brazil has transformed into law its "National Policy for Climate Change" (NPCC), which includes the GHG emission reduction targets announced in Copenhagen. This is Brazil's "nationally appropriate mitigation action" (NAMA) as reported in the Copenhagen Accord.

Brazil's unilateral adoption of the NPCC suggests that at least some portion of the envisioned future avoided deforestation will be accomplished by the Brazilians themselves as part of their commitment to the global community to reduce its GHG emissions. Reducing deforestation emissions from a BAU to a sectoral "crediting baseline" level could be funded domestically, or be done in conjunction with public funds provided by other nations and philanthropic donors. The larger the "gap" between BAU emissions and the lower crediting baseline, the fewer REDD-based offsets potentially will be available to third-parties that are likely to be interested in buying compliance-quality offsets, such as electric companies and others who may be mandated to reduce or offset their GHG emissions in the future.

In this report, the project team lays out some of the issues and challenges that will have to be tackled to develop a workable system of REDD that is fully "nested" within a sectoral crediting architecture and which is internally consistent. One of the key elements of the proposed nesting architecture is the clear setting of reference levels from the national to the individual stakeholder levels that are internally consistent across scales. In addition, the project team believes broad participation in the REDD design process will be an important factor that can help to limit risks that are external to individual implementing entities.

The project team has proposed several options for the design of a nested REDD policy architecture and developed insights related to the different approaches and options that could be used.

From the point of view of private investors, a clear layout of how reference levels will be determined and how risks of non-performance at different scales may impact potential crediting of offsets generated by a REDD project will be important elements in project design, alongside the implementation aspects of a REDD project itself.

A nested REDD architecture could be supported by state-level carbon offset registries linked to spatial datasets that track individual land holdings, reserves, land-use restrictions and other types of information. No carbon registry exists in the world today that operates at multiple geographic scales and which is capable of supporting registration of sector-based offset credits. Development of this kind of state-level spatial registry will involve substantial institutional commitment and resources.

In the absence of a compliance carbon market, there will be limited traditional private sector carbon finance interest in REDD-based activities. Available public funding, including the currently committed $4 billion of fast start funding through 2012, could be used, in part, to leverage private sector investors both through public-private partnerships and carbon bonds, and by creating buffer pools of credits that could be used as an insurance mechanisms against risks of impermanence.

In addition, it is critical to create mechanisms to pre-fund ambitious REDD+ activities and policies. Public-private partnerships utilizing overseas development assistance (ODA) funds could facilitate upfront investment from the private sector, and carbon-linked debt instruments could be an important way to raise the vast amount of funds required to provide up-front finance. Carbon-linked debt instruments could limit the exposure that projects and governments have to carbon markets while providing low-cost finance. Traditional debt financing, ODA funding, and bilateral agreements all could be used to fund REDD+ policies that could attract substantial private-sector investment in underlying REDD+ activities. A critical component of any successful REDD+ financial architecture will be to understand the costs of meeting REDD+ crediting baselines and the effectiveness of policies in terms of leveraging private capital.

Brazil is the world leader in developing a REDD framework. It has the largest forest, the highest rate of carbon emissions from deforestation and forest degradation, a sophisticated satellite based forest monitoring system for the Amazon region, and it has successfully reduced deforestation by two thirds since 2005.

The indigenous reserves of the Xingu River basin in the eastern Amazon region comprise about 20 million hectares of land – an area more than one-half the size of the United Kingdom (UK) and more than twice the size of Costa Rica. The portion of the Xingu basin inhabited by the Kayapo and Panara tribes along with the Xingu Indigenous Park (PIX) is inhabited by 18 indigenous groups and 11,000 indigenous people that live in more than 50 villages and who speak 17 different languages. The Xingu River basin is located in the Brazilian states of Mato Grosso (headwaters) and Pará. If a future REDD project is to be implemented on indigenous lands in the Xingu basin, it will need to be connected to the state and national REDD systems under development and it must be implemented within these two states.

In late 2008 and 2009, staff from the Instituto Socioambiental (ISA) and the Environmental Defense Fund (EDF) facilitated a number of regional and village level meetings with indigenous peoples in the Xingu region that were designed to explain climate science and related policy, to clarify the role of forests in climate change, and to explore on a preliminary basis possible project-related options with local leaders and communities. While a number of consultations have occurred, these consultations are ongoing and the indigenous peoples and their leaders have not yet reached any definitive conclusions regarding their potential interest in developing future REDD projects on indigenous lands.

Recent legal analyses conclude indigenous communities in Brazil have legal rights to their natural resources (excluding sub-surface resources such as minerals and petroleum), including the carbon credits that may be generated by implementation of avoided deforestation projects. These analyses also conclude that indigenous communities have the right to enter into carbon project contracts with certain limitations, so long as these contracts meet the legal requirements defined in the Brazilian Constitution and the Indigenous Statute, as well as the international conventions to which Brazil is a signatory (e.g., ILO 169, UNDRIP) regarding protection of indigenous peoples' rights to use their natural resources as the basis of their traditional livelihoods. Carbon contracts transacted by indigenous communities may have to share some revenues with the Brazilian indigenous peoples agency (FUNAI) to support its monitoring and support functions, and to other government agencies responsible for law enforcement.

Given Mato Grosso's precipitous decline in deforestation since 2005, emissions reductions that are likely to be achieved for during the period 2006-2010 period are estimated to be 850 million tons CO_2e (850 $MtCO_2e$) below the official federal baseline for Mato Grosso of 1.4 billion tons

CO_2e (1.4 $GtCO_2e$). Looking ahead, this state target could provide 17,000 km^2 of reduced deforestation beyond the federal target over the 2010-2020 period and could yield 600 $MtCO_2e$ of emissions reductions beyond the federal target, and 2.4 $GtCO_2e$ of emissions reductions below the federal baseline for Mato Grosso.

When the project team extrapolated the average annual rate of land clearing (3,791 hectares per years) across the Xingu River basin indigenous territories into the future, they estimated an additional 85,000 hectares of forest potentially will be cleared in the basin by 2030. With an average aboveground carbon content of 110 metric tons per hectare and an average carbon content of 10 metric tons per hectare for the pastures and crops that replace forests, the project team estimates a net 30 $MtCO_2e$ would be released from the indigenous territories of the Xingu River basin if historical rates of deforestation continue over the next 20 years.

Model-based simulations of future deforestation within Xingu indigenous lands, however, generates a much higher range of emissions estimates from a low of 1.1$GtCO_2$ (based on a low estimate of BAU deforestation) to a high of 2.1$GtCO_2$ (high BAU) over the same period. If up to 20% of each indigenous territory is allowed to be cleared, as is the case for private properties in the Amazon today, at least 1.1$GtCO_2$ would be released into the atmosphere relative to the 2008 landscape. These potential emissions reductions are more than 30 times larger than the estimate based upon a simple extrapolation of the low historical deforestation rates into the future.

The project team also has outlined a possible future phase two of this EPRI project that would be focused on supporting analytical work which needs to be done to overcome some of the remaining conceptual and architectural obstacles to finalizing a nested sectoral REDD policy design for Brazil.

In addition to the insights described above, this EPRI project also developed the following key insights that can inform future development of a comprehensive REDD program:

- Despite passage of the "Waxman-Markey" climate legislation (H.R. 2454) in the U.S. House of Representatives in June 2009, the probability that comprehensive climate and energy legislation will become law in 2010 is very low. Several key existing pieces of proposed U.S. federal legislation, including H.R. 2454, the "Kerry-Boxer" bill (S. 1733), and other key bills would allow entities covered by a U.S. GHG emissions cap-and-trade program to purchase international REDD-based emissions offsets to help achieve compliance with future U.S. emissions caps.
- State regulations being developed by the California Air Resources Board (CARB) pursuant to California's AB-32 climate law are likely to include the option for covered entities to use international REDD+ offsets for compliance purposes, and other U.S. states and regional programs like the Western Climate Initiative (WCI) could follow California's lead.
- Since the inception of this EPRI project, interest in the voluntary market for REDD-based forest carbon projects has waned. Future forest carbon credits are most likely to be created within state- and national-level REDD+ programs, and pilot projects that formally are linked to these governmental programs.
- Brazil has made important advances towards developing a national REDD framework through adoption of its National Policy on Climate Change (NPCC), which establishes a target for reducing emissions up to 39% by 2020 below BAU levels. This target includes 80% and 40% deforestation reduction targets for the Amazon and Cerrado, respectively.

Brazil is expected to advance the design of its national REDD framework by COP16 to be held in Cancun in December 2010.

- It appears that Brazil could supply 300-500 $MtCO_2e$ of offsets annually to the international community by 2020 if current REDD negotiations and design processes come to fruition.
- Some portion of the emissions reductions achieved by Brazil in the future are likely to be counted towards Brazil's efforts to achieve the goals of the NPCC which can be considered to be a Nationally Appropriate Mitigation Action (NAMA) under the Copenhagen Accords. Consequently, these emissions reductions may not be available to be sold as offsets to third parties, such as U.S. entities that may be regulated by cap-and-trade policies in the future. These emissions reductions cannot be counted twice – i.e., once towards achievement of Brazil's international commitment and again as an offset to be used by a third party. However, so long as Brazil has no international legal obligation to reduce its GHG emissions, it is free to negotiate any bilateral or multilateral arrangement it wants to finance its emissions reductions, including developing an approach like Joint Implementation or through the sale of emission offsets.
- Brazilian states in the Amazon region (i.e., Mato Grosso, Pará, Acre, Amazonas) also have made progress in the development of state-based REDD programs. In Mato Grosso, a multi-stakeholder State Forum on Climate Change is considering a REDD program design in which credits (referred to as REDD certificates or "C-REDD") would be allocated among sectoral programs (i.e., indigenous peoples' lands, smallholder settlements, private properties, and protected areas).
- Formal REDD nesting frameworks that effectively allocate benefits across scales must address the challenge of defining reference levels (i.e., baselines) at each scale, and distributing the errors that will inevitably arise from this definition. The project team recommends a "scale-neutral" framework that constrains total emissions nationally, and accommodates both REDD projects and policies.
- A carbon offset registry that tracks the creation, transfer, acquisition, and status of every tonne of REDD-based carbon emission reductions has not yet been developed for multiple-scale, nested frameworks. The project team recommends modifying one or more existing carbon registries to operate at the state level, supported by a spatial database that tracks REDD projects and information that is relevant to REDD programs.
- In the absence of regulatory clarity, over the next few years REDD projects and programs are likely to be funded primarily by public funds committed by developed nations. However, the approach used for this public funding could provide entry points to private investors that would reduce risk and attract the private funds that will be needed in the long run to cover the substantial costs of REDD programs.
- Indigenous people in Brazil have clear constitutional rights to their land and aboveground natural resources and are free to negotiate contracts – with certain limitations – for the sale of REDD-based emissions reduction credits.
- The indigenous peoples who inhabit the Xingu basin have the rights and authority to manage their own affairs and determine their own destiny. Only they have the authority to decide if they wish to become involved in any potential future project in the Xingu basin that is designed to reduce deforestation and forest degradation in the region. In addition, only the indigenous peoples themselves can decide if implementing a potential future REDD project in the region is in their best interests and will provide significant benefits to them. No REDD

project can be designed and implemented in the region without the explicit informed consent of the indigenous peoples who live in the Xingu basin.

- A future REDD project that potentially could be implemented on indigenous lands in the Xingu River basin could deliver at least 30 $MtCO_2e$ of emission reductions over the period 2010-2030 (below the most conservative baseline), but the potential for generating offset offsets credits is much higher. Using a sophisticated spatial simulation model of land use, the project team estimates that more than $1GtCO_2e$ of emissions would be released from forests on indigenous lands by 2030, even if historically-observed levels of inhibition of deforestation by indigenous groups continue into the future. These emissions could be avoided through successful implementation of a large-scale REDD project.

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INTRODUCTION

Rapid reductions in global greenhouse gas (GHG) emissions will be needed if the nations of the world are to succeed in minimizing the risks of climate change.[1] Many observers and policy experts believe one of the most efficient ways to reduce GHG emissions would be to implement a so-called "cap-and-trade" program under which a declining GHG emission cap would placed on national or sectoral emissions and the associated "emissions allowances" would be allocated and/or auctioned to the industrial entities covered by the cap. Each covered entity in turn would be required to submit an emissions allowance for each ton of GHG missions they emit during a given compliance period, and the sum of all available emissions allowances would be set equal to the overall cap. Covered entities would be allowed to trade emissions allowances. This market-based regulatory approach would drive each covered entity to optimize their emissions during a compliance period and would drive the economy to achieve the necessary emissions reductions at the lowest social cost.

As part of a GHG cap-and-trade program, covered entities as well as society at large could lower their compliance costs even further by substituting qualifying *emissions offsets* from sectors and geographic regions located outside of the GHG emissions cap where it may be possible to reduce emissions at lower cost than can be achieved either by the covered entities themselves or by others sources under the cap. The ability of GHG emissions offsets to reduce compliance costs is the predominant reason they now play a key role in evolving climate policy in the U.S. and internationally.

This type of "cap-and-trade" approach to reducing GHG emissions has been implemented in the European Union to help the 27 EU nations comply with their national obligations under the Kyoto Protocol. The EU Emissions Trading Scheme (EU ETS) in turn is "linked" to the United Nations' Clean Development Mechanism (CDM) – the worlds largest GHG offsets program. The CDM issues offsets for emission reductions achieved by qualifying emissions reduction projects implemented in countries in the developing world (i.e., the "non-Annex 1 countries."). Although comprehensive federal energy and climate legislation currently is stalled in the U.S. Congress, most observers believe it is likely the U.S. electric sector will face "carbon constraints" in the future which could take the form of an GHG emissions cap-and-trade program.

This report examines the potential for GHG emissions offsets to be developed and generated through investments in programs designed to reduce deforestation in the Brazilian Amazon. The development of an international architecture to support the issuance of offsets for "Reduced Emissions from Deforestation and Degradation" (i.e., REDD) still has not been completed, but it is moving forward within the international climate negotiations being held under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC) for the post-2012 period. The concept of REDD-based offsets also has been incorporated into different legislative approaches to comprehensive energy and climate legislation that have been debated in the

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[1] IPCC, 4th Assessment Report of the Intergovernmental Panel on Climate Change, edited by S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller, 996, 2007.

current U.S. Congress. REDD also is a key component of some state-level GHG emissions reduction programs in the U.S. (e.g., California's AB-32 program).

As currently framed within UNFCCC negotiations, "REDD+" would compensate tropical nations for reducing emissions from deforestation and forest degradation, and for enhancing forest carbon sequestration through forest regeneration and restoration activities (represented by the "+"). REDD also played a prominent role in the development of the Copenhagen Accord at COP15 in 2009.

At least thirty-five tropical nations formally have expressed interest in developing REDD programs via the World Bank's Forest Carbon Partnership Facility. Eleven tropical states and provinces, containing more than one-fifth of the world's tropical forests, are developing REDD programs to link with the GHG offsets program now being developed as part of the implementation of California's "AB-32" cap-and-trade legislation.

The Potential Scale of REDD-Based Offsets

The potential for REDD+ to supply large volumes of inexpensive international offsets is high, but a variety of implementation challenges are likely to reduce these volumes substantially and increase the potential costs of REDD-based offsets. Globally, the net annual flux of carbon to the atmosphere of emissions from tropical deforestation and forest degradation (through logging) and through carbon uptake by forest regrowth is approximately 6 billion tons of CO_2 ($GtCO_2e$), which is approximately 17% of total global anthropogenic emissions.[2, 3] This flux places an upper limit of roughly 60 $GtCO_2e$ by 2020 on the potential amount of offsets that theoretically could be supplied through reduction of these emissions. A recent analysis by McKinsey for Project Catalyst[4] determined that a total of 17 $GtCO_2e$ of emissions reductions would be needed by 2020 to preserve the option to limit the potential increase in global average temperature to less than two degrees centigrade (2°C). Of this 17 $GtCO_2e$ total, forest carbon could provide 9 $GtCO_2e$, and REDD-based activities in developing nations could provide 5-6 $GtCO_2e$. The same report estimated that global demand for REDD-based offsets would be only a fraction of this potential supply, totaling 1.2-1.7 $GtCO_2$ by 2020.

Estimates of the costs of reducing tropical forest emissions vary greatly. Global economic models designed to calculate the *full economic* costs of slowing deforestation estimate that 1.7-2.7 $GtCO_2e$ per year of REDD-based emissions reductions could be achieved for an average price of $11 per ton CO_2 (tCO_2).[5, 6] These estimates do not include the numerous difficult-to-

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[2] IPCC. 2007. 4th Assessment Report of the Intergovernmental Panel on Climate Change, edited by S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor and H. L. Miller.

[3] van der Werf, G. R., D. C. Morton, R. S. DeFries, J. G. J. Olivier, P. S. Kasibhatla, R. B. Jackson, G. J. Collatz, and J. T. Randerson. 2009. CO2 emissions from forest loss. Nature Geosci 2 (11):737-738.

[4] McKinsey & Company analysis for Project Catalyst in "Towards the inclusion of forest-based mitigation in a global climate agreement" (Working Draft May 2009). Based on calculation of abatement potential at a cost of less than €60/tCO_2e. McKinsey & Company analysis for Project Catalyst in "Scaling up Climate Finance: Finance briefing paper" (September 2009). Required mitigation is calculated as the difference between BAU GHG emissions and the level of emissions required to stay on a pathway to stabilizing greenhouse gas concentrations at 450ppm.

[5] Stern, N. 2006. The Economics of Climate Change. London: HM Treasury. http://www.hm-treasury.gov.uk/stern_review_report.htm

quantify economic benefits of forest conservation, such as flood control, soil conservation, biodiversity conservation, and local climate regulation. Cost assessments that calculate the *budgetary* costs of programs designed to achieve these reductions estimates the costs could be much lower on the order of $1-3/t$CO_2$e.[7]

Challenges to Developing REDD-based Offsets

While REDD-based emissions offsets appear to hold great promise as a potential large-scale source of low-cost GHG emissions reductions, REDD presents a number of policy, substantive and technical challenges that are likely both to substantially reduce the amount of REDD-based offsets that may be available and increase their economic cost. These challenges include:

- Many REDD projects are located in "risky" countries where it is very difficult to conduct normal business activities;
- Many potential REDD host countries lack essential expertise, institutional capacity and effective governance;
- In several versions of proposed U.S. federal legislation (e.g., the "Waxman-Markey" legislation [HR 2454]), REDD-based offsets only would be allowed to be used for compliance purposes to the extent they are supplemental to a "deforestation emissions baselines" that require "zero net deforestation" to be achieved in 20 years. This provision alone would reduce substantially the amount of REDD-based offsets that could be made available to covered entities in the U.S. for compliance.
- An evolving "sectoral" policy environment that favors REDD "projects" being accounted for as part of "sub-national" and "national" REDD-based accounting systems; and,
- "Domestic" GHG emissions reductions commitments made by key developing countries like Brazil as part of ongoing international climate negotiations may drastically limit the future supply of low-cost REDD-based offsets.

The Key Role of Brazil in Developing REDD

The speed that nations can reduce emissions from deforestation and forest degradation, and the rate at which REDD+ efforts can generate GHG offsets for use by regulated entities, cannot be gauged precisely. However, the policy process for developing REDD programs and implementing REDD activities already has begun on a large scale in the Brazilian Amazon region.

Since 2006, deforestation in this region has declined 64% below the 10-year average, resulting in a 0.5 GtCO_2e reduction in annual emissions, which is equal to one percent of total global anthropogenic emissions. Brazil is on a path to double these emissions reductions by 2020 through implementation of its National Climate Change Plan (NCCP). As part of this plan, Brazil

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[6] Kindermann, G. E., M. Obersteiner, B. Sohngen, J. Sathaye, K. Andrasko, E. Rametsteiner, B. Schlamadinger, S. Wunder, and R. Beach. 2008. Global cost estimates of reducing carbon emissions through avoided deforestation. Proceedings of the National Academy of Sciences 105 (30):10302-10307.

[7] Nepstad, D., B. S. Soares, F. Merry, A. Lima, P. Moutinho, J. Carter, M. Bowman, A. Cattaneo, H. Rodrigues, S. Schwartzman, D. G. McGrath, C. M. Stickler, R. Lubowski, P. Piris-Cabezas, S. Rivero, A. Alencar, O. Almeida, and O. Stella. 2009. The End of Deforestation in the Brazilian Amazon. Science 326 (5958):1350-1351.

is striving to reduce deforestation in the Amazon region by 80% and in the Cerrado savanna/woodland region by 40% by 2020. However, it is not clear what portion of these emissions reduction would be available as GHG offsets to entities that may be covered by future U.S. carbon constraints and other private investors. However, it appears that Brazil could supply 300-500 million tons CO_2e of offsets annually to the international community by 2020 if current REDD negotiations and design processes come to fruition.

Indonesia, the other major deforesting nation in the world, also is now designing a program to reduce forest clearing, but Indonesia lags far behind Brazil in terms of its institutional capacity and governance and so may not be able to supply large quantities of high-quality REDD-based offsets in the near term.

Brazil's leadership developing large-scale international forest carbon offsets derives from its advanced capacity in forest frontier governance and the sheer size of its forest estate (see section three). Brazil has monitored deforestation in the Amazon region on an annual basis since 1988, and makes available maps and underlying satellite data on the extent of deforestation to the public free of charge. National policies, such as the Forest Code, impose on landholders ambitious requirements to maintain forests on private lands. Brazil has set aside 53% of the forests of the Amazon region as protected areas[8], and it has launched successful campaigns to punish illegal deforestation and logging. Several states in the Brazilian Amazon have developed and implemented land-use zoning plans required by national law that define allowable uses of the land in geographically explicit zones.[7] These advances in institutional capacity and public policies are particularly important because Brazil also contains far more forest than any other tropical nation. The Brazilian Amazon forest covers 3.3 million km^2 and is twice the size of the Congo forest and five times larger than the remaining forests of Indonesia.[7] In addition, Brazil has 1.5 million km^2 of savanna woodland (in the *Cerrado* biome) which is more than any other nation.

Report Summary

This report summarizes analyses and research conducted to inform and support the potential development of a very large-scale REDD- based forest carbon project in the Brazilian Amazon that could generate large quantities of REDD-based GHG offsets.

Since this original research project was conceived several years ago, both the national and state-level REDD frameworks in Brazil have evolved rapidly. These developments made it clear that additional analysis was needed to provide insights on the most appropriate approaches that could be used to integrate REDD regimes across scales (i.e., national, state, project) and attract private investors into REDD programs by lowering their risks. In response, the project team modified its original focus part way through the original project to include these additional analytic components.

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[8] Soares-Filho, Britaldo, Paulo Moutinho, Daniel Nepstad, Anthony Anderson, Hermann Rodrigues, Ricardo Garcia, Laura Dietzsch, Frank Merry, Maria Bowman, Leticia Hissa, Rafaella Silvestrini, and Claudio Maretti. 2010. "Role of Brazilian Amazon Protected Areas in Climate Change Mitigation." Proceedings of the National Academy of Sciences 107, no. 24: 10821-26.

In addition, there is growing recognition and interest among policy experts and others involved in evolving climate policy both in the U.S. and internationally in the potential to develop "sectoral" emission reductions programs that would seek to reduce emissions from entire economic sectors like cement, electricity, forests, steel, and other sectors in more advanced developing countries like Brazil, China, India and others. The concept of "sectoral" emissions reductions is new in the context of international climate negotiations, and many parties believe existing offsets mechanisms like the CDM and Joint Implementation (JI) programs need to be augmented with the creation of new sectoral-based offset crediting mechanisms. Sectoral mechanisms potentially could scale up more rapidly than project-based offset programs like the CDM, which have not achieved the scale that many of its advocates and proponents originally had hoped when it was created by the Kyoto Protocol.

Apart from the specific challenges associated with developing future REDD-based offset programs, the more general development of "sectoral" offset programs also faces many policy, substantive and technical challenges that are likely to slow the development of these approaches and ultimately reduce the absolute amount of emissions reductions likely to qualify under these evolving programs. These challenges include:

- To date, no sectoral offsets program has been implemented anywhere in the world, and there is no existing international or domestic policy architecture to provide guidance;
- Proposed U.S. federal legislation (e.g., H.R. 2454) would require countries to enter into either multi- or bi-lateral agreements with the U.S. to go forward and develop sectoral-based crediting mechanisms that would qualify to be used by U.S. firms that may be covered by future cap-and-trade legislation;
- Based on the experience of the development of the CDM program, it could take a number of years to develop an internationally acceptable sectoral crediting program; and,
- Today, it is not clear how "compliance parties" either could pay for, or receive, sectoral-based compliance offsets, as there is no obvious way for private firms to finance "sector" wide emissions reductions in foreign nations. It is possible that private firms could purchase *ex-post* sectoral emissions reductions once the emissions reductions have been achieved, demonstrated and suitably registered. There is also no way for firms that do so to be compensated if a particular sector fails to achieve a level of emissions reductions beyond the so-called "sectoral" crediting baseline that would qualify it to generate sectoral offsets.

This EPRI research project consisted of a number of project tasks which are summarized in the various sections of this report.

Sections two and three summarize the status of REDD today internationally, and how REDD policy is unfolding in Brazil.

Section four describes the results of an evaluation of the potential designs of sub-national REDD programs in Brazil, and different approaches that could be used to "nest" REDD-based projects into sub-national and national REDD-based sectoral crediting programs.

Section five reports on the project team's analysis existing carbon registries and their potential to be used to register GHG offsets generated by REDD projects implemented in the Brazilian Amazon region. The project team examined existing carbon offset registries operating around the world to determine if any of them would be adequate to be used to register offsets generated by a

large-scale REDD project implemented in the Brazilian Amazon. As a consequence of this analysis, the project team has proposed creation of a more comprehensive, state-based environmental registry that would be integrated with GHG emissions accounting components.

Section six of this report describes alternative contractual and financial mechanisms that could be used to deliver large-scale, project-based, private-sector funding and reduce financial risks associated with possible REDD-based offsets that are part of evolving sub-national and national-based REDD programs in Brazil.

Section seven describes the Xingu River basin in physical and demographic terms and provides a landscape overview of the potential to achieve regional GHG emissions reductions.

Section eight summarizes existing legal research that has been conducted related to ownership of forest carbon stocks located on indigenous lands in Brazil.

Section nine describes a proposed deforestation "baseline" for the Xingu indigenous lands that could be used as the basis for quantifying carbon dioxide (CO_2) emissions reductions from potential future avoided deforestation projects and activities. The project team examined the assumptions underlying previous modeling projections and refined one of the existing models specifically to be to analyze the Xingu region so as to improve the estimate of the potential quantity of CO_2 emissions that could be avoided by implementing a REDD project in the indigenous territories.

Section 10 describes potential next steps that the project team believes are necessary to move the REDD process forward in Brazil.

Section 11 provides key insights based on the work completed by the project team as part of this EPRI supplemental project.

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BACKGROUND: THE STATUS OF REDD IN 2010

The Role of REDD in Climate Change Mitigation

Tropical deforestation and land-use change causes approximately 17% of global GHG emissions.[9] Most scientists, economists and policy makers agree that stopping tropical deforestation has the potential to reduce significant GHG emissions cost-effectively. The Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report states, "Reduced deforestation and degradation is the forest mitigation option with the largest and most immediate carbon stock impact in the short term per hectare and per year globally."[10] Some analysts have suggested that up to 4 $GtCO_2e$ per year potentially could be abated for under $5 per tonne CO_2e ($5/tCO_2e) by stopping slash and burn agriculture, avoiding forest conversion to pasturelands and reduced timber harvesting.[11] REDD is thought by many experts to be one of the largest source of relatively low-cost mitigation by an order of magnitude compared to any other sector of economic activity.

Given this potential, REDD has generated intense interest in UNFCCC negotiations, in deliberations about federal U.S. climate change policy, and in the implementation of California's AB-32 law. Although all of these processes face obstacles, REDD is the most advanced option for bringing in large-scale offsets into a future U.S. carbon mitigation program and enjoys considerable political support and momentum even while the operational details of REDD remain highly uncertain. In Europe, the EU ETS currently does not allow REDD or any other kinds of forestry offsets to be used for compliance purposes, although EU policymakers are considering allowing REDD-based offset credits to be used for compliance after 2020.[12]

The "Old" Forest Carbon World (pre-2005)

In 2005, REDD officially was introduced at the 11th Conference of the Parties (COP11) of the UNFCCC led by the Costa Rica and Papua New Guinea delegations. Without REDD, efforts to mitigate climate change in forests in developing countries are limited to project-based Afforestation and Reforestation (A/R) efforts that can be implemented under the CDM, which

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[9] IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Pachauri, R.K and Reisinger, A. (eds.). IPCC, Geneva, Switzerland.

[10] IPCC, 2007: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds), Cambridge University Press, Cambridge, United Kingdom. Section 9.4.2.1.

[11] McKinsey & Company. 2009. Pathways to a Low-Carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve.

[12] European Commission, 2008. Addressing the challenges of deforestation and forest degradation to tackle climate change and biodiversity loss: 645/3. EC, Brussels.

excludes forest conservation activities, and in the "voluntary" carbon markets. The CDM program's methodologies and rules for A/R projects have been slow to develop and are complicated and expensive to implement. As a result, only a handful of small projects have been approved to date, and very few investments have been made into CDM forest carbon projects. In the voluntary carbon market before 2005, approximately $40 million in carbon finance was spent on forest carbon projects that could be considered to be REDD precursors.[13] None of these investments generated carbon credits or offsets. While these projects are noteworthy and important for innovation, during the period prior to 2005 there was very little financial support for forest carbon-related activities and no visible path for forest carbon pilot projects to create compliance-grade offsets.

An Evolving Forest Carbon World (2005-2009)

During the period 2005-2009 leading up to COP15 in Copenhagen, enthusiasm and support for REDD increased among policymakers and others focused on mitigating future global climate change. REDD discussions within the UNFCCC made significant progress and the issue received widespread public and media attention.

In 2007, the World Bank initiated its Forest Carbon Partnership Facility, with the dual objectives of building developing country capacity to implement REDD+ through its Readiness Mechanism, and implementing and evaluating pilot incentive programs for REDD+ through its Carbon Finance Mechanism.[14]

In 2008, the UN-REDD Program was launched as a joint initiative of the UN Development Program (UNDP), Environment Program (UNEP), and Food and Agriculture Organization (FAO). The goal of this program is to assist developing countries to prepare and implement national REDD+ strategies.[15]

In the voluntary carbon market, substantial interest in REDD has developed. In 2008 alone, investments in voluntary REDD pilot projects were estimated at $37.1 million,[16] reflecting a clear increase in philanthropic and private sector support compared to pre-2005 activity.

REDD also featured prominently in key pieces of U.S. federal legislation toward the end of this period, enhancing the prominence of REDD in the U.S. domestic climate policy discussion.

During this period, governments, project developers, non-governmental organizations (NGOs) and private sector parties initiated a plethora of project-based REDD+ efforts. These efforts ranged from those initiated by "carbon cowboys" (firms trying to profit quickly from questionable REDD deals with communities and governments) to legitimate efforts to use carbon

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[13] Ecosystem Marketplace, 2010. State of the Forest Carbon Markets 2009: Taking Root and Branching Out. Ecosystem Marketplace, Washington DC. On-line at: http://moderncms.ecosystemmarketplace.com/repository/moderncms_documents/SFCM_2009_smaller.pdf .

[14] For more information about this program see http://www.forestcarbonpartnership.org .

[15] http://www.un-redd.org/AboutUNREDDProgramme .

[16] Ecosystem Marketplace, 2010. State of the Forest Carbon Markets 2009: Taking Root and Branching Out. Ecosystem Marketplace, Washington DC. On-line at: http://moderncms.ecosystemmarketplace.com/repository/moderncms_documents/SFCM_2009_smaller.pdf .

finance to sponsor integrated approaches to control of deforestation. Leading up to COP15, REDD was the segment of the post-2012 UNFCCC climate treaty that had progressed furthest within the international negotiations. In general, the REDD concept received nearly universal support. Given this, the actual REDD-related negotiations focused primarily on design issues, such as the scale of REDD accounting (e.g., national versus sub-national), the scope of activities (i.e., deforestation, forest degradation, enhancement of carbon stocks), and appropriate methodologies to establish baselines for measuring the efficacy of future REDD activities.

The "New" Forest Carbon World in 2010 (Post-Copenhagen)

Negotiations before and during COP15 failed to achieve a comprehensive global climate change agreement for the post-2012 period. This failure provoked widespread uncertainty about the global climate policy framework that continues to be exacerbated by delays in the U.S. climate and energy policymaking process. However, REDD continues to enjoy broad support within UNFCCC negotiations. Of the various programs and funds announced at COP15, REDD stands out for its continued progress in the development of the associated technical framework, its widespread cross-sector support and its ability to attract voluntary funding pledges.

The Copenhagen Accord developed at COP15 calls for a new REDD+ mechanism, one of only two new mechanisms contained in the Accord. Although prospects for implementing the Copenhagen Accord remain in question, many nations of the world have begun to make financial commitments to REDD. The "Paris-Oslo process"[17] has organized a dialogue and strategy among 17 donor nations and 41 developing countries that culminated (as of May 2010) in REDD+ pledges totaling $4.0 billion for the period 2010 to 2012. Norway and the U.S. have promised $1.0 billion each for REDD+ efforts during the three-year period. Since Copenhagen, NGOs, private sector parties, and key federal agencies in the U.S. have coordinated their efforts to push Congress to authorize and honor the $1.0 billion U.S. REDD pledge.

In addition to the Copenhagen Accord's call for an international REDD+ mechanism and substantial REDD+ donor commitments, COP15 adopted a technical decision requesting developing countries to establish forest-monitoring systems.[18] This decision states:

> *The Conference of the Parties…request developing country Parties…to establish…robust and transparent national forest monitoring systems, and if appropriate,* ***sub-national*** *(*bold font added*) systems as part of national forest monitoring systems that:*
>
> 1. *Use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating, as appropriate, anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes;*

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[17] "REDD+ Partnership", on-line at: http://www.oslocfc2010.no/pop.cfm?FuseAction=Doc&pAction=View&pDocumentId=25019 .

[18] UNFCCC Decision 4/CP.15. "Methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries". On-line at: http://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf#page=11 .

2. *Provide estimates that are transparent, consistent, as far as possible accurate, and that reduce uncertainties, taking into account national capabilities and capacities;*
3. *Are transparent and their results are available and suitable for review as agreed by the Conference of the Parties;*

If a post-Kyoto Protocol framework matures, these monitoring systems would form the basis for accounting for emissions avoided through REDD activities, and likely would become the foundation upon which potential issuance of REDD offset credits would depend. In addition to the focus on national monitoring systems, UN decision 4/CP.15 also recognizes the importance of *sub-national* forest monitoring systems as part of national ones. Given the state of forest inventories, and the level of technical capacity in many potential REDD+ countries, provision for this interim monitoring system sets the stage for countries to be able to offer REDD+ credits earlier than if an entire national monitoring and accounting system was required before a country could participate in a REDD+ incentive mechanism.

The topic of whether sub-national REDD monitoring and actions should be included was extremely contentious at COP15 and in preceding talks, and is still being actively negotiated. Even with the possible inclusion of sub-national provisions, there is an ongoing debate within the international community about the allowable scale of sub-national activities. The debate centers on whether "sub-national" activities refer only to state or province-level activities, or whether they also could include smaller scale activities, such as individual projects.

However, with the decision to consider the inclusion of sub-national REDD forest monitoring and review, the UNFCC has left the open the possibility to credit REDD emission reductions that can be measured and verified at scales below the national level.

REDD and Proposed U.S. Federal Legislation in 2010

In the U.S., REDD consistently has been included in climate-related legislative proposals under consideration in the U.S. Congress. The "Waxman-Markey" bill (H.R. 2454), which passed the House of Representatives in June of 2009, set an ambitious goal of reducing carbon emissions from tropical deforestation by an amount equal to 10% of U.S. CO_2 emissions. To accomplish this, the legislation set aside five percent of the total emission allowances to be issued under the legislation to be used by the U.S. Environmental Protection Agency (EPA) to arrange for the protection of forests in developing nations.

Although the more recent "Kerry-Lieberman" draft legislation in the Senate (i.e., the "American Power Act") contained the same broad goal for conserving tropical forests, it did not set aside any specific funds or emission allowances to be used to stop tropical deforestation. The program was designed to support a variety of activities, including national and sub-national emissions reduction activities, forest governance, illegal logging prevention, and enforcement of forest protection laws.

Several proposed bills included language that stipulated that qualifying offset credits could be generated by reduction in national deforestation emissions and only would have allowed sub-national programs and activities during a limited multi-year transition period.

Funds generated under the proposed Kerry-Lieberman bill would be distributed to an international fund designed to reduce deforestation emissions through bilateral assistance. The program would be guided by an interagency body made up of the key U.S. agency officials to ensure that the program is focused, targeted, and effective. Similar to provisions in the Waxman-Markey bill, the Kerry-Lieberman draft would allow offsets to be generated for national level deforestation reductions, and also included a provision for state/province level emission reductions during a transition period of five years, after which time the participating country would be required to move to the national scale to continue its participation. The draft bill also included specific provisions to create offsets from REDD-related project and program activities. These activities would be allowed to create offsets for an eight year window, with possible five-year extension for those countries considered "Least Developed Countries," provided they had established a process for transitioning their programs to the national scale, but did not yet have the capacity to do so.

Countries that generate REDD-based credits under the Kerry-Lieberman bill would be required to establish a baseline based on real historical data on deforestation rates that would be required to decline to zero net emissions after 20 years, accounts for nationally appropriate mitigation commitments, and covers all significant sources of deforestation emissions. The requirement that REDD-based offsets only could be created by emissions reductions achieved below a steeply declining national deforestation baseline also is included in the Waxman-Markey bill, and can be expected to significantly reduce the amount of offsets that would available from REDD-based programs in Brazil and other countries and increase the price of the remaining REDD-based offsets that do qualify. Eligible countries also would be required to have developed a "land use or forest sector strategic plan" that would prepare the country for efforts to address deforestation and encourages a holistic government approach to the management of its lands.

Furthermore, in both bills, provisions were included to insure that countries that receive investments must protect indigenous and forest dependent peoples, promote the preservation of biodiversity, and develop transparent and equitable benefit sharing for relevant populations on the ground.

The REDD provisions contained in all of the recent draft climate legislation in play in this Congress have been vigorously supported by an alliance of major U.S. businesses, non-governmental organizations, and scientific institutions working to protect tropical forests as part of efforts to mitigate climate change.[19] While the Kerry-Lieberman draft bill did not explicitly set aside funds for REDD, the REDD provisions include crediting for state/province and project/program type activities for limited time periods to allow for the development of national programs in REDD countries. Specific guidance on the development of appropriate baselines, stakeholder engagement, governance, and other important components of high quality REDD-based offsets have been included in many of the current legislative proposals, and generally are in harmony with the direction of ongoing UNFCCC negotiations.

While none of these bills now are being debated actively in the Congress, the evolution of proposed U.S. climate legislation over the past few years suggests REDD is likely to be included

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[19] For more information about the organizations participating in the Tropical Forest and Climate Coalition see http://climateforest.org/.

in future U.S. climate and energy-related legislative efforts and suggests some of the key REDD policy components that may be included in future U.S. legislation.

Reduced Emphasis on Isolated REDD Projects

Many observers anticipate REDD will play an important role within both the UNFCCC and U.S. climate policy if and when policies are adopted domestically and internationally that establish binding carbon constraints. Within these contexts, policymakers have signaled that REDD *projects* have an important, but limited role. For REDD to succeed at scale without simply shifting deforestation from one area to another, policy makers have begun to emphasize a transition from sub-national regimes to nationally-based GHG mitigation programs and targets.

This evolution can be traced, at least in part, to the fact that in the first commitment period of the Kyoto Protocol (2008-2012) the international community emphasized *project-based* offset crediting through the CDM and JI programs. These mechanisms generated an estimated $60 billion in investments in emission reduction projects in the developing world, but they have not had a discernable impact on aggregate GHG emissions emanating from various sectors in developing countries.

There also is a growing recognition that stopping deforestation at national levels (e.g., across all of Brazil) will not happen overnight. Since it will be challenging to move immediately from *project-based* accounting to *national-level REDD regimes*, states and provinces have emerged as the critical sub-national scale at which to design and implement REDD programs in the near term. This sub-national scale may provide a way include stand-alone REDD projects by *nesting* them within a larger sub-national framework while simultaneously coordinating with evolving national baseline, additionality and monitoring systems.

Although isolated forest carbon projects have proliferated in recent years in the voluntary carbon market, the project team believes stand-alone REDD projects are unlikely to produce fungible, compliance-quality offset credits in the longer term as U.N. and U.S. policies consolidate over the coming years. Given language included in evolving U.N. and U.S. policy discussions, nested frameworks that combine project-based accounting, nested within state and federal programs, such as may be possible in the Xingu River basin in the Amazon, are likely to have the best chance to yield fungible offsets in the future.

States and Provinces Come to Center Stage

Within the discussion on appropriate scales to implement REDD, there is a growing recognition that states and provinces in developing countries are likely to play critical roles. States and provinces often have jurisdiction over land use zoning, law enforcement, environmental licensing, benefit distribution mechanisms, and many other important government functions. States and provinces already are building initial architectures to bridge the “old world” of project-based accounting to the “new world” of national carbon accounting. States in Brazil continue to motivate changes in the federal governments approach to REDD. Amazon states have been vocal in calling on the federal government to allow REDD+ crediting and access to carbon markets at the state level.

States in Brazil are developing comprehensive “wall-to-wall” land use plans that define legally permitted levels of deforestation. Several of these plans have been reviewed and authorized by

state legislatures and approved by the federal government, and now are taking on the force of law. States play a crucial role in managing and regulating land use and forests in Brazil under the *Pacto Federativo*. Provincial governments in Indonesia fill similar land use planning roles, oversee logging concessions, conduct forest law enforcement, and are the key government entities that implement and oversee a range of social and economic development programs.

Some states and provinces in developing nations have emerged as advocates for vigorous federal engagement on REDD. For example, in Indonesia, governors of several heavily forested provinces have pressured their federal counterparts to facilitate and fund REDD initiatives in Indonesian provinces. These governors have implemented a range of REDD activities and are ready to engage the private sector and international donors to continue to advance implementation. On April 20, 2010, governors from Aceh, Papua, East Kalimantan and West Kalimantan sent Indonesian President S. B. Yudhoyono a letter urging him to "…work with other world leaders to include strong provisions for sub-national action on REDD and other forest activities in any international climate treaty and domestic legislation."[20]

Donors have taken note of the important role states and provinces have in implementing REDD initiatives. A May 26, 2010 letter of intent between Norway and Indonesia describing Norway's planned $1.0 billion support for REDD in Indonesia explicitly calls for a Phase 1 province wide REDD pilot.[21] Other donors have signaled varying levels of interest in funding REDD efforts at the state and provincial scales in developing countries.[22]

Common rules for statewide REDD policies are being developed now through the Governors' Climate and Forests Taskforce (GCF) that potentially can link to various potential sources of demand for REDD-based offsets, including the voluntary carbon markets, California's AB-32 process, U.S. federal legislation and the UNFCCC system.

The Governor's Climate and Forest Taskforce (GCF)

The GCF is now at the center of the evolving landscape of state and provincial REDD innovations. The GCF is the most advanced policymaking process in the world today actively engaged in developing compliance-grade REDD rules. The GCF was formed in 2008 and currently has 14 member states from the U.S. (California, Illinois, and Wisconsin), Brazil, Indonesia, Mexico and Nigeria with others applying to join.[23] Member states include the most advanced state and province REDD programs in the world, from Aceh, Indonesia to Acre, Brazil.

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[20] April 20, 2010 letter from Governors Irwandi Yusuf (Aceh), Barnabas Suebu (Papua), Awang Saroek Ishak (East Kalimantan) and Cornelis (West Kalimantan) to S. B Yudhoyono. On-line at: http://www.gcftaskforce.org/documents/Letter%20to%20SBY%20(April%202010).PDF

[21] http://www.redd-monitor.org/wordpress/wp-content/uploads/2010/05/Norway-Indonesia-LoI.pdf

[22] Tropical Forest Group, 2010. Funding Opportunities for REDD+ in GCF Member States and Provinces at http://www.gcftaskforce.org/documents/TFG%20GCF%20Report%20on%20REDD+_Funds_GCF_May%207%20(English).pdf .

[23] The GCF states and provinces include Aceh (Indonesia); Acre (Brazil); Amapá (Brazil); Amazonas (Brazil); California (U.S.); Campeche (Mexico); Cross River State (Nigeria); East Kalimantan (Indonesia); Illinois (U.S.); Mato Grosso (Brazil); Papua (Indonesia); Pará (Brazil); West Kalimantan (Indonesia); and Wisconsin (U.S.).

These states share a common purpose to advance REDD by focusing on development of state and provincial REDD frameworks.

The current GCF work plan is focused on building a system of rules that GCF states can adopt in late 2010, combining voluntary carbon standards with state government frameworks and regulation. The GCF has been coordinating its work to inform the rule-making process for REDD as part of California's efforts to implement AB-32. Since California's emerging CO_2 cap-and-trade program would be the first U.S. compliance program to allow sub-national REDD credits to be used for compliance, the GCF has attracted substantial interest worldwide. Also, the geographic size and importance of the GCF member states has reinforced their role as policy leaders in this area.

California's demand for REDD credits is estimated to be approximately 15 $MtCO_2e$ per year at most, which is very small compared to the potential international supply of REDD-based offsets. However, given the potential role of sub-national accounting under the UNFCCC and the role of states and provinces in proposed U.S. federal climate legislation, the GCF's efforts and the fate of REDD in the implementation of California's AB-32 program are likely to influence REDD+ design on a global scale.

The Interaction of Nationally Appropriate Mitigation Actions (NAMAs) & REDD

A final level of complexity must be resolved in the sphere of international cooperation on climate change mitigation if REDD is going to evolve into a mechanism capable of generating large quantities of international offsets. This complexity has to do with the interplay between "Nationally Appropriate Mitigation Actions" (NAMAs) under the Copenhagen Accord and international commitments made by developing countries to reduce their own emissions and stop deforestation.

The Copenhagen Accord includes two appendices that form the core numerical aspiration of nations in terms of the domestic efforts each country is willing to undertake to confront climate change.

Appendix 1, "*quantified economy-wide emissions targets for 2020*", is the appendix to the Accord where ***developed nations*** commit to national reductions in GHG emissions for the year 2020.[24] This is the appendix in which the U.S. has inscribed its commitment to reduce U.S. national emissions 17% below a 2005 baseline by 2020.

Appendix II, "*nationally appropriate mitigation actions (NAMAs) of developing country Parties*" is the appendix where developing countries state their intentions to reduce their own GHG emissions and plans to adapt to climate change.

In creating this two-tiered architecture, the Copenhagen Accord left open two critical political questions, which leave the relationship between NAMAs and commitments by developed nations to reduce their own GHG emissions in question.

First, it is not clear what the overall role of the Copenhagen Accord will be in international efforts to mitigate climate change. The role of the Accord is still being debated intensely, since it

[24] UNFCCCC, 2009. The Copenhagen Accord.

failed to reach a consensus at COP15, and so is not a formal UNFCCC agreement. The failure of the Copenhagen Accord to reach consensus has meant international cooperation on climate change remains in flux with no clear process to implement the Accord.

If some international agreement resolves the larger question of the role of the Copenhagen Accord, the relationship between NAMAs and finance from developed nations still will need to be resolved. The Copenhagen Accord is silent on whether NAMAs will be carried out by developing countries with or without financial assistance from developed nations.

Some interpretations suggest developing countries first will need to meet the emissions reduction commitments contained in their NAMAs on their own before they would be eligible to sell offsets to parties in the developed world. Based on this interpretation, Brazil's NAMA represents Brazil's domestic contribution to the shared international goal of reducing GHG emissions, so Brazil cannot sell these emissions reductions to others, even though some donor countries may be willing to make philanthropic investments to help Brazil achieve its own NAMA. For instance, when Brazil submitted its contribution to the Copenhagen Accord, it stated it would reduce deforestation in the Amazon and the Cerrado (woodland savannah), increase biofuel usage, restore grazing land and increase energy efficiency.[25] Combined, Brazil estimated these and other actions would reduce Brazil's GHG emissions by 36% -39% by 2020 compared to BAU emissions levels.

However, Brazil also highlighted that it would implement these provisions in accordance with the provisions of the UNFCCC, particularly Article 4.7, which notes that the extent to which developing countries will implement actions depends on the availability of financial resources and technology transfer by developed nations. Therein is a central conundrum that will need to be resolved as part of further international negotiations: Can Brazil's NAMAs generate offset credits and carbon finance? Or, does carbon finance and offsets begin once a nation like Brazil successfully reduces its emissions below the level stated in their NAMA?

Several key U.S. climate legislative proposals, such as Waxman-Markey would require developing nations like Brazil to establish credible plans to reduce deforestation by 80% over 20 years, and stipulate that offsets only would be available for emissions reductions in excess of these "baseline" emissions reductions. The regulators developing emerging regulations under California's AB-32 also are grappling with similar questions of when, and under what conditions, crediting for offsets should begin for REDD projects.

To complicate matters further, Brazil is considering implementing national legislation that would cap GHG emissions domestically on an economy-wide basis and potentially allow domestic covered entities in Brazil to create and use REDD-based GHG offsets to achieve compliance with Brazil's own domestic climate legislation. This has the potential to reduce the available supply of REDD-based offsets even further in the evolving global carbon market.

The question of when to begin "crediting" actions in developing countries that reduce emissions remains unresolved and is being discussed by the UNFCCC, the U.S. government, the Brazilian government and even states within GCF countries. How this question ultimately is resolved will have significant bearing on the amount of available REDD-based offsets and their financial cost.

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[25] The Government of Brazil, 2010. The Embassy of the Federative Republic of Brazil Presents its Compliments to the UNFCCC. On-line at: http://unfccc.int/files/meetings/application/pdf/brazilcphaccord_app2.pdf .

Prospects for COP16 in Cancun, Mexico in 2010

International focus on reaching a prompt and meaningful global agreement on climate change clearly has waned since COP15. Although COP15 was the largest gathering of heads of state in the history of humankind, it failed to produce a binding international agreement to reduce GHG emissions. Furthermore, the Copenhagen Accord, which was developed through a process that deviated from UNFCCC protocol, contributed to further erosion of trust between industrialized and developing nations. Continuing negative global economic conditions and the uncertainty surrounding U.S. climate legislation have further hindered progress towards achieving a comprehensive international climate deal.

There is an effort within the U.N. to pick up where the Copenhagen Accord left off and fill in the missing pieces. Recently, a new UNFCCC Executive Secretary (Ms. Christiana Figueres) has been appointed and nations of the world are working toward achieving incremental and measured progress at COP16 to be held in Cancun, Mexico at the end of 2010.

Given the advanced technical and operational detail and broad political support for REDD, it is a policy issue that is likely to make at least some progress in Cancun. Still, there are many daunting issues to resolve in the UNFCCC process before clear market signals are likely to emerge regarding REDD, including: (i) What scale will the international process recognize REDD-based emission reductions? (ii) Which activities will be included in the definition of REDD+? And, (iii) What baseline methodologies will be included?

Section Summary

- There remains substantial policy and market uncertainty surrounding development of a coherent and comprehensive international approach to mitigating climate change. COP15 simply did not deliver a comprehensive, operational international agreement.
- Despite uncertainty in the overall UNFCCC process, REDD+ continues to make progress and to attract significant funding. Several developing countries have initiated legal reform processes, stakeholder engagement activities, and pilot processes to map and monitor their forests to prepare for eventual REDD+ implementation.
- Within the U.S. and California substantial opposition and roadblocks remain to implementing GHG emissions cap-and-trade programs that would create real market demand for international offsets including REDD. In addition, the upcoming mid-term congressional elections in November 2010 could have a profound impact on the pace of likely future domestic climate legislation at the federal level and in California. Meanwhile, a variety of legislative and regulatory processes continue to unfold at the federal and state levels.
- There is a high level of interest and enthusiasm for REDD+ among most developed nations. This interest is best exemplified by the $4.0 billion in pledges made for REDD by developed nations for the 2010-2012 period.
- In all areas of REDD design and implementation, the drive to move to large-scale implementation continues to grow. In Brazil and Indonesia, state- and province-level REDD programs and large-scale REDD projects nested within government programs are crucial in the next 2-3 years. States and provinces actively are engaging their federal counterparts on linking state-level and national REDD strategies. Policy and financial architectures that can drive private sector support to multi-scale levels of reducing deforestation have not yet been created but actively are being investigated.

- For now states and provinces in the developing world are the key to linking voluntary carbon projects with creation of pre-compliance GHG offsets.
- While REDD+ faces many challenges, it has a number of positive attributes compared to other opportunities to achieve large-scale emissions reductions:
  - REDD has been extensively discussed, debated, and key issues have been decided in a formal international context. There have been several formal UNFCCC decisions about REDD, including those related to topics such as linking remote sensing with field measurements, the establishment of baselines, and the role of local and indigenous communities.[26] Furthermore, the UNFCCC has established a REDD web platform to aggregate technical methodologies, and the UNFCCC has not created this kind of platform for any other sector of global GHG emissions.
  - The Copenhagen Accord calls for a mechanism to include REDD+. Ultimately, this is likely to be a significant outcome, given the importance of the CDM in the Kyoto Protocol, and because REDD is one of only two new mechanisms called for in the Copenhagen Accord. The other mechanism for technology transfer does not have the technical decision-making or momentum that REDD currently enjoys.
  - Substantial international donor funds to support REDD are being organized, and this funding is at a scale that is much larger than funding being mobilized for any other mitigation sector or for adaptation measures. This is a clear sign that REDD is likely to be a key component of any future global compact to mitigate climate change.

[26] REDD: A Quick Guide to the SBSTA Agenda UNFCCC. Available online at http://unfccc.int/methods_science/redd/items/4615.php .

3
THE EMERGING REDD+ FRAMEWORK IN BRAZIL

Introduction

Brazil is the single most important nation in the world for advancing an international REDD regime. Brazil's highly skilled international climate policy negotiating team was successful in blocking the inclusion of avoided deforestation in the Kyoto Protocol. At COP12 in Nairobi, Brazil endorsed a system of international compensation for nations that succeed in lowering their emissions from deforestation and forest degradation. Today, Brazil's international negotiation position still falls short of endorsing a full-fledged market mechanism to achieve compensation for REDD, but its negotiating position steadily has been moving in this direction.

Brazil's enormous influence over the emerging international REDD regime extends far beyond the skills of its UNFCCC negotiators. Brazil has the world's most sophisticated system of deforestation monitoring, created by its National Space Research Institute (INPE).[27] INPE has used high-resolution satellite imagery since 1988 to create deforestation maps and estimates of the area deforested on an annual basis. This information is made available for free to the public through INPE's website. The availability of these maps and associated data permit analysis of historical deforestation trends in Brazil with a high-level of confidence.

Brazil's credibility in REDD negotiations is heightened by its success in slowing deforestation in the Amazon region by 64% since 2006, and by its official commitments to reduce GHG emissions made at COP14 in Poznan in 2008 and at COP15 in Copenhagen in 2009. The institutions responsible for rural land use, including the environmental agency (IBAMA) and the land institute (INCRA) at the federal level, and the environmental agencies and land institutes at the state levels, have a high-level of institutional capacity as compared to similar institutions in other developing nations. Brazil's constitution recognizes the rights of indigenous and traditional peoples, establishes a "social" function of the land that includes the conservation of environmental services, and protects forests and native ecosystems in "permanent preservations areas" (e.g., steep slopes, riparian zones) and as a percentage of every property holding.

Finally, Brazil's has consolidated its status as an emerging international powerhouse by maintaining a stable economy since 1994, avoiding economic retraction during the current global economic crisis, growing its influence in international relations as demonstrated by its leadership role in the Doha round of World Trade Organization negotiations, its leadership role at COP15 in Copenhagen, its recent interventions in the Iran nuclear weapon issue, and its efforts to be a stabilizing influence over some of South America's volatile governments (e.g., Venezuela).

Brazil is the most important nation in the world for developing GHG offsets that could be created by REDD projects because of the overall size of its tropical forests, the country's advanced legal and institutional framework, a demonstrated track record of success in lowering its own

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[27] INPE. "Projeto Desmatamento (Prodes): Monitoramento Da Floresta Amazônica Por Satélite." INPE, http://www.obt.inpe.br/prodes/.

deforestation emissions, and deep political will to complete the development of a national REDD framework.

In the future, it may be possible to work collaboratively with the indigenous tribes that inhabit the Xingu basin to develop a large-scale avoided deforestation project that eventually may generate compliance-grade offsets. However, the potential to develop any large-scale REDD project in Brazil only can be understood within the context of Brazil's emerging REDD+ institutional framework. In this section, we review the current state of this evolving framework at the national, state, and project levels, and identify a pathway by which these different scales of REDD projects and programs ultimately may be reconciled and integrated. We begin with an historical overview of Brazil's success in controlling Amazon deforestation and the inter-related changes in its policies and commitments to reduce GHG emissions.

Deforestation in the Brazilian Amazon

Brazil is the world's tropical forest giant based on the size of its forests, the rate at which they are being cleared, the nation's ability to monitor forest clearing, and its effective national efforts to slow this forest clearing in recent years. Half of the world's closed-canopy tropical forests are found in the Amazon region; Brazil contains 60% of the Amazon Basin and 70% of the Amazon forest. The forest of the Brazilian Amazon alone covers an area of 3.5 million km^2, an area twice the size of the entire Congo Basin forest formation. These forests are being cleared at an annual average rate of 19,500 km^2 (for the period 1996-2005), releasing two-to-three percent of the world's anthropogenic GHG emissions to the atmosphere. After climbing to 27,000 km^2 in 2004, deforestation has declined precipitously, reaching the lowest level in 20 years (7,500 km^2) during the period of August 2008 - August 2009, as shown in Figure 3-1. Today, few other developing nations can provide such credible estimates of their historical deforestation trends.

Brazil's recent achievement in reducing its rate of deforestation also was aided by a temporary economic downturn in the soy and cattle sectors. Pressure to clear new forest for new pasture and cropland was suppressed by the low profitability of beef and soy in 2005 and 2006, resulting in a contraction in both the regional herd and the area of soy cultivation, both of which have not yet returned to 2005 levels.[28] The long-term projections for increasing global food demand[29] eventually are likely to foster a return to higher beef and soy prices and strong economic incentives to convert additional forest area. Cattle ranching is associated with approximately four fifths of forest clearing in the region.[30] The prospect of profits from cattle ranching and associated land use activities (e.g., timber harvest) is an important motivation for people to clear forests in the Amazon. Cattle ranching also plays an important role in deforestation because it provides a way to demonstrate "productive" use of the land in Brazil, which is a necessary criterion for acquiring formal land title.

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[28] Nepstad, D., B. S. Soares, F. Merry, A. Lima, P. Moutinho, J. Carter, M. Bowman, A. Cattaneo, H. Rodrigues, S. Schwartzman, D. G. McGrath, C. M. Stickler, R. Lubowski, P. Piris-Cabezas, S. Rivero, A. Alencar, O. Almeida, and O. Stella. 2009. The End of Deforestation in the Brazilian Amazon. Science 326 (5958):1350-1351.

[29] N. Alexandratos, World Agriculture: Towards 2030/2050. Food and Agriculture Organization, United Nations (2006)

[30] Alston, J. M., J. M. Beddow, and P. G. Pardey. "Agricultural Research, Productivity, and Food Prices in the Long Run." Science 325, no. 5945 (2009): 1209-10.

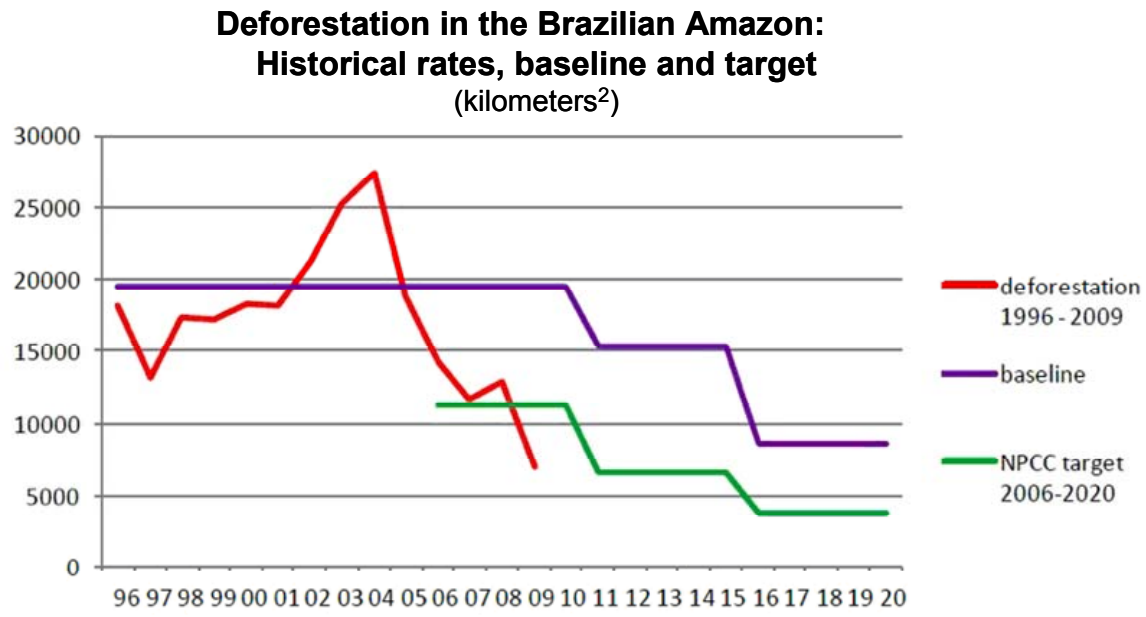

Figure 3-1
Brazil's steep decline in deforestation in the Brazilian Amazon through 2009 (annual historical deforestation), and the official deforestation baseline and target for deforestation formally adopted by Brazil through its National Policy on Climate Change (NPCC). In the one-year period ending August 2009, forest clear-cutting in the Amazon region was 7,500 km^2, two-thirds (64%) less than its ten-year (1996-2005) average annual deforestation rate of 19,500 km^2.

As a driver of deforestation, cattle ranching is intertwined with the far more profitable soy industry, which pushes up land prices, encouraging ranchers to sell their properties and acquire new forest land on the frontier.[31] The lucrative market for land on the frontier fosters corruption and graft and is the principle obstacle to government control of the Amazon region. However, the potential for soy expansion, and correspondingly sharp increases in land prices, is restricted to only 3% of the region's forested land outside of protected areas due to inappropriate soils, relief, drainage, and/or climatic conditions elsewhere.[32, 33] An additional three percent of the remaining forests in the Brazilian Amazon are suitable for conversion to soy, but are located in protected areas.

The decline in deforestation has been aided by a growing rejection of those entities engaged in forest clearing from food commodity supply chains. This market trend could help to reduce the

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[31] Houghton, R. A. "Tropical Deforestation as a Source of Greenhouse Gas Emissions." In Tropical Deforestation and Climate Change, edited by P. Moutinho and S. Schwartzman, 13-21. Belém, Pará, Brazil: Amazon Institute for Environmental Research, 2005.

[32] Nepstad, D. C., C. M. Stickler, B. S. Soares Filho, and F. Merry. "Interactions among Amazon Land Use, Forests and Climate: Prospects for a near-Term Forest Tipping Point." Philosophical Transactions of the Royal Society 363 (2008): 1737-46.

[33] Nepstad, D., B. S. Soares, F. Merry, A. Lima, P. Moutinho, J. Carter, M. Bowman, A. Cattaneo, H. Rodrigues, S. Schwartzman, D. G. McGrath, C. M. Stickler, R. Lubowski, P. Piris-Cabezas, S. Rivero, A. Alencar, O. Almeida, and O. Stella. 2009. The End of Deforestation in the Brazilian Amazon. Science 326 (5958):1350-1351.

risk to forest carbon project investors in the Brazilian Amazon region of REDD projects not achieving deforestation reduction targets. Soy traders (e.g., Associação Brasileira das Indústrias de Óleos Vegetais (ABIOVE), Archer Daniels Midland, Grupo Maggi, Cargill), meatpacking companies (e.g., Marfrig, JBS), leather working companies (e.g., Timberland, Nike) and retailers in Brazil (e.g., Wal-Mart, Carrefour) are taking steps towards excluding from their supply chains those cattle ranchers and soy farmers who are engaged in forest clearing.[34]

A "moratorium" on buying soybeans grown on lands cleared from Amazon forest after July 26, 2006, operated successfully for two years, with no newly cleared land being added into soy production, and the moratorium has been extended.[35] A similar beef moratorium also was launched recently. At the international level, multi-stakeholder commodity "roundtables" for soybeans,[36] palm oil,[37] sugar cane,[38] and biofuels[39] have completed – or will soon complete – development of environmental certification systems that include criteria for excluding products grown on recently cleared lands.

These roundtables have engaged companies that represent large shares of global production of each commodity, including 33% of world trade in soy, 25% for palm oil, and 28% for sugar cane.[40] The soy trading companies and meat packing companies seeking zero-deforestation suppliers of beef and soy are motivated by the reputational risk of being associated with Amazon deforestation, and by the growing demands in western Europe, the US, Brazil and elsewhere for beef, soy, oil palm, and sugar cane whose production does not cause negative environmental and social impacts.[41, 42, 43] These market trends alone, however, may not be sufficient to curb deforestation, especially since important markets (e.g., China) participate little in these certification processes.

This market trend provides an opportunity to break the historical antagonism that exists between landholders and the government by facilitating compliance with the law, incentivizing this compliance, and strengthening the connections between forest conservation and the well-being of law-abiding Amazon land managers generally. If a growing fraction of Amazon commodity

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[34] Greenpeace, http://www.greenpeace.org/international/news/global-cattle-giantsunite051009 (2009).

[35] Associação Brasileira das Industrias de Óleos Vegetais (ABIOVE). http://www.abiove.com.br/sustent/bs_edicao016_jul09.pdf (2009)

[36] "Round Table on Responsible Soy Association." http://www.responsiblesoy.org/index.php

[37] "Roundtable for Sustainable Palm Oil." http://www.rspo.org/

[38] "Better Sugar Cane Initiative." http://www.bettersugarcane.org/.

[39] "Roundtable for Sustainable Biofuels." http://cgse.epfl.ch/page65660-en.htmls

[40] "Building Bridges Between Agriculture And REDD+: An international REDD+ Farm Fund", Nepstad, Jason Clay, Jeroen Douglas, Jan Kees Vis, David Tepper, Michael Jenkins. Unpublished proposal. 2010.

[41] Houghton, R. A. "Tropical Deforestation as a Source of Greenhouse Gas Emissions." In Tropical Deforestation and Climate Change, edited by P. Moutinho and S. Schwartzman, 13-21. Belém, Pará, Brazil: Amazon Institute for Environmental Research, 2005.

[42] Greenpeace International. "Slaughtering the Amazon." 13: Greenpeace International, 2009.

[43] Conroy, M. E., Branded! How the 'Certification Revolution' Is Transforming Global Corporations New Society Publishers, 2007.

producers perceive that a trajectory of declining deforestation rates will improve their incomes and their access to markets, than the government and civil society may gain powerful allies in imposing the rule of law in the region. Similarly, if state agencies face stronger incentives to improve their efficiency in helping landholders come into compliance with the law and imposing stronger punitive measures when they do not, the agencies will be better able to fulfill their responsibilities and rapid changes in bureaucratic efficiency may result.

Brazil's Climate Change Policy

Brazil's deforestation monitoring system and success in slowing deforestation through its National Plan for the Control of Deforestation (NPCD) have helped to galvanize support for REDD within the UNFCCC negotiations and within Brazil's international negotiating team. Brazil's most poignant departure from its previous opposition to the inclusion of tropical deforestation in the climate treaty came during COP12 in Nairobi, where Environment Minister Marina Silva, armed with news of a further sharp decline in deforestation, announced a proposal to create an international tropical forest fund to support developing nations striving to curb clearing of their forests. This proposal initially was met with skepticism about the potential for national donations (e.g., Overseas Development Assistance – ODA) to provide funding at the scale necessary to significantly slow tropical deforestation. During the subsequent year, however, the Governments of Norway and Brazil negotiated a one billion dollar ($1B) commitment to Brazil's newly created "Amazon Fund", with disbursements tied to Brazil's progress in further lowering deforestation rates in the Amazon region.

Encouraged by continuing success in slowing Amazon deforestation, Brazil's Environment Minister Carlos Minc announced at COP14 in Poznan in 2008 Brazil's commitment to reduce Amazon deforestation by 70% by 2017 – a commitment subsequently revised to 80% by 2020.

Shortly thereafter, Norway released an initial disbursement of $110 million to the Amazon Fund in recognition of Brazil's progress in slowing deforestation. At COP15 in Copenhagen, Dilma Rousseff, the head of the Brazilian delegation and a leading contender for the upcoming Presidential election, announced Brazil's national commitment to reduce GHG emissions 36-39% below BAU levels by 2020. Most of the reductions necessary to achieve this target are expected to come from the 80% reduction in Amazon deforestation announced previously and a 40% reduction in clearing of the Cerrado, the savanna-woodland formation south of the Amazon region, which is South America's principal agricultural region.

Since Copenhagen, Brazil has transformed into law its "National Policy for Climate Change" (NPCC), which includes the GHG emission reduction targets announced in Copenhagen. The NPCC is supported by a $500 million annual budget and related programs in important ministries. The Ministry of Agriculture, Livestock, and Supply (MAPA) recently announced a $2B program of low-interest agricultural loans intended to favor farmers and ranchers who are lowering their GHG emissions. However, like any program announced during an election year, this on likely should be viewed with some skepticism. The broad public policy framework to achieve the goals of the NPCC is scheduled to be completed in October 2010. The government has organized five sectoral working groups to develop the broad policy and programmatic framework for the NPCC and includes working groups devoted to the Amazon, the Cerrado, and agriculture. A Presidential Decree now is being prepared for release prior to the COP16 meetings in Cancun, Mexico later this year that would formalize some aspects of an integrated, nested REDD framework in Brazil.

Brazil also has initiated a dialogue on the creation of a possible domestic Brazilian economy-wide GHG cap-and-trade program that would impose a limit on national GHG emissions from the industrial, energy and transportation sectors and would allow a portion of these emissions to be offset by investments in actions to reduce emissions from deforestation. If this program is implemented, it could result in fewer REDD-based offsets being available for compliance use outside of Brazil by U.S. electric companies and others.

Regulated companies in Sao Paulo and other industrial centers potentially would be allowed to meet part of their GHG emission reductions through investments in deforestation reduction programs in the Amazon and, perhaps, the Cerrado. This dialogue is motivated by a growing perception in Brazil that GHG emissions will be limited eventually through government regulation, and that some of the world's cheapest offsets can be found in the Brazilian Amazon.[44]

In moving from a commitment to reduce Amazon deforestation to the national GHG emission reduction targets contained in the NPCC, Brazil has positioned itself as a world leader in adopting formal emissions reduction targets. Measured against a 1990 baseline, the NPCC commits Brazil to a 17-19% reduction in national GHG emissions, which is particularly ambitious given the low level of emissions in Brazil's electricity and transportation sectors. (Approximately two-thirds of the electricity consumed through Brazil's electricity grid is supplied by hydroelectric generation and more than half of the fuel consumed by its car fleet is sugar cane ethanol.) Approximately two-thirds of Brazil's GHG emissions are from deforestation in the Amazon and Cerrado regions.

But the NPCC also highlights an important contradiction in Brazil's public policies. It's 80% and 40% deforestation reduction commitments for 2020 for the Amazon and Cerrado respectively, need to be juxtaposed against other government plans to increase agricultural output from 50-250% over the same period, as shown in Figure 3-2. A recent study of the potential for "low-carbon" development in Brazil commissioned by the World Bank and other previous studies[45] concluded the most important component of a national strategy to achieve the goals of the NPCC is the re-direction of agricultural expansion away from the forested lands of the Amazon and Cerrado, and onto the nation's existing pasturelands which cover 200 million hectares. (The entire area of cultivated crops in Brazil is less than 65 million hectares.)

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[44] Nepstad, D., B. S. Soares, F. Merry, A. Lima, P. Moutinho, J. Carter, M. Bowman, A. Cattaneo, H. Rodrigues, S. Schwartzman, D. G. McGrath, C. M. Stickler, R. Lubowski, P. Piris-Cabezas, S. Rivero, A. Alencar, O. Almeida, and O. Stella. "The End of Deforestation in the Brazilian Amazon." Science 326, no. 5958 (2009): 1350-51.

[45] Nepstad, D. C., and C. M. Stickler. "Managing the Tropical Agriculture Revolution." Journal of Sustainable Forestry 27, no. 1 (2008): 43-56.

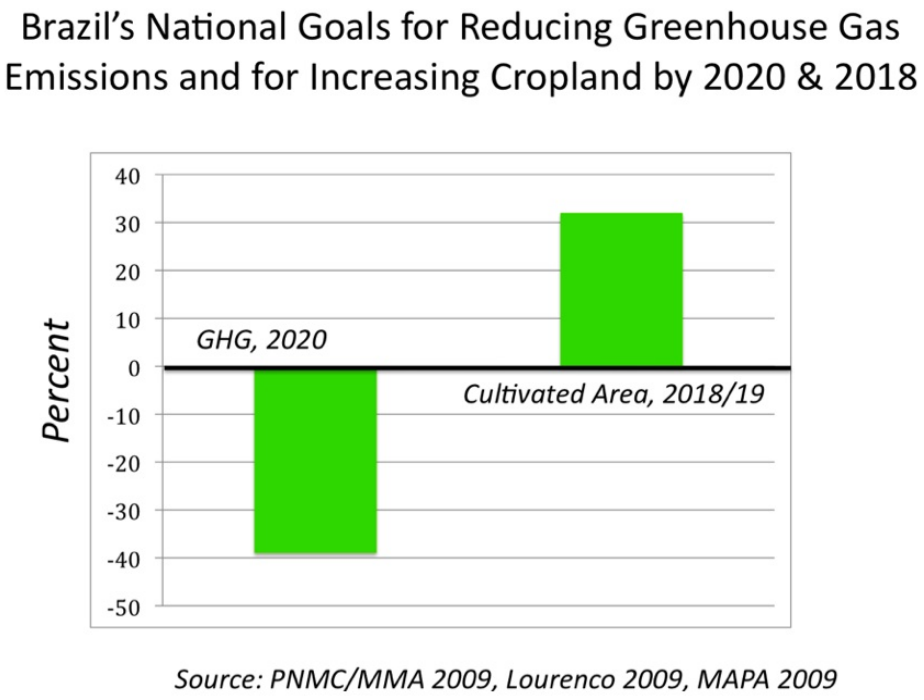

Figure 3-2
Brazil's contradictory goals for reducing GHG emissions (2020) and for expanding production of crops and livestock (2018/19). In moving to a nation-wide GHG emission reduction target, Brazil is the first nation to face the challenge inherent in the REDD+ component of the UNFCCC – to slow emissions from deforestation as world's demand for land-based production of food, fiber, fuel, and feed increases.

Brazil's NAMA and Potential for Provision of Offsets

As part of its association with the Copenhagen Accord, Brazil agreed to reduce its national emissions in a manner that "….will lead to an expected reduction of 3.6.1% to 38.9% regarding the projected emissions of Brazil by 2020."[46] As part of this Nationally Appropriate Mitigation Action (NAMA) under the Accord, Brazil appears to have committed to reduce deforestation in the Amazon by 80% by 2020. Brazil's recently adopted climate law represents Brazil's domestic implementation of its commitment to the international community's goals of reducing anthropogenic GHG emissions.

In addition, Brazil has made clear to the international community its desire and need to obtain international financial commitments to help pay for at least some portion of its domestic GHG abatement, and already traditional forms of foreign aid, such ODA funds, are flowing to Brazil to assist in this effort. For example, Norway has contributed $260 million so far to the Amazon Fund and this amount could grow to reach $1 billion over time in recognition of Brazil's progress in slowing Amazon deforestation. Under the Copenhagen Accord, and through the subsequent Paris-Oslo process, developed countries agreed to contribute $4B over the 2010-2012 period to support REDD capacity building and pilot activities.

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[46] Letter to Mr. De Boer, Embaixada do Republica Federativa da Brazil, Berlim, January 29, 2010.

One key to understanding the potential value of REDD-based offsets and the potential limits to their use by compliance parties in the U.S. is to understand the potential conflict that exists between on the one hand counting GHG reductions from REDD-based activities towards Brazil's voluntary international commitment to reduce its own emissions based on its NAMA, and the sale of the emissions reductions as offset credits to third-parties to achieve their own compliance obligations. In short, there may be a "zero-sum" game between Brazil's establishment of its NAMA that incorporates an 80% reduction in deforestation by 2020 and the quantity of REDD-based emissions offsets that ultimately may be generated by REDD projects in Brazil and credited for use by third-parties for their own compliance purposes. However, since Brazil has not yet agreed to undertake an internationally *binding legal commitment* to reduce its deforestation emissions based on its NAMA, it is not yet entirely clear whether some portion of the emissions reductions associated with its NAMA could be sold to third-parties as offsets in the international market.

Regardless, since emission reductions cannot be counted twice, it will be very important to determine clearly who "owns" REDD-based emission offsets in the evolving REDD framework in Brazil. Also, it will be critical to consider what the consequences will be for a REDD project that achieves its own emissions reduction goals if the overall REDD sector does not achieved emissions reductions below its sectoral "crediting" baseline.

Most economic analyses of REDD assume REDD credits would be issued compared to an historic baseline, which in the case of would allow Brazil to create substantially more offsets than a "crediting baseline" would allow, particularly if a crediting baseline is set at the -80% level as incorporated in Brazil's NAMA.

This dynamic between NAMA's and offsets comes together with establishment of a sectoral "crediting baseline." The crediting baseline represents some level of GHG emissions reductions below expected business-as-usual (BAU) emissions which the "host" country is required to achieve to be eligible to create offsets. Emissions reductions achieved below the "crediting baseline" potentially could be credited to REDD-projects and activities that achieve the "excess" emissions reductions.

It is also conceivable that Brazil could develop some kind of bilateral accord with the U.S as part of the implementation of its NCCP. In theory, such a bilateral accord potentially could facilitate establishment of joint emission reduction targets and facilitate implementation of some kind of joint approach to achieving these required emissions reductions. This approach potentially could facilitate making REDD-based emissions reductions available to future U.S. compliance parties, but to date no one has developed a design for such a bilateral accord.

An Integrated REDD Framework for National and State Programs and Projects

Four states in the Brazilian Amazon region – Acre, Amazonas, Mato Grosso, and Pará – have taken important steps towards developing state-level REDD programs. These states are shown in Figure 3-3. Each state has pursued a different path in developing their program, but they have come together as a political block to influence development of a national REDD program in Brazil.

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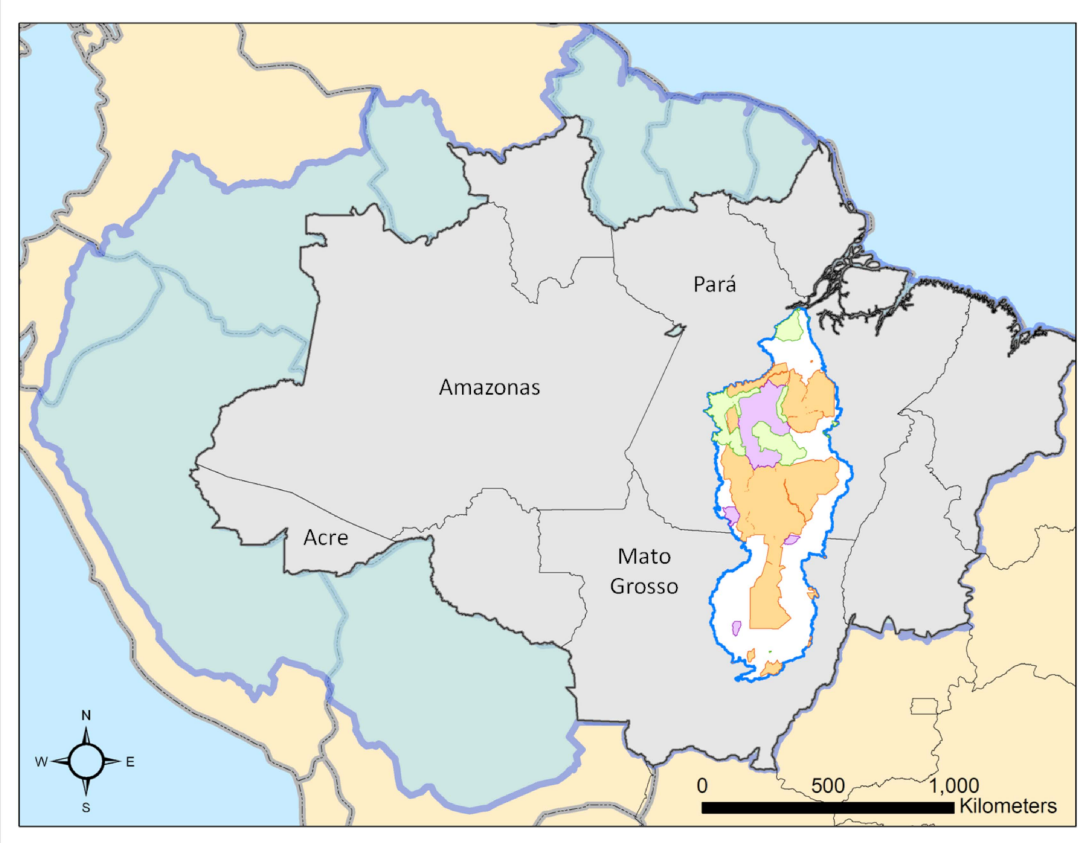

Figure 3-3
The Brazilian Amazon (gray), showing states where REDD programs are most advanced (Acre, Mato Grosso, Pará, Amazonas) and the Xingu River Basin that is the focus of the modeling exercise described in section nine of this report. The Xingu River basin represents approximately 7% of the total area of the Amazon River watershed (light blue), or 508,474 km^2.

The "Amazon Governors' task force" grew out of meetings that took place as part of the GCF, and has been a consistent source of pressure on the federal government to become a proponent of REDD in UNFCCC negotiations, and to endorse a market-based mechanism to fund REDD.

The emergence of state-level REDD programs is reinforced by the numerous governance roles that states exercise through Brazil's national decentralization policy – the *pacto federativo*. State governments have jurisdiction over land-use zoning (although final approval must be provided by the national council on environment), enforcement of land-use law (e.g., the Forest Code, which mandates legal forest reserves and permanent preservation areas on private lands), environmental licensing of private property, and the titling of large portions of each state's territory. Amazon states receive substantial federal funding to carry out these responsibilities, and their governments often have closer relationships with the major stakeholders involved in REDD than their federal-government counterparts

The emergence of Brazilian state-level REDD programs has provoked controversy over the rights of states to pursue independently investments in their REDD programs and projects, and over the calculations to determine the allocation of REDD benefits among states. State involvement also has created opportunities. In addition to moving the Brazilian government's international negotiating position closer to one of accepting market mechanisms for

compensating reductions in emissions from deforestation, it has promoted advances in design and dialogue over the most equitable, efficient and effective system for linking REDD activities at the national, state, and project scale. Below we describe a REDD system that has earned support in the Brazilian REDD regime design process.[47]

This REDD system is designed to accommodate revenues flowing from both regulatory markets and ODA funding and to link together national, state, and project level REDD activities in an equitable, efficient, and effective framework. It addresses an important political dispute that has arisen surrounding the allocation of REDD benefits across states, and the concern that the vast majority of REDD benefits would flow to states with historically high rates of deforestation. It proposes the design and implementation of state-level REDD systems that are operated by the states of the Amazon region in compliance with principals and criteria established and monitored by the federal government. The primary features of this system would include the following:

- Each state of the Brazilian Amazon would develop its own system for certifying, registering and monitoring emissions reductions from deforestation and issue REDD "certificates" (C-REDDs) for key REDD projects and programs that would be equivalent to one ton of CO_2e per C-REDD certificate.

  C-REDDs would be negotiable in the voluntary market and exchangeable for REDD carbon credits within the evolving regulatory carbon markets. The C-REDDs and accompanying data would be registered in an official public system of the state that would be integrated with the national REDD registry.
- REDD projects and programs would qualify to receive C-REDDs if they follow and reinforce the REDD principles and strategies previously defined by the State REDD Plan, with the effective participation of forest stakeholders.

  The volume of C-REDDs issued would be limited to the quantity of C-REDDs available for a given reference period (e.g., five years) to be determined by the federal government. C-REDDS would be issued on an *ex-post* basis after demonstrating that REDD activities successfully had avoided expected deforestation. However, incentives to reduce deforestation would be required to be implemented throughout the reference period.
- The allocation of C-REDDs to each state would be determined by performance, calculated as a combination of three variables: (i) The state's forest carbon stock; (ii) The quantity of emissions reductions, and (iii) Success in achieving emissions reduction targets.

Implementation of this kind of system could occur through the four steps described below.

Step 1: Accounting for emissions reductions from deforestation

As an example, if we compare the deforestation rate for the period 2006-2009 and the deforestation target for 2010 (as defined in the NPCC), the total reduction of emissions from deforestation in the Amazon for the 2006-2010 period (which is the first reference period for the NPCC target) would be 1.4 $GtCO_2$.

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[47] A. Lima. 2009. Meta, Estoque Florestal e Redução do Desmatamento: Uma proposta de sistema de divisão de benefícios financeiros de REDD para a Amazônia brasileira," IPAM, Brazil. Presented at 2009 UNFCCC/SBSTA meeting, Bonn, Germany.
http://www.ipam.org.br/uploads/livros/fd30bd927378b83e99ceb7a4715939f0a852000e.pdf .

Step 2: Converting reductions in emissions from deforestation into C-REDDs

A portion of the total emissions reductions from deforestation would be designated for inclusion in the regulatory carbon market. In this example, we assume 50% of total emissions reductions would be converted into C-REDDs and eventually into carbon credits, while the remainder would be set aside as an insurance buffer, or designated as Brazil's voluntary contribution to climate change mitigation as part of its NAMA. In this example, this implies 725 million tons CO_2 would be designated as C-REDDs to be allocated across states.

Step 3: Distributing C-REDDs among states

Using the "stock-flow with targets" approach[48], a method was developed to allocate C-REDDs among the states. The weighting assigned to each component of the formula can be adjusted to accommodate political aspects of the REDD system. In this example, 50% of the C-REDDs are allocated according to the state forest carbon stock, 30% according to the portion of the basin-wide emission reduction verified in each state, and 20% according to the success in reaching the state target. Given these assumptions, the allocation of C-REDDs for the 2006-2010 period among states is shown in Figure 3-4.

Step 4: Registering and certifying REDD programs and projects

Each state would develop a system for certifying, registering, and controlling REDD projects and programs, using the principles and strategies developed by the state within its REDD plan. The federal government could establish an inter-ministerial process to engage civil society, other stakeholders, and the states, to define the general principles for the state-level REDD strategies and the distribution of C-REDDs. These principles could include the definition of the ceiling of C-REDDs that could be allocated to states and the establishment of a buffer reserve against performance reversals.

This REDD system would create a decentralized framework for orchestrating and integrating REDD plans, programs, and projects between the federal government, state government, and civil society. At its core, it defines national targets for reducing emissions from deforestation and forest degradation, encourages states to develop REDD plans to achieve a portion of these emissions reductions, and allocates the flow of REDD benefits according to each state's forest carbon stocks, emissions reductions, and success in reaching emission reduction targets. For this system to be effective, the state-level REDD plans must include programs and projects that provide effective incentives to traditional populations, indigenous groups, private property holders, and others, to achieve the desired reductions in deforestation emissions. The programs and projects developed must be aligned with the state-level policies for combating deforestation which, in turn, must support the federal NPCC.

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[48] Cattaneo, A. 2009. A "Stock Flow with Targets" Mechanism for Distributing Incentive Payments to Reduce Emissions from Deforestation: Woods Hole Research Center.

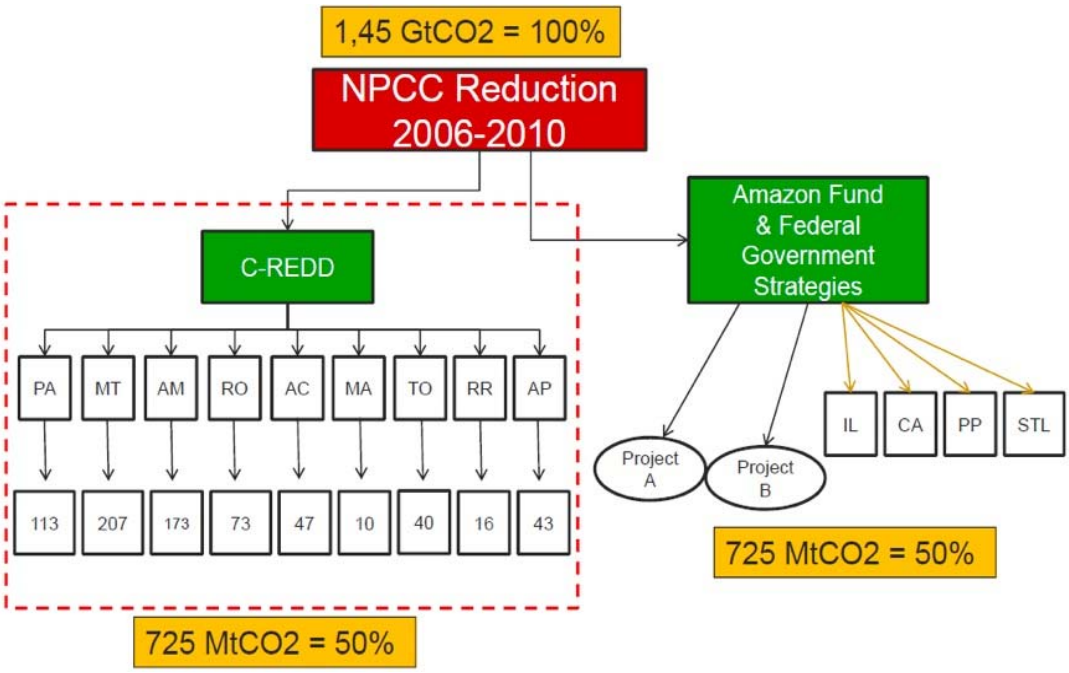

Figure 3-4
Diagram of one plausible REDD architecture that integrates federal, state and project-level REDD activities, based upon a hypothetical 2006-2010 reference period. REDD funding flowing into Brazil is divided between states and federal programs (in this case, 50:50). Allocation among states is determined according to forest stocks, emissions reductions, and success in reaching emission reduction targets. (The number beneath each state represents the volume of REDD certificates assigned to each state based on performance during the 2006-2010 period). Funds that flow to federal programs could contribute to the Amazon Fund or to related federal programs, for example, for Indigenous Lands (IL), Conservation Areas (CA), Private Properties (PP), and farm settlements (STL)) designed to support the REDD strategy. Projects could be funded through states or through federal programs. State abbreviations: PA (Pará), MT (Mato Grosso), AM (Amazonas), RO (Rondônia), AC (Acre), MA (Maranhão), RR (Roraima), AP (Amapá).

Critical components of this REDD design include:

1. A methodology to estimate reduced emissions for each type of project

These methodologies will be needed for indigenous lands (IL), conservation areas (CA), private properties (PP), and farm settlements (STL). These "actor-specific" methodologies will need to be developed for the entire biome and applied within each state.

Today, there is only one approved REDD-based offsets methodology in either the "compliance" or "voluntary" carbon markets around the world, and this applies solely to REDD projects implemented in certain peat swamps.[49] In August 2010, both the Voluntary Carbon Standard Association (VCSA) and Winrock International's American Carbon Registry (ACR) published draft offset protocols related to a subset of REDD-based activities and both organizations are now seeking public comment on the draft methodologies.

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[49] Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests, v1.0 (VM0004), Voluntary Carbon Standard Association, 2010.

2. Creating a state REDD offset registry

Each state could develop a REDD project registry that could be used to determines if a REDD project or activity is aligned with state policies for controlling deforestation. The registry also could determine if the methods used to determine baseline emissions and other project features are consistent with the state- and national-level REDD plans. Each state would have a limited number of C-REDDs to allocate each year, and each program or project (sectoral or geographic) would need to be selected in accordance with the priorities set forth in the state REDD plans. Registration of qualifying REDD activities and projects could be developed in two stages:

(i) Pre-Registration: This would be done at the time REDD programs or projects are presented to a state-level agency to take on a commitment to reduce emissions from deforestation. The agency would determine if the proposed methodology and potential emissions reductions are consistent, and to what extent the proposed activity or project is aligned with the state REDD plan priorities.

(ii) Registration: Emissions reductions would be "registered" in a serialized REDD registry once they have been reported and verified for the reference period defined in the pre-registration. Upon registration, C-REDDs would be issued.

Mato Grosso State's REDD Program

The Xingu River basin is located in the states of Mato Grosso (headwaters) and Pará. Any REDD project to be implemented on indigenous lands in the Xingu River basin that is to be connected to the state and national REDD systems under development must be within these two states. We describe here the status of the Mato Grosso statewide REDD program, since it is more advanced than the design of the Pará REDD program. However, Pará state has many of the components of a state-wide REDD program already in place, including a land-use zoning plan approved at state and federal levels, environmental licensing program for private landholders, a formal deforestation reduction target, and vigorous, well-organized organizations of smallholder farmers. (The most advanced state-level REDD program under development in Brazil, and perhaps in the world, is in Acre state in the southwestern Amazon.)

Mato Grosso is the biggest agricultural state in a nation that is an emerging global agricultural superpower.[50] The state covers 900,000 km^2 and provides four percent of Brazil's annual gross domestic product (GDP) through its powerful agro-industrial sector. If it were a nation, Mato Grosso's average annual deforestation rate of 8,000 km^2 during 1996-2005 would make it the world's 3rd or 4th largest deforester. And, yet, 60% of the reduction in Brazil's deforestation achieved since 2006 (Figure 3-1) took place in Mato Grosso. The government of Mato Grosso has launched a program called MT Legal to facilitate landholder compliance with the national Forest Code which requires 80% forest cover to be retained on private lands in the Amazon forest biome; it has announced a deforestation reduction target of -89% by 2020, and it has created policies and incentives to reduce expansion of the area of cattle pasture, which occupies 90% of all cleared land in the state at a very low stocking density. However, the state's attempt to approve a land-use zoning plan that had been developed over a 15-year period through

[50] Tollefson, J., 2010, Food: The global farm. Nature 466:554-556.

numerous public hearings recently was thwarted, and a drastically altered version of the plan was approved by the state legislature.

More recently, a corruption scandal involving approximately $700 million in illegal timber sales led to the imprisonment of 91 people, including the state's former Secretary of Environment and numerous other government staff. Little progress is expected on moving forward to develop the state's REDD program until after the political elections to be held in the fall of 2010.

Mato Grosso's REDD program is being developed by the State Forum on Climate Change, a multi-stakeholder group that includes representatives of government, civil society, agriculture, ranching, and small landholders, and is led by the Secretary of Environment. Prior to COP15, the Forum developed a state-wide REDD framework that reconciled the large REDD pilot projects being designed in the state (including the Xingu REDD project that is the focus of this EPRI project and a second pilot project in the northwestern region of the state), and identified the need to develop sector-specific programs that would qualify for a portion of the state's share of C-REDDs.

The Mato Grosso REDD program framework presented here is under discussion within the Forum as one possible approach the state could adopt. The final design will depend upon the outcome of the federal REDD design process and further dialogue among Mato Grosso stakeholders.

This framework begins with the State's official target of an 89% reduction in deforestation achieved, incrementally, by the year 2020. This target is more ambitious than the federal government's target for the Brazilian Amazon as a whole (-80% by 2020).

Given the precipitous decline in deforestation since 2005, Mato Grosso is expected to achieve 850 $MtCO_2e$ of emissions reductions for the period 2006-2010 below the official federal baseline for Mato Grosso of 1.4 $GtCO_2e$.[51] For the period 2010-2020, achievement of Mato Grosso' state target could yield 17,000 km^2 of deforestation reduction beyond the federal target, and generate 600 $MtCO_2e$ of emissions reductions beyond the federal target and 2.4 $GtCO_2e$ of emissions reductions below the federal baseline for Mato Grosso, as illustrated in Figure 3-5.

One design of the state-level REDD system under consideration by the Forum that would be compatible with the federal design shown in Figure 3-4, would allocate C-REDDs issued to the state among sector-level programs designed to protect forests and slow deforestation, as shown in Figure 3-6.

[51] The project team estimated the federal baseline for Mato Grosso assuming the same proportional stepwise reduction for the Brazilian Amazon that is established by the federal government.

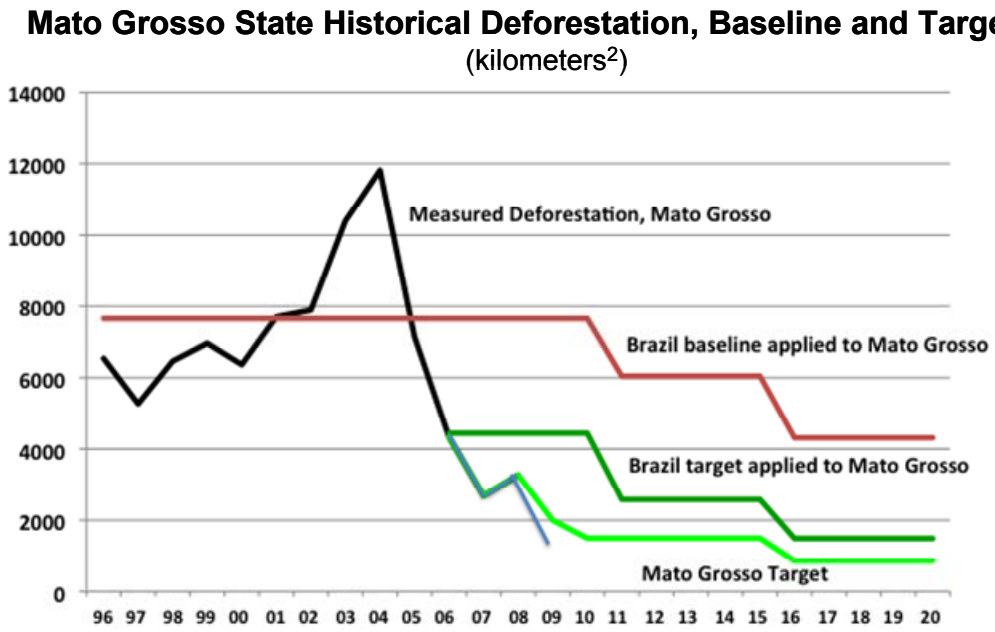

Figure 3-5
Mato Grosso state historical deforestation, baseline, and targets. The federal baseline (top red line) and target (green line) were calculated assuming the state will follow the same proportional step-wise reduction in deforestation as the federal baseline for the Brazilian Amazon. As of 2009, the state already had achieved its target of 1,500 km^2 annual deforestation, two years ahead of schedule. In this state alone, deforestation would be reduced by 65,000 km^2 over the 2010-2020 period if the target is achieved. The state's target provides 17,000 km^2 of avoided deforestation beyond the federal target.

In this example, programs would be developed for indigenous lands, conservation areas (e.g., parks, ecological reserves), farms and ranches, and small landholder settlements. A large portion of the state's C-REDDs would be allocated to an insurance reserve. Private investors, including potentially entities regulated within a Brazilian national cap-and-trade program and third parties could purchase C-REDDs from the project or program of their choice through a fund administered by the state-level REDD agency. A REDD project on indigenous lands in the Xingu Basin could become one project to receive C-REDDs through the indigenous lands program. Other projects and programs could receive additional C-REDDs through this program.

One of the strengths of this approach is that it could be integrated easily with the prevalent national REDD system proposal, and it would link projects to both state and federal REDD frameworks. It would allow for development of systemic programs to discourage forest-destroying behavior and reinforce forest-conserving behavior.

For example, an indigenous lands program could be developed through the sale of C-REDDs that builds capacity within indigenous tribes to develop non-timber forest product businesses and commercialization and marketing strategies for these projects. Another program might improve livelihoods in indigenous reserves through improvements in education, health care, and cultural survival.

One of the challenges associated with this approach could be ensuring the permanence of emissions reductions achieved by nested REDD-based projects and activities. Perhaps the most vexing issues in this area is what to do if a REDD project achieves its own emissions reductions, but the REDD sector overall does not surpass its "crediting baseline" so it would not able to create any offsets.

A great deal of this sectoral risk, and impermanence risk more generally, potentially could be addressed using two mechanisms described here. First, C-REDDS would be issued on an "*ex-post*" basis after the REDD-based activities had been implemented and verified. This would assure that offsets only would be issued for real emissions reductions.

Second, a number of C-REDDS could be held back by either the state or federal governments from each project or activity that generates C-REDDS and held in escrow as a "buffer reserve" to be used in the event of default on the nation's sectoral commitment.

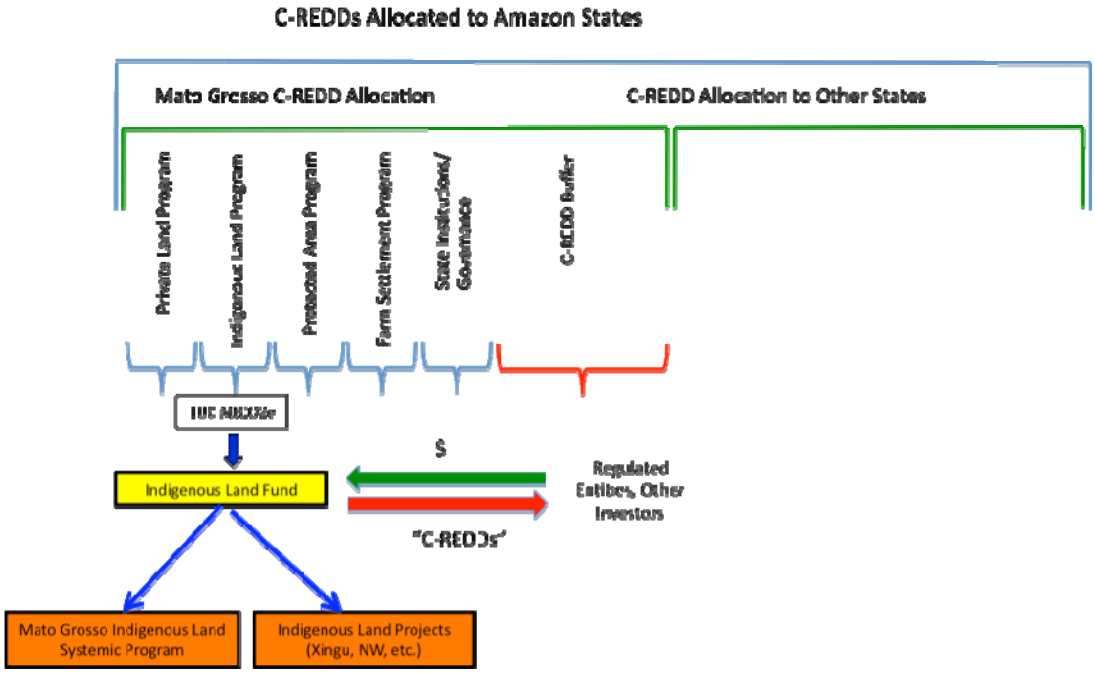

Figure 3-6
Mato Grosso State REDD Program Design. This diagram represents one of the REDD systems under discussion within the State Forum on Climate Change. It would allocate the state's share of C-REDDs from the federal government among state-level program for protecting forests and reducing deforestation in four categories: indigenous lands, conservation areas, farms and ranches, and small landholder settlements. A portion of these C-REDDs would be allocated to an insurance reserve. Private investors (including entities regulated within a cap-and-trade program) could purchase C-REDDs from the project or program of their choice through a fund administered by the state-level REDD agency.

Section Summary

- Brazil is the world's leader in developing a REDD policy framework. It has the largest forest, the highest rate of carbon emissions from deforestation and forest degradation, a sophisticated forest monitoring system for the Amazon region, and it has lowered deforestation by two thirds since 2005.
- Brazil also has made important advances towards developing a national REDD framework through its "National Policy on Climate Change", which establishes a target for reducing emissions up to 39% by 2020 as compared to BAU. This target includes 80% and 40% deforestation reduction targets for the Amazon and Cerrado, respectively. Brazil is likely to move the design of its national REDD framework forward in time for COP 16 in December 2010 in Cancun, Mexico.
- One conception of the design of a national REDD program in Brazil would result in REDD-based credits from national emissions reductions being allocated among states on the basis of their forest carbon stock, the state decline in deforestation, and the state's success in achieving its emission reduction targets. Brazil also is discussing implementing a domestic cap-and-trade system that may be linked to its REDD policy framework.
- Many of the emissions reductions achieved by Brazil through its NPCC (which can be considered a Nationally Appropriate Mitigation Action under the Copenhagen Accord), may not be available to be used as offsets by entities regulated by external cap-and-trade programs, such as those that may be created by passage of comprehensive climate-related legislation in the United States. This conflict between counting emissions reductions towards NAMAs or as fungible international GHG emissions offsets remains unsettled in the international climate negotiations.
- Brazilian states in the Amazon region (i.e., Mato Grosso, Pará, Acre, Amazonas) have made substantial progress towards developing state-based REDD programs. In Mato Grosso, a multi-stakeholder State Forum on Climate Change is considering a REDD design in which credits (referred to as REDD certificates or "C-REDD") would be allocated among sectoral programs (i.e., to indigenous peoples' lands, small landholder settlements, private properties, and protected areas).
- In Mato Grosso alone, achievement of the state deforestation target over the period 2010-2020 could generate up to 600 $MtCO_2e$ of emissions reductions beyond the federal target and 2.4 $GtCO_2e$ of emissions reductions below the federal baseline for Mato Grosso.

4
DESIGN OF A NESTED SUB-NATIONAL REDD ARCHITECTURE

Introduction: The End of Isolated REDD Projects

As discussed in section two, the prevalence of isolated, "stand-alone" REDD pilot projects, particularly in larger, more advanced developing countries, may be short-lived, and state/province level actions appear likely to become the key scale for the implementation of REDD-based offset projects for a number of reasons, including:

- UNFCCC negotiating texts and decisions as well as current versions of U.S. domestic climate legislation emphasize national and sub-national regimes for REDD-based projects in large developing countries like Brazil and Indonesia;
- This language is rooted in the original conception of REDD[52] (i.e., "compensated reduction") being implemented at the national level to address leakage and to achieve meaningful impacts on GHG emissions;
- In most developing countries, it will be impossible to move immediately to national-level REDD regimes, so REDD-based projects and sub-national (at state- and province-level) REDD programs are essential to be used as transition steps;
- State and provincial governments in many countries bear many of the governmental responsibilities for local governance and land use policy.

Consequently, although isolated forest carbon projects have proliferated in recent years and may achieve near-term emissions reductions, we believe there is little prospect for stand-alone REDD projects to produce large quantities of fungible offset credits that will be available to be used in evolving emission reduction compliance regimes in the longer term.

This situation presents a problem. Private investors are attracted to offset *projects* since the risks and boundaries of the investment are easily defined. However, it is only in the context of nested, multi-scale institutional frameworks that large-scale projects, such as a Xingu indigenous lands REDD project, are likely to yield fungible "compliance-quality" offsets in larger, more advanced developing countries.

Sectoral Crediting Mechanisms and International Climate Negotiations

REDD is perhaps the most well known example of what has come to be called a "sectoral crediting mechanism." As part of the international climate negotiations, the negotiating parties

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[52] Santilli, M., P. Moutinho, S. Schwartzman, D. Nepstad, L. Curran, and C. Nobre. 2005. Tropical deforestation and the Kyoto Protocol. Climatic Change 71 (3):267-276.

have been trying to define a new market mechanism that could credit emissions reductions at a *sectoral* rather than *project-based* level.

Advocates for this scaling up approach argue it is worthwhile to try to do this because sectoral emission reduction programs may be able to scale up to a much larger level more quickly – at least in theory – than a project-based approach along the lines of the existing CDM.

At the moment, the meaning a "sectoral crediting mechanism" and how offsets might be handled as part of the design of such a system is described below. An approach now is being developed in Brazil for REDD-based sectoral crediting that may become a template for how other sectoral programs may be designed in the future. REDD is a sectoral mechanism that now is at the center of policy discussions about how to define sectoral trading mechanisms more generally. This means a lot more is riding on the way a REDD sectoral crediting framework is designed than just emissions reductions from REDD, as it may portend more broadly what sectoral crediting mechanisms may look like going forward in other sectors of the global economy.

How would a sectoral crediting mechanism work in practice? A developing country voluntarily would establish an "emissions baseline" (i.e., the "crediting baseline") below BAU for a given sector, like REDD. If actual emissions over time *are below the crediting baseline* at the end of the crediting period, the country / sector would earn tradable credits *ex-post*. These credits then could be sold into domestic and international GHG trading programs as compliance quality offsets. Under a "no lose" approach, if actual emissions are *above the crediting baseline* at the end of the crediting period, the country / sector would not receive any tradable credits and would not be penalized for the emission reduction shortfall.

Because project-based activities in a sectoral scheme are separate from the activities of the sector as a whole, it is possible a project can succeed in reducing emissions while the sector as a whole fails to reduce emissions below the crediting baseline. For example, a situation could arise in which a REDD project achieves its emissions reductions as compared to a project-based baseline, while the REDD sector fails to slow deforestation below the crediting baseline. In a sectoral system, this adds a new layer of risk associated with the permanence of offsets that previous offset programs like CDM have not had to address. The relationship between sectoral BAU emissions, the crediting baseline and actual emissions is illustrated in Figure 4-1.

Reducing Deforestation: a Multi-Scale Challenge

One of the challenges for the implementation of REDD activities at all scales is to determine the distribution of incentives among stakeholders. This challenge has emerged at the international level, as Parties debate how to establish reference emissions levels and how to structure REDD incentives. At more disaggregated scales, these issues may become even more relevant and challenging. For individual stakeholders, it is difficult to predict specifically who would deforest in a given year, making it more difficult to define BAU and crediting baselines than is the case at more aggregated scales. Nonetheless, if REDD is to be successful, incentives on the ground must change, and therefore some way of crediting changes of behavior must be put in place. A multi-scale REDD system also will have to reconcile the different activities intended to reduce emissions with actual emissions from avoided deforestation. A crucial element of a successful REDD system will be to make the crediting at the stakeholder level consistent with the regional and national crediting.

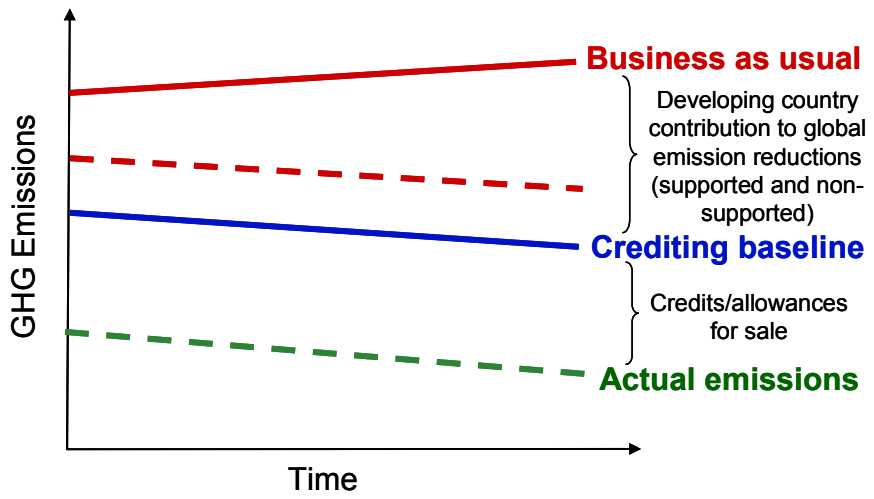

Figure 4-1
Illustration of a hypothetical sectoral crediting system. The red line represents BAU emissions or deforestation, the blue is the crediting baseline. The green and red-dotted lines represent possible trajectories of actual emissions in the sector (both below and above the crediting baseline respectively over the crediting period). Based on a presentation by Richard Baron, International Energy Agency, EPRI GHG Offsets Workshop 7: Sectoral Crediting Mechanisms, February 25, 2010.

Throughout this section, it should be kept in mind that the strict application of crediting baselines as the tool for determining the allocation of REDD revenues eventually may cease to be applied at the level of the individual stakeholder or pilot project. Rather, baseline analysis may become a tool for supporting REDD policy planners striving to allocate incentives across a range of stakeholders in ways that allow the state or nation to achieve its aggregated crediting baseline.

Definitions for REDD at Different Scales

Crediting reductions in emissions: At any scale, all emissions reductions would be accounted for relative to a crediting reference level for that scale.

National-level REDD program: A national government implements a national accounting system based on a national crediting reference level. Crediting to the national government would be based on performance against this national baseline.

Sub-national-level REDD program: REDD activities are implemented at a sub-national scale, but at a governmental level (e.g., a state, province or district). Credits would be allocated to the sub-national government(s) based on performance against the sub-national baseline.

REDD projects: REDD projects are expected to be implemented by project developers. REDD-based offset credits would be allocated to project developers based on performance against the project crediting reference level.

Individual REDD stakeholders: Individual actors participating in REDD who may participate through a government program, in a project or independently.

Hybrid ("nested") approaches: Individual, project or sub-national-level REDD activities are undertaken, but somehow would be linked across scales and to national-level performance.

Reference level error: The discrepancy between the reference level and BAU at a given scale. It can be interpreted as the crediting or debiting of emissions reductions that will occur even without any action taken at that scale, and is attributable to errors committed in the estimation of either the BAU or reference level of emissions.

"Scale-neutral" REDD architecture: A REDD policy architecture is "scale-neutral" if the emissions reductions relative to the reference level at a given scale are not affected by errors in reference levels at more disaggregated scales below it.

Options for a REDD policy architecture designed to harmonize incentives across actors and geographic scales through application of the unifying principle of "scale neutrality" are described below. The architecture described below would allow for individual actions, for project-based emission reductions, and actions in the context of broader sub-national REDD programs within a country. The underlying assumption behind this analysis is that, if REDD is to be undertaken rapidly and at large-scale, projects will be essential, but will not realize the full emission reduction potential on their own. A REDD program structured to guarantee consistency and ease of access to potential offset buyers will be more successful in garnering private sector investment. Project-level activities, such as in the Xingu basin, will be an essential part of how a structured REDD program comes together. In turn, project-level activities will benefit from a framework that is internally consistent in terms of setting reference levels and allocating risks, because this consistency contributes to creating a homogenous fungible offset product. The objective here is to try to clarify the challenges confronting the design of a REDD architecture and propose a way forward.

Subdividing the Problem into Manageable Components

Below the international level, it is possible to distinguish between four different levels at which REDD activities may take place: (i) National programs; (ii) Sub-national programs, (iii) Projects; and, (iv) Individual stakeholder actions. There are a variety of REDD activities that could be undertaken at each of these different levels, including:

Accounting Frameworks: Setting crediting reference levels, monitoring deforestation, and accounting for emissions reductions could be performed on the national-level, sub-national-level, project-level, or at several levels. Ideally, to avoid conflicting claims, all accounting would be done in the context of a consistent national framework.

A distinction must be made between *accounting* and *crediting*. Whereas it may be both desirable and increasingly attainable to monitor and account for deforestation as part of a consistent national framework, it may be challenging to set crediting reference levels in a consistent manner across scales. This is the focus of the discussion below.

Implementation: Implementing activities that reduce deforestation could be undertaken by national governments (e.g., through large-scale policy reform), by sub-national governments (e.g., through district or provincial spatial planning and policies), by project developers (e.g., through specific actions to reduce deforestation in a designated area), by individuals and at several levels simultaneously (e.g., through a combination of policy enactment and local action).

Crediting emissions reductions: Either national governments, sub-national governments, project developers, or individuals could be credited for emissions reductions. Each country will need to choose how ownership and benefits for credited emissions reductions are to be shared among REDD stakeholders.

To accomplish this, countries will need to define a clear structure of property rights to emission reductions across scales and stakeholders. The national government could own and transact all emissions reductions, or it could decide to devolve ownership of credited emissions reductions to sub-national and local actors so long as the accounting structure for doing so is "trued up" to the national accounts.

Approval and Verification: The verification of credited emissions reductions could be done in different ways. Some existing offset programs rely on validation and verification by private third-party entities at the project level, but this also could be done at the state or national level by government agencies or an international third-party entity.

Based on the classification above, several policy options could be pursued that may not be limited strictly to a project-level approach, where project developers take on all of the activities listed above, or a national-level approach, where governments would take on all of the activities. Instead, hybrid mechanisms and approaches also could be designed.

For example, the national government could carry out monitoring and accounting and allocate incentives to implement successful REDD activities around the country. National-level accounting does not presuppose national-level implementation. Either governments or private investors could undertake projects and activities and receive credit for emissions reductions. Some kind of linking mechanism between individual projects and the overall emissions of the country could be designed. This type of hybrid mechanism may better account for leakage while still fostering private-sector investment in REDD projects.

One example of this intermediate approach is the "nested approach," proposed by Streck et al.[53] and Pedroni et al.[54], which would grant tradable emission reduction credits to participants in REDD activities while promoting action on both the national and sub-national level.

The principle of the "nested" mechanism proposed by Streck et al. and Pedroni et al. consists of the following elements:

- A country-wide scheme would be developed based on an internationally negotiated target level of deforestation, the creation of fungible carbon credits that could be used to comply with GHG targets, and a mechanism to reserve credits would be created to guarantee compliance with agreed-upon targets. Countries would be able to allocate these credits to private entities and authorize them to trade the issued credits.
- A project-based mechanism for REDD based on the authorization by host governments of private or public entities to implement REDD activities at the project level, with the issuance

[53] Streck, C., L. Pedroni, M.E. Porrua, M. Dutschke (2008) "Creating Incentives for Avoiding Further Deforestation: The Nested Approach" in Climate Change and Forests : Emerging Policy and Market Opportunities, edited by C. Streck, R. O'Sullivan, T. Janson-Smith and R. Tarasofsky, Brookings Institution Press, p.237-249.

[54] Pedroni, L., M. Dutschke, C. Streck, M.E. Porrúa (2009) "Creating Incentives for Avoiding Further Deforestation: The Nested Approach", Climate Policy, Vol. 9(2): 207-220

of fungible carbon credits directly to the project entities through an international and independent mechanism, regardless of national emissions from deforestation. Mechanisms to address leakage and to ensure long term and additional climate benefits would be included.

Although this approach appears straightforward in principle, it likely would be challenging to implement in practice. At the heart of the matter is that in this type of mechanism credited emissions reductions from projects can be issued and traded *regardless of national emissions from deforestation*.

This approach has several important implications. First, it skews the link between projects and the overall emissions reductions of the country in favor of projects, which would be rewarded first, and only subsequently would other actors potentially be credited for their actions if "residual" emissions reductions remain to be allocated. The risk of going down this path is that it may create incentives for project-type activities, but not for other more broad-based policies, which only would be rewarded residually. For REDD to be implemented successfully on a large scale it will be necessary to create incentives that are likely to function not just at the project-level, but also at a regional scale so as to address underlying drivers of deforestation.

This approach appears to be based on the assumption that countries which currently do not have the capacity to control national deforestation will be able to build this capacity by starting with individual, stand-alone REDD projects and then building up necessary capacity from there. While this may be true, there is little evidence to date that this kind of developmental process will occur. The experience in Brazil, which is the only country that has demonstrated an ability to reduce its national deforestation rate, suggests that broad policy interventions (e.g., large scale creation of protected areas coupled with improved law enforcement) have been effective for reducing deforestation and related emissions.[55]

In addition, inconsistent incentives have the potential to increase leakage if projects and individual stakeholders tend to engage in REDD in areas where reference levels are defined so it is a particularly profitable activity, while other areas will not benefit from coordinated action to slow deforestation. Removing a risk element that faces private project activities, and transferring it to the public sector, may not be the most economically efficient approach to implementing REDD. It may lead to a sub-optimal outcomes in the aggregate, and may lead to a loss in environmental integrity, which in turn would affect the longer-term viability of REDD. Insulating project activities from external risks is one way among several ways in which risk can be distributed across institutions and entities, but how this may be done and whether it is the best approach in terms of the overall desired outcome would require a more in-depth analysis of the balance between the "institutional" program and project/stakeholder components of the nested approach.

REDD+ Nesting Approaches

We focus here on a policy approach that features national carbon emissions accounting but would also allow for multiple different entities to implement REDD activities and project at different scales. We focus here on this option because the project team believes national accounting is necessary for investors to have confidence in the system, and we believe that for

[55] Soares-Filho, Britaldo, et. al., 2010, op. cit.

REDD to function at scale the system will have to create incentives for individual landholders, project developers, local governments, and national government. Also, both the international negotiations and the ongoing legislative debate in the U.S. appear to have moved beyond the idea of crediting stand-alone REDD project implemented in more advanced countries like Brazil and Indonesia towards crediting REDD *projects* only in the least developed countries.

Once emissions reductions are verified at the national level these could be fully fungible, independent of whether they were generated by project activities or broader institutional actions. However, the actual volume of emissions reductions that could be credited – for a given national reference level – would depend on how easy it is for different implementation entities to understand the rules by which emissions reductions are credited inside a country, and how the risks involved are distributed throughout the system. This will be the case because the price of a REDD-based offset credit may be the same regardless of who generated it, but the uncertainty in outcomes before REDD actions are undertaken will be case-specific. This means that the expected return from REDD activities, and therefore participation, may vary substantially across REDD options at different scales depending on the REDD architecture adopted. From the point of view of the private investor, a clear layout of how reference levels will be determined and how risks of non-performance at different scales will impact potential crediting for a project will be an important element in project design, alongside the actual implementation of the REDD a REDD project itself.

For the purpose of this discussion, we introduce the notion of "*scale-neutrality*" of a REDD architecture. A policy architecture is scale-neutral if the emissions reductions relative to the reference level at a given scale are not affected by errors in reference levels at scales below it. In other words, scale-neutrality requires an internal consistency in the system so any errors in reference levels at one scale cancel out at more aggregate scales, which reflects upon how risk is distributed throughout the system. Subject to a similar set of implementation measures for a given level of financial incentives (i.e., the price of carbon), if an architecture is scale-neutral it will not make a difference whether credited reductions are generated by government action at the regional scale or by individual stakeholders on small plots. The amount of credited emission reductions generated will be the same and will only depend on the level of financial incentive.

One of the elements introduced in the hybrid approach is that implementation entities at different scales may be credited for emissions reductions, from national governments down to individuals. How would a sub-national distribution of incentives need to be structured so that implementation entities at different scales can co-exist and be most effective in reducing deforestation? Is scale-neutrality even possible to obtain in practice? We address these issues below.

The main elements necessary to evaluate how multiple implementing entities would interact in a nested system are:

- The coordination structure for defining reference levels at different scales and the linking of offset credit registries;
- The specification of who takes on the risks associated with inconsistent reference levels, non-performance, and leakage outside of project areas. Emissions reductions from disaggregated scales have to sum up to a nationally consistent amount. Therefore, how risk is allocated will affect the amount of credits received by project activities or other activities undertaken to reduce emissions;

- The financial incentives that drive avoided emissions from different activities, which will be linked to the risks mentioned above, and specifically whether credited reductions are sold *ex-ante* or *ex-post*;
- The level of transaction costs, such as costs to set up and manage a system for monitoring and enforcement, associated administrative costs, and how much of these costs would be shouldered by the national program and individual projects.

In the analysis below, we assume all REDD-based offset credits are monitored and awarded on an *ex-post* basis and are verified emission reductions. [56]

At the sub-national level, credits potentially could be issued on an *ex-ante* basis before REDD activities have been implemented, but this approach would have a number of problematic implications. First, *ex-ante* issuance of offsets could result in credits being issued for "phantom" emissions reductions that never are achieved thereby undermining the environmental integrity of the REDD system. Second, from the perspective of private investors, *ex-ante* issuance has two potential implications for offset credit pricing. First, the price of *ex-ante* REDD credits will be discounted substantially more than *ex-post* credits because investors will face significant uncertainty about the ability of the underlying REDD activities to achieve the desired emission reductions and this uncertainty would remain unresolved at the time the credits are issued. Second, the price of *ex-post* credits issued in parallel with *ex-ante* credits also may be affected depending on how risk is shared among activities, because there would remain unresolved uncertainty about the environmental integrity of the *ex-ante* credits.

Nesting as a Way to Build a Coordinated Network of Institutions

One of the challenges to reducing deforestation substantially on a broad geographic scale is that an institutional arrangement must be developed between different implementation entities and a clear mechanism for coordination needs to be introduced.

In practice a network needs to be put in place so that information flows appropriately across scales and actions can be taken accordingly, accounting for the different elements of risk. Although there are many institutional aspects that need to be considered, here we focus exclusively on the assignment of reference levels to different implementation entities, and how different scales interact in the crediting of emissions reductions.

In Figure 4-2 we present a top-down nesting architecture in which reference levels originate at the more aggregate national scale and gradually are disaggregated to the regional level, the municipality level ($M_{i,j}$), and then across different implementation units (or institutions) such as the private project level ($PP_{i,j}$), indigenous peoples ($IP_{i,j}$), and protected area units ($PA_{i,j}$). This represents one possible top-down specification.

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[56] At the sub-national level, the existence of *ex-ante* credits, for example at the project level through projected emissions, has two implications for pricing: (i) the price of *ex-ante* REDD credits will be discounted more heavily than *ex-post* credits because the uncertainty relating to attaining the desired impact is not resolved when the credit is sold, and (ii) the price of *ex-post* credits may also be affected depending on how risk is shared among activities because of the unresolved outcome of *ex-ante* credits.

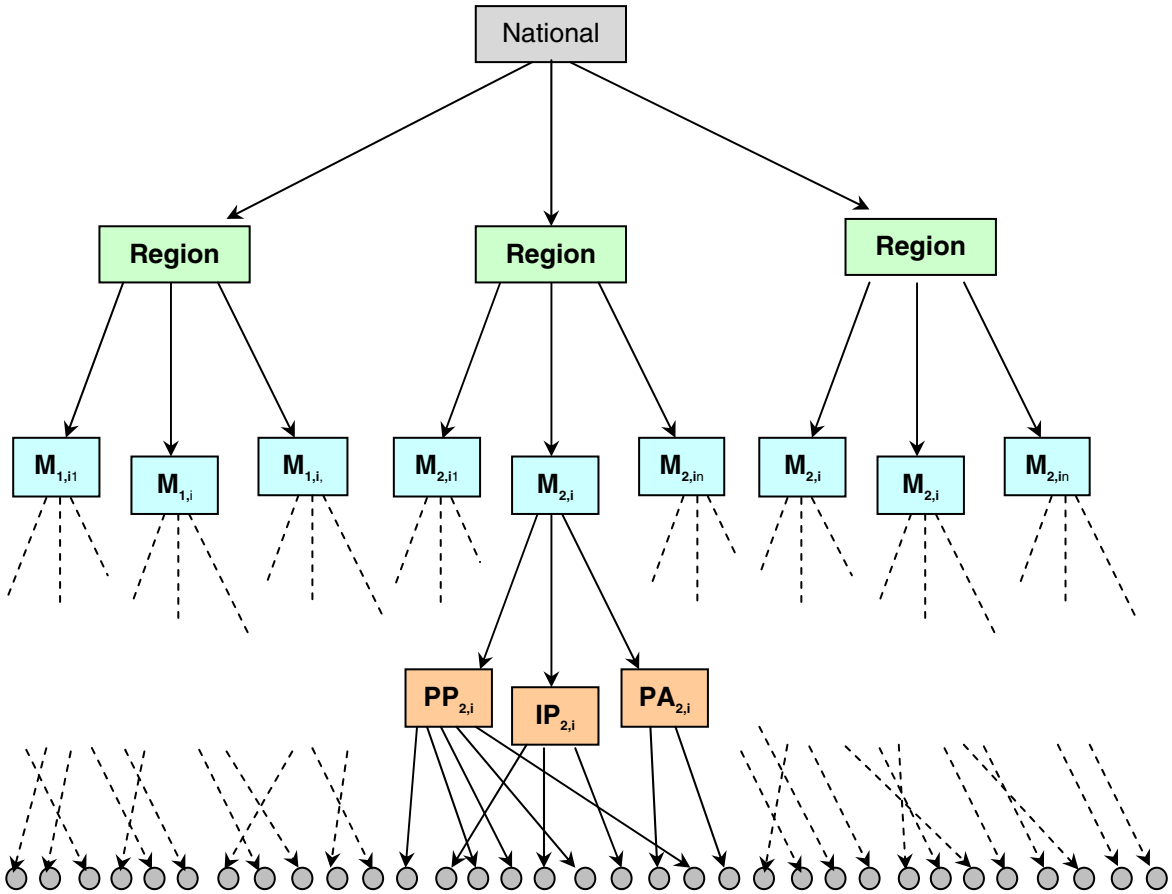

Figure 4-2
The causal relationship between reference levels in a top-down nested approach (National → regions → municipalities → implementation entities → stakeholders).

For example, a country may decide not to include the municipal level as an additional layer in specifying reference levels, and go directly from the regional level to specific implementation units, which may extend beyond the boundaries of single municipalities. Furthermore, the characterization of implementation units in different categories will depend on institutional arrangements. In principle, all activities outside of policy measures can be viewed as project activities, however, the institutional and legal arrangements will depend on who is implementing the specific REDD activities. For example, implementing a REDD activity in indigenous lands would not have the same institutional framework as implementing a REDD project with individual landowners. Similarly, REDD activities in protected areas likely would involve governmental institutions rather than the private sector. It is for these reasons we distinguish here between private projects and activities conducted on indigenous lands and in protected areas, but this distinction is not an essential component of a nested REDD approach.

In a "top-down" nesting, the coordination effort, expressed here as the negotiation of reference levels at different scales, begins with the national reference level, which either is linked to international agreements or to domestic legislation. The emissions below the national reference level then are allocated to regions, which in turn, would allocate them to more regionally disaggregated implementation entities. The more intermediate entities involved before reaching

people on the ground, the more complicated it is likely to be to negotiate a system of reference levels.

In a top-down nesting the causal relationship between reference levels is hierarchical in the sense that the flow of decisions concerning reference levels goes from the more aggregated national scale to the more disaggregated scales.

The top-down nesting structure intuitively is appealing if a national reference level is adopted by a country. However, there are three disadvantages to this approach. First, the coordination problem can be challenging given the number of decision-makers involved in determining reference levels at different scales, as can be seen from the schematic diagram in Figure 4-2. Second, the approach is dependent on the initial institutional structure, and would need to be renegotiated if a new implementing entity enters the scene, such as a new REDD project, as the tree structure would change and reference levels would have to be reallocated. Third, the top-down approach may create a disincentive for private project developers who face the reference level for a given project being imposed from above rather than determined internally and then certified by a third party, as is done with project-based emission reduction projects.

Figure 4-3 presents a *bottom-up* nesting approach as a possible alternative form of nesting. In this approach, reference levels would be allocated directly to the most disaggregated units, compatible with the national reference level, and then would be aggregated up step-by-step to the regional level. The challenge here would be to find a relatively simple rule to allocate reference levels to the individual stakeholder level.

For example, one could envisage allocating the reference levels based on a combination of the amount of forest carbon managed by a stakeholder, the historical deforestation rate in a region, and the legal status (e.g. indigenous land, conservation area, private property) of the land involved. Whatever combination is used the resulting individual reference levels need to add up to the national reference level. Once an agreement is reached on the criteria to set the most disaggregated reference levels possible, then the more aggregate reference levels are obtained by simply summing the reference levels at the more disaggregated levels. The advantage of this approach, relative to the top-down approach, is that it is institutionally flexible to the extent that implementing entities at more aggregated levels may come into the process without disrupting the system. On the downside, finding a general rule of thumb to allocate reference levels directly from the national to the individual stakeholder level may make it difficult to take into consideration local conditions.

Figures 4-2 and 4-3 provide an intuitive representation of the top-down and bottom-up approaches to structuring the causal relationship between reference levels across scales.

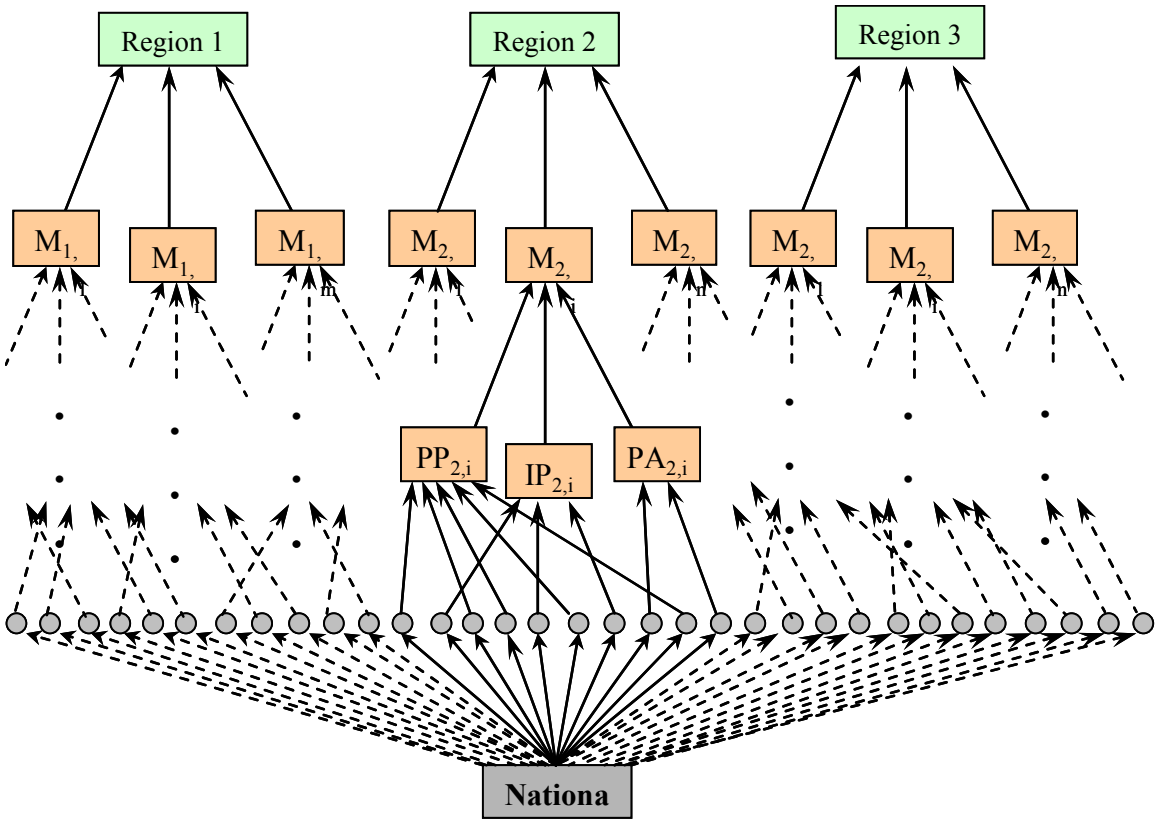

Figure 4-3
The causal relationship between reference levels in a bottom-up nested approach.

However, there are many other possible ways to design a nested structure. Figure 4-4 shows a top-down structure, but in this case the reference levels at the project level are set independently from the national reference level. By following the arrows in the diagram once can see that any potential inconsistencies between the project-level and the national-level in terms of crediting will have to be resolved at the regional level and will have repercussions on the reference levels for non-project activities, such as protected areas or indigenous lands. This complication suggests some nested architectures may be more difficult to coordinate than others. In turn, these coordination challenges will affect the risks associated with inconsistent reference levels and non-performance.

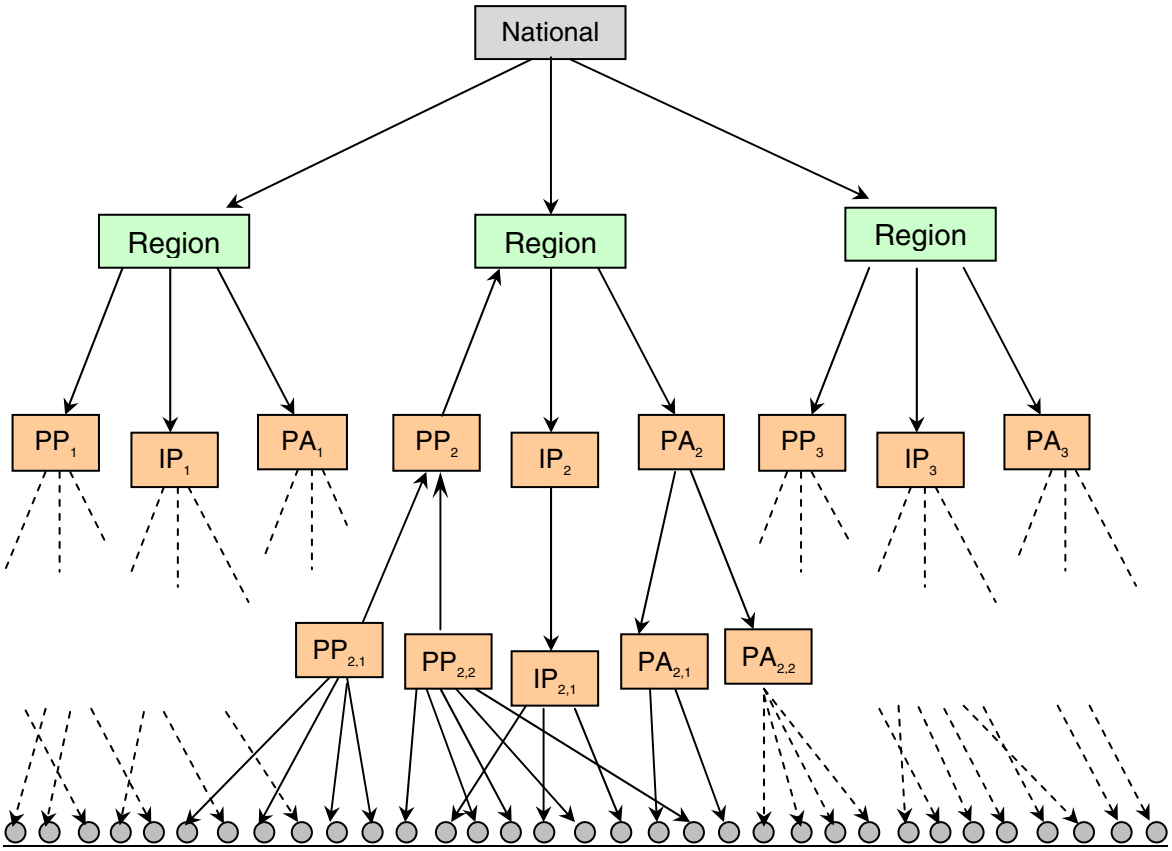

Figure 4-4
The causal relationship between reference levels when project reference levels are set independently of the national reference levels in what is otherwise a top-down nested approach.

Allocating REDD Risk on a Sub-national Basis

Risk arises because decision-makers at all scales in REDD have imperfect information. This lack of perfect information means expectations contain an element of error. In the presence of uncertainty, understanding the sources of error can lead to better decision-making. For example, in structuring a REDD program, the BAU emissions are not known with certainty, and neither is the impact of future REDD actions. The level of risk will depend on these two sources of error.

Since credited emission reductions allocated at the sub-national level have to sum to the observed emissions reductions relative to the national crediting reference level, any errors have to be attributed to its possible sources if the system is be internally consistent. The structure of the sources of error is expressed schematically by the tree in shown Figure 4-5.

In practice, attributing errors to one or other actions will be challenging. Aside from the fact that it will be difficult to distinguish *ex-post* between errors in reference levels and in implementation, one also has to take into account the interaction between the different scales or implementation entities. One instructive example of this interaction is project leakage, where an action by one implementing entity (i), will affect the BAU of another implementing entity (j), thereby affecting the reference level error of the latter. For this reason, it can be useful to have a formal framework to analyze errors and risk of non-compliance in the design of a REDD

program. Please refer to appendix B for a more complete mathematical treatment of error and how error potentially can be addressed in a scale-neutral manner in a nested REDD architecture.

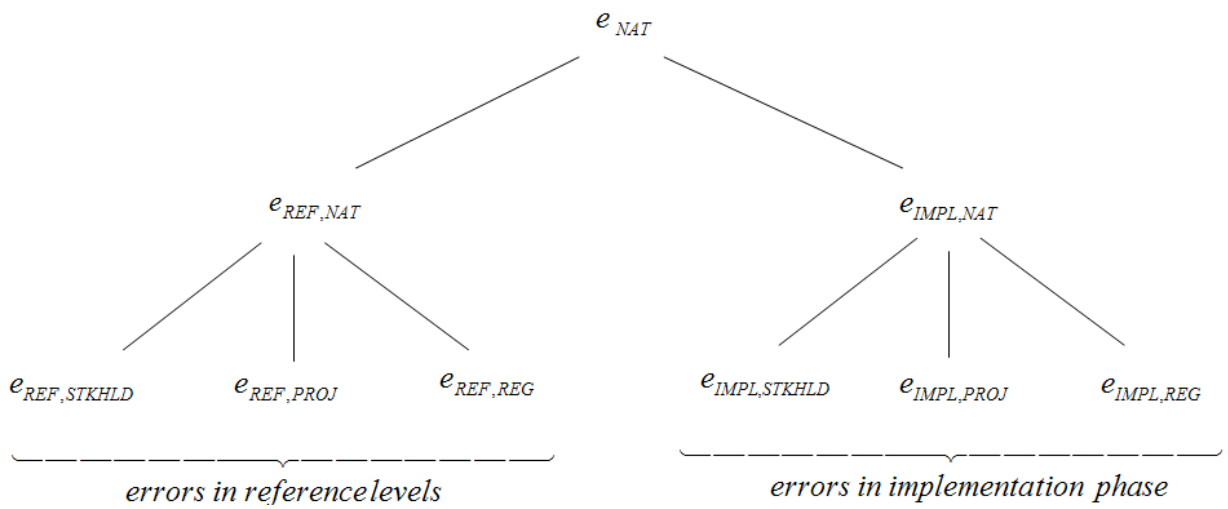

Figure 4-5
Components of the error in aggregating from sub-national activities to a national level ($_{NAT}$): errors in reference levels ($_{REF}$) and in implementation ($_{IMPL}$) at national ($_{NAT}$), Regional ($_{REG}$), Project ($_{PROJ}$), and Stakeholder ($_{STKHOLD}$) levels. Error variables are defined in the text.

Below are some of the project team's observations related to the development of a hybrid, nested REDD architecture.

1. Setting a national reference emissions level will involve a degree of error relative to the unobservable BAU emissions, which may lead to discrepancies in the distribution of credited emissions reductions at the sub-national level relative to expectations.

   In an ideal world, a solution to this potential problem would be to define the national crediting reference level at the exact value of the unobservable BAU. This would help to create cross-scale consistency in terms of the credited emissions reductions. However, even the best model projections will contain errors. The design of a REDD program architecture will determine how this discrepancy between aggregate reductions monitored at the national level and the sum of the sub-national outcomes will be resolved.

2. The expected values for the reference level errors and their variance will determine the perceived risk that implementers of REDD activities take on, which in turn may affect their participation. If potential REDD investors believe the reference levels below which credits will be generated have been set too low, they will be less inclined to invest.

   The error linked to the national crediting reference level will depend on how stringent the crediting reference level is set: the closer to the unobservable "true" BAU, the lower the absolute value of the error. Crediting reference levels that are above BAU will provide credits that do not represent true emissions reductions. Crediting reference levels that are set far below BAU reduce the likelihood credits will be generated.

3. The REDD architecture must specify a rule to allocate the national reference level error among different sub-national activities and scales. The closer the allocation rule is to the proportion in actual reference levels, the more equitably the risk will be distributed. Some of the possible options for allocating this risk are mentioned briefly below.

   Option 1 – Shared liability*:* If there is a shortfall or windfall of credited reductions relative to what would be expected from sub-national accounting, than the difference is distributed according to each implementing entities' reference level.

   Option 2 – Regional scale buffering: The expected reference level for crediting from regional policy actions could be taken as the difference between the national crediting reference level and the sum of all the individual stakeholder and project-based reference levels. In this case, the risk associated with biases in reference levels would be attributed by default to the regional actions.

   Option 3 – Scale Prioritization: When one scale, or category of implementation, is insulated from risk outside of its domain. For example, a nested system where projects would be credited for emissions reductions regardless of actual reductions achieved in national emissions.

However, errors do not arise only from setting of the national reference level. Errors at one scale (*i)* can be driven by errors at another scale (*j)*. Because of this scale interaction, the following insights may be useful to consider as policy makers design a nested REDD architecture.

Proposition 1 – A nested REDD architecture in which the crediting reference levels are allocated in an internally consistent manner is scale-neutral subject to the level of participation being fixed.

Proposition 2 – A sectoral cap-and-trade architecture in which emission allowances are allocated in some way to individual stakeholders and then aggregated into emission reduction projects or other regional activities also is scale-neutral.

Evaluation of the Prevailing REDD Architecture in Brazil

The theoretical discussion presented above clearly is relevant to the discussion of the design of a REDD system in Brazil that would involve the allocation of C-REDDs, as described in section three. To link the more theoretical approach to how things might be done to how they can be done in practice, we observe that the current approach being proposed in Brazil to construct a multi-scale REDD architecture appears to be moving in the right direction, as the design is trying to define clearly how different implementing entities would be allocated credits, and is highlighting the importance of the development of state REDD registries.

However, the approach currently is limited to a sectoral specification of credit allocation, and is based on an *ex-post* specification of how many credits are to be distributed as a whole. This leaves two areas of uncertainty remaining that are likely to have impacts on the incentives to reduce deforestation, including:

(i) Stakeholders in each of the given sectors will need additional clarification regarding their potential share of REDD credits, so they can make informed decisions regarding what actions to undertake; and,

(ii) Even if stakeholders' share of credits is made clear by the relevant state governments, it will be difficult for individual stakeholders to plan REDD activities in advance, since the aggregate amount of REDD credits to be issued will be based on an *ex-post* evaluation of the success of REDD-based activities.

In this respect the possibility mentioned in section three that REDD will be linked to a domestic cap-and-trade program may be an interesting development to the extent that it would encourage a clearer setting of reference levels for implementing entities and potentially individual stakeholders. These reference levels most likely would be specific to individual implementing entities and not be dependent on aggregate outcomes from emission reduction activities conducted in a previous reference period. However, a risk-sharing rule still would have to be developed in case of an aggregate shortfall in emissions reductions. Alternatively, if a full cap-and-trade system were implemented that includes REDD, any individual shortfalls relative to reference levels would require individual entities that implemented REDD-based project and activities to purchase offset credits or emission allowances to compensate for any shortfall in expected emissions reductions. A full cap-and-trade approach for REDD would insulate implementing entities from one another and entities would not need to be concerned about the performance of other entities within the cap-and-trade system.

Section Summary

The underlying goal of REDD is to reduce emissions relative to a BAU scenario that is unobservable once REDD-based actions have been implemented. Ideally, if BAU was known, then compensation could be provided relative to BAU without any errors arising in the process. Unfortunately, the BAU is not known and only can be estimated. This means errors will arise both in the national crediting reference level, and at more disaggregated scales, and the magnitude of the overall error will depend on the approaches taken to assign credits at the national and sub-national levels. Isolated forest carbon projects cannot deal with these systemic issues on their own, unless they are integrated into a broader internally coherent national approach to reducing deforestation.

Despite the existence of a number of "early action" REDD-based projects and the inherent challenges to designing an effective multi-scale REDD program, policy makers have been shifting away from support for isolated "project" level REDD to development of "sub-national" and "national" approaches. In the future, stand-alone projects may remain the building blocks of REDD architectures, but they are likely to be tightly integrated into a broader policy-coherent systems to reduce emissions from deforestation on a sectoral basis.

The project team has laid out some of the issues and challenges that will need to be tackled to develop a workable system of REDD that is fully "nested" and internally consistent. Two key elements of the proposed nesting architecture are:

(i) To manage risk effectively in REDD, there needs to be clear setting of reference levels from the national level to the individual stakeholder that is internally consistent across scales; and,

(ii) Broad participation in REDD will be an important factor that can help to limit risks external to individual implementing entities.

Formal REDD frameworks designed to "nest" REDD projects within state and national level emissions reductions program that are designed to allocate benefits effectively across scales will need to address the challenge of defining appropriate baselines at each scale, and distributing the errors that inevitably will arise from this definition. The project team recommends development of a "scale-neutral" REDD framework that constrains total emissions nationally, and accommodates both REDD projects and other actions and policies.

In this section, the project team has proposed several theoretical options for the design of a nested REDD policy architecture. In principle, the architecture that is most likely to be effective in limiting external risks is a full cap-and-trade program, where emission allowances are distributed at a disaggregated level and then aggregated according to whatever implementing entities are formed. Participation by "covered entities" in this kind of system would be compulsory and not voluntary. Implementing this kind of program in Brazil will be politically challenging as is the case in the U.S., but doing so could make the system more manageable and internally consistent.

Short of adopting an economy-wide cap-and-trade system in Brazil including REDD, which currently is under discussion in Brazil, there are some innovations that could be incorporated into the emerging state-level REDD framework discussed in section three that could improve their attractiveness to private investors and improve its performance.

First, development of a process and institutional arrangement to evaluate reference emission levels in a systematic way and other policy evaluation tools to measure performance and allocate potential REDD credits among policies and activities at national, sub-national, project, and stakeholder scales are important.

Second, mechanisms to provide up-front, *ex-ante* funding to forest stakeholders will be needed to elicit the changes in behavior necessary to achieve emissions reductions, a topic that is explored in more depth in section six of this report.

Finally, for regulated entities interested in buying REDD-based offsets, or investing in REDD activities, it will be important to do so in a policy environment where all institutions are engaged to make the system work and where risk is manageable as part of the business process.

5
STATE CARBON REGISTRIES IN BRAZIL

The need to coordinate rewards, risks, baselines and credits across multiple scales in Brazil for REDD was explored in section four. Ultimately, many vexing REDD issues must be reconciled into a manageable carbon accounting system. In this chapter, we explore existing carbon offset registries and the emerging concept of a statewide REDD registry in Brazil.

Overview of Carbon Registries

Carbon registries are systems that track issued GHG emissions allowances and offsets that have been created by specific programs in specified areas during specified time period pursuant to program-specific rules. GHG registries have evolved as computer databases designed to assign and track the serial numbers of specific GHG offsets or allowances that have been issued by qualified regulatory and voluntary emission reduction programs. Registries track the creation, purchase, sale, and retirement of offsets and/or allowances.

Broadly, there are two categories of existing carbon registries: (i) Registries that support the "voluntary" carbon market; and, (ii) Registries used to track formal compliance with regulatory-based GHG cap-and-trade and offset programs.

The most powerful example of a compliance-based carbon registry is the Community Independent Transaction Log (CITL), which aggregates the required national registries under the EU ETS. The CITL tracks individual EU State emissions registries and aggregates registries for all EU States, plus the "linked" countries of Norway, Iceland and Liechtenstein. The CITL serves as a "registry of registries," so to speak. The CITL records the issuance, transfer, cancellation, retirement and banking of EU Emission Allowances (EUAs) within the 27-nation EU. The CITL also communicates with the International Transaction Log (ITL) – a registry established by the UNFCCC under the Kyoto Protocol. The Kyoto Protocol obligates Annex 1 (i.e., developed countries) to limit or reduce their emissions and submit information about their emissions to the UNFCCC's Compilation and Accounting Database (CAD). The CAD is managed by the UNFCCC and its subsidiary bodies. The ITL is the sanctioned international registry that tracks to what extent a country's emissions and emissions removals during the period 2008-2012 match the country's Kyoto "units," including Assigned Amount Units (AAUs), emission reductions generated or purchased through the CDM and JI programs. The CAD and ITL are governed by rules established by the Parties to the Kyoto Protocol.

Regulated (compliance) registries list the reported, verified annual emissions of nations and operators and contain registered *credits* and *allowances* to be surrendered to cover reported emissions. *Emissions allowances* are registered as soon as they are *ex-ante* allocated or auctioned to accounts of operators that fall under regulatory-based cap-and-trade systems. If an operator has a surplus of allowances, these can be traded and transferred via the registry.

Emissions Credits (i.e., offsets) are registered on an *ex-post* basis after an issuing body approves the verified emission reductions. For example, Certified Emission Reductions (CERs) are issued by the CDM Executive Board and placed in the CDM registry.

Companies and governments can then use these credits for compliance under the Kyoto Protocol and with the EU ETS through the EU Linking Directive. As one would expect, prices for carbon allowances and offsets on average are higher in compliance markets, (currently in the range \$14-22/tCO_2e in the EU ETS) than prices for carbon offsets sold in voluntary markets (in the range of \$1-\$7/tCO_2). Since REDD is not yet an activity that can be used to create compliance quality offsets anywhere in the world, the voluntary market is where REDD credits are likely to be registered and transacted for at least the next several years. While REDD-based offset credits currently can only transacted in the voluntary market – and even in the voluntary market very few REDD-based offsets currently are traded – there is a growing perception by some market observers that voluntary REDD-based offset credits could be transformed in the future into pre-compliance or even compliance credits.

In the voluntary carbon market, there exist a number of registries that track issued offsets, such as the APX, Caisse des Depots, Climate Action Reserve (CAR), TZ1 Markit and others. These voluntary carbon market registries track offsets issued by the various existing and evolving voluntary offset programs around the world, such as the Voluntary Carbon Standard (VCS), the Chicago Climate Exchange (CCX), CAR and Winrock International's American Carbon Registry (ACR). Some registries have the ability to track offsets issued by multiple voluntary offset programs and can facilitate arbitrage between offsets registered on different platforms.

Table 5-1 illustrates many of the voluntary carbon market standards that exist around the world today and the corresponding offset registries that are approved to register offsets issued pursuant to each offset standard. For example, offsets issued pursuant to the VCS program can be registered on a variety of registries, including TZ1 Markit, APX, Blue, CAR and ACR.

In the existing voluntary carbon market, the financial value of issued offsets is influenced directly by the perceived environmental integrity of the offset program that issued the credit and the perceived likelihood that an issued credit may "count" in the future as an "early action" emission reduction or as a compliance-quality offset in a future carbon compliance program.

The value of an offset credit is not correlated directly with the actual registry where the offset is tracked, except in those cases where offsets standards and registries are linked together under a single program administrator. This is the case, for example, with CAR which manages the registry for Climate Reserve Tons (CRTs) – the name of offsets issued by CAR – and also sets the standards under which CRTs can be issued. For instance, the market prices for offset issued for Gold Standard methane destruction projects are determined largely by the perceived market value of Gold Standard emissions reductions, and not by the particular registry that tracks each Gold Standard offset credit.

Registries do incorporate different functionalities and charge different prices to conduct similar functions. In terms of functionality, the existing registries have built database tracking systems that are not identical, as shown in Table 5-2. For instance, some registries allow on-line verification of credit trades, while others do not support this kind of access. Some registries issue serial numbers for individual offsets while others do not.

Table 5-1
Voluntary Carbon Offset Standards and Associated Registries

Registry Standard	APX Voluntary Carbon Standard[57]	TZ1 Markit[58]	Caisse des Dépôts VCS[59]	Blue Registry[60]	Gold Standard[61]	Climate Action Reserve[62]	Chicago Climate Exchange[63]	American Carbon Registry[64]
Voluntary Carbon Standard	X	X	X	X		X		X
Gold Standard VCS	X				X			
Carbon Platinum								
CarbonFix		X						
CCBS		X						
PlanVivo		X						
Chicago Climate Exchange							X	
Social Carbon		X						
American Carbon Registry		X				X		X
Cosain		X						
Green-E Climate		X						
Brasil Mata Vivo		X						
Climate Action Reserve	X							
VER Plus				X				

[57] http://vcsregistry.apx.com

[58] http://www.tz1market.com/vcs.php

[59] http://www.vcsregistry.caissedesdepots.com/?LANGUE=en

[60] https://www.netinform.de/BlueRegistry/LoginPage.aspx

[61] http://goldstandard.apx.com/

[62] http://www.climateactionreserve.org/

[63] http://www.chicagoclimatex.com/content.jsf?id=582

[64] http://www.americancarbonregistry.org/

Table 5-2
Voluntary Carbon Credit Registries, Standards, and Trade Exchanges

Registry Functionality	APX VCS	TZ1 Markit	Caisse des Dépôts VCS	Blue Registry	Gold Standard	CAR	CCX[65]	ACR
Reporting	X	X	X	Retire + Withdraw	X	X	NA	X
Project Database	X	X	private	X	X	X	NA	X
Online Verification	X	X	X			X	NA	
Retirement Extension Audit		X	X		X	X	NA	
Serial Numbers	X	X	Several IDs	Several IDs	X	X	NA	
Pending for Transfer	X	X	X	X	X	X	NA	
Settlement Confirmation	X	X	X	X	X	X	NA	X

The TZ1 Markit Environmental Registry covers the most discrete functions of the registries shown in Figure 5-3. The TZ1 Markit registry also has developed a new relationship with the Brasil Mata Viva standard that can be used to register project-based REDD credits in Brazil.[66]

The relationship between the TZ1 registry and this new Brazilian REDD standard has not yet been in existence long enough to be tested by the market and few offset buyers even are aware of the Brasil Mata Viva standard.

Brazil Mata Viva environmental offset credits are established by the Economic and Environmental Development Institute (IDESA), which has been certified to operate by the Brazilian Environmental Ministry and the Brazilian Environmental and Renewable Resources Institute (IBAMA). The Brasil Mata Viva standard uses carbon inventory validation by University of the State of Sao Paulo (UNESP) and the Foundation of Agricultural and Forest Study and Research (FEPAF). Although still relatively unknown, the collaboration between the TZ1 Markit registry and a REDD initiative in Brazil makes the TZ1 a leading potential registry to be engaged in developing a REDD registry in Brazil that could be applied in the Xingu basin and adapted to a nested architecture.

[65] The project team was not able to obtain information about the specific types of services offered by the CCX registry, as this registry only is available to CCX members.

[66] Markit, 2009. Press Release: Brasil Mata Viva and Markit announce Brazilian Environmental Alliance. On-line at: www.markitenvironmental.com/newspress.php?id=84 .

Table 5-3
Pricing for Services Provided by Existing Offset Registries

Registry Services	APX VCS	TZ1 Markit	Caisse des Dépôts VCS	Blue Registry	Gold Standard	Climate Action Reserve	Chicago Climate Exchange[67]	American Carbon Registry
Annual Fees	$500	$100 per Member	0	€400 per Account		$500	NA	$500
One-time Fee	0	$500 per member	0	€550	$0.15/t	$500	NA	$500
Voluntary-Carbon-Standard Fee	€0.04/tCO_2	€0.04/tCO_2e	€0.04/tCO_2e				NA	
Issuance	$0.05/$tCO_2e$	€0.5-0.2/tCO_2e	€0.06/tCO_2e	0		$0.15 /$tCO_2e$	NA	Free
Registry-interaction Transaction	$0.02 /$tCO_2e$	€0.03-0.06/tCO_2e	€0.02/tCO_2e	€0.032/tO_2e		$0.03 /$tCO_2e$	NA	$0.05-0.07/$tCO_2e$
Who pays?	Buyer	Seller/Buyer	Buyer	Seller	Seller	Seller	NA	
Transfer to Other Registry	NA	€0.03-0.06/tCO_2e	To be determined	€150+ €0.03/tCO_2e			NA	$0.15-0.20/$tCO_2e$
Retirement (Same Registry)	0	€0.03-0.05/tCO_2	0	€150 + €0.03 /tCO_2e	0	0	NA	
Retirement (Other Registry)	To be determined	€0.03-0.05/tCO_2e	To be determined		N/A			

[67] The project team was not able to obtain information about the specific types of services offered by the CCX registry, as this registry only is available to CCX members.

An Emerging Role for Brazilian States in REDD Registries

An offset credit issued from a REDD project in the Xingu basin potentially could be registered on one of the voluntary carbon market registries, provided the offset could be issued pursuant to one of the existing voluntary offset standards like the VCS or ACR. Unfortunately, to date there only has been one offset protocol approved for use in the voluntary market[68], although many other REDD-based voluntary offset protocols are now in development.

As described in section one, one of the initial goals of this EPRI project was to begin to develop a pilot scale REDD-based offsets project in the Xingu basin that could lead to the eventual development of a large-scale, compliance-quality offset project in the future. One clear path to begin the transition from voluntary REDD projects toward development of REDD projects in Brazil that could yield compliance-quality offsets could be to aggregate project-based information from existing and evolving REDD projects into planning tools used by state government agencies in Brazil. These existing planning tools include geographic information system (GIS) databases, land use plans and zoning information. Aggregation of project based REDD offset information and project-related information into state planning systems could help to facilitate the transition from credits issued in the voluntary carbon market towards issuance of compliance-quality offsets. As described in detail in section two, the project team believes project-based REDD offsets on their own may not be viable in future programs designed to mitigate climate change. The project team believes aggregating project-based REDD information into state land use and planning systems, that ultimately would be subject to national review, is a critical step toward developing future compliance-quality REDD-based offsets.

As discussed in section two, sub-national forest monitoring systems have been approved by the UNFCCC for use by developing countries as they build their REDD systems. Importantly, this could form the basis for eventual development of a well-defined REDD+ offset credit within the UNFCCC framework. As discussed in section two, the project team believes the Brazilian states will play a prominent role over the next few years in the development and transition to a compliance-quality REDD+ system.

States in Brazil already are filling the gap between voluntary and pre-compliance REDD credits by nesting voluntary project-based emissions reduction projects into state planning systems. At the same time, states in Brazil are submitting land use plans for federal review and approval.

One possible next step in the evolution towards the creation of compliance-quality REDD credits would entail the development of a comprehensive registry that is based on some fusion between carbon accounting on the one hand and state spatial-planning GIS databases on the other. The merging of nested statewide land-use permitting through the *Pacto Federativo* with federal review and approval (as discussed in section three) with a carbon accounting system and registry could be a key step toward linking voluntary REDD offsets that may be issued in the near term for REDD-based projects with development of future compliance REDD credits.

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[68] The first avoided deforestation methodology was approved under the VCS Program in August 2010. Infinite Earth's VM0004 Methodology is designed to address avoided deforestation in peat swamp forests so would not be appropriate to use for a REDD project in the Xingu River basin.

A combined system of statewide planning and carbon accounting could resolve numerous challenges noted in section four (i.e., program architecture) and section five (i.e., project finance). Using this kind of integrated approach may make it possible for stakeholders, projects, municipalities, state government and federal agencies to coordinate key REDD dimensions, such as the allocation of baselines and associated uncertainties, the status of REDD+ projects, and compliance (or lack thereof). The term "*Statewide REDD Registry*" as used in this report refers to a combination of state planning, spatial databases and carbon accounting registries.

A Statewide REDD Registry for Brazil

Technically, a multi-scale REDD registry would be a spatially explicit terrestrial carbon accounting system that tracks C-REDDs, voluntary credits, and, eventually, fungible compliance-grade credits at the project, state, and federal levels. As described above, the project team believes it is important for this REDD registry to have functions that go beyond simply the tracking of offset credits, and would include a system to coordinate and integrate information central to REDD program implementation, including: land-use zoning, landholder compliance status, land cover change, carbon stock information, baseline allocations, land tenure status, validation, verification, data to evaluate leakage and permanence, and funding flows from new REDD-specific public finance structures. An ideal REDD registry would link project-based efforts directly with state and national carbon accounting.

The most important functions a Statewide REDD Registry would need to accomplish are spatial demarcation of land use attributes, the status of particular REDD-based offset credits, the prevention of double counting, and ultimately the ability to transfer offset credits and handle the reconciliation of various scales of oversight and accounting. In essence, such a Statewide REDD Registry would geo-spatially demarcate the following attributes:

- Land cover data, preferably aggregated into discreet land use classes;
- Different levels of carbon stock information, following IPCC Tiers 1-2-3 of discrete land use classes;
- Ownership and usufruct status (tenure) of land, forests and carbon. On some parcels, land, forests and carbon all may belong to the same owner (e.g., a government or private entity) or these attributes may have different owners. For instance, one tract of land may be owned by the federal government, while the usufruct rights and REDD emission reduction credits are ceded to smallholder farmers who are part of a settlement program;
- Legal compliance (in the case of private properties) with state and federal land-use legislation (e.g., Forest Code), including legal forest reserve (and forests in excess of the legal forest reserve), permanent preservation areas, environmental licensing status, and environmental recuperation plans to achieve compliance;
- Status of REDD program planning processes for municipalities (similar to U.S. counties);
- Deforestation estimates and likely land use conversions of forests to non-forests in a state;
- Differentiation between offset credits generated with public financial support (i.e., a federal government program to provide enhanced law enforcement in protected areas) and those issued that are associated private investments;

- Policy-related information, land use plans, and applicable laws (e.g., 80% of private lands are required by law in the Brazilian Amazon region to remain forested, but this requirement can be modified by approved land-use zoning plans);
- Spatially-explicit assignments related to the REDD validation system, including date, validation results, case numbers and methodologies or standards used, monitoring reports, results of social/environmental audits, reservations/limits/holds. These assignments for parcels of land would make it possible to track and monitor REDD within a state program.

In addition to demarking the above attributes across vast areas of each Brazilian state, a Statewide REDD Registry in Brazil would need to accomplish three overall goals:

1. **Prevent double counting**. A fundamental objective of any carbon registry is to create an exclusive right to registered carbon assets (e.g., a unit of carbon reduction or sequestration). Any REDD+ registry developed in Brazil must ensure only one legal entity can legally claim any unique emission reduction, sequestration or carbon stock in a given area.
2. **Oversight through standards and auditors**. GHG registries fundamentally trade in avoided emissions of invisible gases. To assist with rigorous oversight of the environmental integrity of issued offsets, registries typically rely on the application of standards and accounting methods combined with auditing by independent and qualified auditors. As part of the development of a statewide REDD registry, each state will need to determine the acceptable standards that can be used to create REDD-based credits and how these credits will be validated and audited against the established standards.
3. **Insure against reversals**. Some registries insure registered carbon assets against losses. In the case of the VCS, Agriculture, Forest and Other Land Use (AFOLU) projects that generate offsets are required to contribute a percentage of issued credits into an insurance "buffer pool" managed by the VCS to guard against the risk of offset impermanence. As part of a future state-based REDD program, some quantity of offset credits likely will need to be put in "escrow" to cover potential losses, based on a given project's risk profile. In the case of the VCS, offset projects also can apply to use their own form of insurance to cover potential losses. Similarly, projects that create agricultural and forestry offsets under the regulations being designed under California's AB-32 law likely will be required to provide some type of performance guarantee (e.g., insurance, buffer pool) to guard against permanence risks. As discussed in section six, one way to resolve some of the permanence and enforceability-related issues may be to use public sector finance to achieve substantial emissions reductions below a crediting baseline, and then to hold some of these emissions reductions in escrow to "back-up" further privately finance REDD reductions.

Development of a Statewide REDD+ Registry that includes the comprehensive list of potential components and goals described above may appear to be a monumental task. Development of such a comprehensive registry will require cross-government support and the ability to manage vast technical, spatial, legal and other information in one database, or a set of interconnected databases. However, complex, web-based GIS systems already have been built for most of the Brazilian Amazon states that assign ownership, track environmental licensing processes (e.g., one third of all land outside of protected areas in Mato Grosso already has been registered), and influence billions of dollars of investment and liabilities. Most major cities and many other scales of commerce and government use GIS systems for to plan, oversee and implement

projects. To varying degrees, these systems assign certain geospatial values. As such, the project team believes the evolution of a Statewide REDD registry is feasible, even though it will be a complex technical endeavor that will require extensive policy coordination across a variety of institutions.

While a variety of carbon registries in both the compliance and voluntary carbon markets exist today, no existing voluntary carbon registry has evolved beyond project-based accounting.[69] Yet, the policy direction guiding development of REDD clearly has moved beyond project-based accounting to larger scales, such as sub-national and national REDD-based programs. Policy developments in the UNFCCC, the U.S. congress and in California all portend this development.

To bridge the large gap between project-based accounting and accounting under national REDD frameworks, state systems for managing information and data pertinent to REDD are needed until national and international registries for land-based carbon storage and emissions can be developed. Given the central role states and provinces play today in the developing world in land use planning, forest governance and enforcement, and regulatory and social systems, states are likely to be important testing beds for innovative development of REDD-based carbon registries.

Section Summary

- REDD-based offset credits need to be tracked and accounted for in carbon registries.
- Currently, voluntary market registries exist that can be used to track REDD-based offsets, but these offsets must be generated in a manner that is consistent with project-related standards developed by these programs. Currently, there is only one approved REDD-based offsets methodology in the global carbon market and this applies solely to REDD projects implemented in certain peat swamps.
- Today, there are no compliance registries that can be used to track REDD-based offsets issued as part of larger sub-national and national programs. Currently, all existing carbon offset registries are designed to track offsets created by discrete carbon reduction projects not sector-wide emissions reductions.
- Given the prevailing policy emphasis on moving away from project-based crediting alone and toward sectoral crediting, a new registry system, or hybrid system involving carbon registries integrated with land-planning databases, is needed to be designed that can authenticate potential REDD credits issued from sectoral REDD programs.
- Among the existing voluntary carbon market registries, the TZ1 Markit registry appears to have some advantages for the future design of a registry that could be used for track offsets issued for REDD-based activities. This registry should be explored further to determine if can scale up beyond project-based accounting and integrate with statewide land planning and management systems already in place in Brazilian states.
- While there appears to be a critical need to develop a new integrated carbon and land management registry system that can accommodate sectoral REDD crediting, particularly at the statewide scale, such a registry necessarily will need to handle greater complexity than exist today in either voluntary carbon market registries or statewide planning systems.

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[69] Reed, D. et al, 2010. A REDD+ Registry Approach. The Technical Working Group, Institutional Architecture for Climate Finance. On-line at: www.climateregistryoption.org

Despite this and other challenges, REDD policy is evolving towards development of REDD systems that can account for GHG emission reduction credits at larger scales beyond project-based accounting. The development of integrated statewide land planning, management and carbon registries will help to facilitate the transition from REDD-based offset credits that can be transacted in voluntary carbon markets to development of compliance quality credits.

6
REDD FINANCE: OPPORTUNITIES FOR PRIVATE INVESTORS

The market for REDD-based emissions reductions is in a state of tremendous flux. Substantial uncertainty surrounds the emerging carbon "compliance" markets in the U.S., Australia and elsewhere. Furthermore, a growing number of voluntary REDD pilot projects that are being developed and implemented are increasingly sophisticated and rigorous, but they may never yield compliance-quality offsets. Several lines of evidence suggest that fungible, compliance-grade REDD credits and international emissions offsets will most likely begin to flow to private investors and offset-seeking entities within the context of nested REDD architectures, such as those being developed in Brazil, as described in section three and evaluated theoretically in section four. The hybrid, nested REDD program architecture described in this report is designed to integrate REDD-based pilot projects within state-level and national REDD programs.

The project team believes the safest REDD investments for both private investors generally and offset-seeking entities specifically are in those projects for which a clear path exists to link eventually with evolving national and state-level REDD programs.

In this section, we evaluate "entry points" through which U.S. electric companies and other private investors may be able to acquire options on future REDD credits. In addition, we describe possible mechanisms that could be used to minimize risks associated with investments in REDD projects and more generally for public REDD finance, private investors, and governments.

REDD as a New Model of Rural Development

The REDD carbon market is qualitatively different than other carbon markets, such as the markets for CDM offsets and the EU ETS, because of its enormous scope and complexity. Given the focus on achieving nation-wide emissions reductions from deforestation and forest degradation, the success of REDD depends upon changing the path of rural development from one that encourages clearing and degrading forests to one that provides incentives to maintain and regrows forests. The project team believes successful REDD programs will be those that develop public policies and deploy public finance to provide the infra-structure, incentives, market conditions, laws, and law enforcement capacity to move rural development towards a low emission pathway. Successful REDD programs also will be those that succeed in attracting substantial amounts of private investment to support agricultural and forestry enterprises that contribute to low emission rural development. REDD will succeed in nations that leverage the prospect of receiving future payments for nation-wide performance maintaining and enhancing forest carbon stocks to create the enabling conditions necessary to achieve this performance.

From the standpoint of private investors, including offset-seeking companies, investments in stand-alone REDD projects (i.e., projects not nested within a state or national REDD framework) are likely to be fleeting in the larger and more advanced developing nations like Brazil. There may be a multi-year period during which stand-alone REDD pilot projects may yield fungible

carbon offset credits, particularly in countries in the least developed parts of the world, however, the flow of carbon offsets that potentially may be available to investors and compliance entities eventually is likely to depend upon success achieving emissions reductions below national crediting baselines.

Different Roles for Public and Private REDD Finance

In the emerging REDD regime, it is likely each participating nation will negotiate internationally a crediting baseline that defines the level of emissions below which credits can be issued.[70] These baselines are expected to be lower than the BAU emissions trajectory, and pose an important challenge to the success of REDD programs. How will nations fund the activities and programs needed to lower emissions to the level of the crediting baseline? This issue is particularly important for private investors in REDD, including offset-seeking companies, because the delivery of credits likely will depend upon funding that is not supplied directly by the REDD carbon market. In this section, we examine the different roles of public and private REDD finance in achieving, and moving below, the crediting baseline.

The role of the crediting baseline also highlights once again the inter-dependency that exists between Brazil's NAMA commitments and the ability of REDD-based activities to generate fungible offsets. There is a chance that the more avoided deforestation Brazil commits to achieve "on its own," the fewer overall international offset can be created by additional REDD activities. Whether or not this proves to be the case will depend on the ultimate design and regulations for Brazil's National Climate Change Policy. The project team's interpretation of the UNFCCC process and numerous submissions from Parties is that mechanisms may be created by which wealthy nations may fund some portion of the emission reduction commitments represented in developing country NAMAs.

Effective forest frontier governance and implementation of land-use laws will be necessary to lower deforestation and associated emissions to achieve the crediting baseline. But only emissions reductions below the baseline are likely to generate offset credits. It is possible that developing nations will be able to negotiate with Annex 1 countries to allow emissions reductions below BAU or historical levels to count as buffers against non-performance or performance reversals, but it is very unlikely that any credit-related funds will be invested in countries to cover the costs incurred in lowering their emissions to the crediting baseline.

There are also some categories of costs associated with lowering emissions that will be incurred in Brazil that will not qualify for crediting. For example, activities designed to increase compliance with land-use laws probably will not be directly eligible for credits that flow to projects. However, this does not necessarily mean Brazil's national and state governments will not be allowed to use REDD funding to provide incentives to increase compliance with land-use laws. For example, Brazil's Forest Code requires private landholders to set aside 20-80% of their land as forest reserves. Compliance with the Code is low, especially in the Amazon region where

[70] In the case of Brazil, its National Climate Change Program defines a step-wise declining baseline established using historical deforestation rates. It is not yet known if this baseline will become the crediting baseline or not.

the requirement was raised in 1996 from 50 to 80%.[71,72] Clearly, new incentives are needed to achieve broader compliance with this ambitious law.

In this section, we review some potential sources of funding for programs that will be necessary to lower emissions to the level of the crediting baseline and/or bring farmers and ranchers into compliance with the Forest Code. Costs associated with achieving the baseline could be covered by public finance combined with private sector investment in low-emission land practices that generate market-clearing returns without a tradable credit. Below is a list of public-sector sources of funding that may be available to assist Brazil and other developing countries to reduce their REDD emissions to the level of the crediting baseline and perhaps below.

- REDD+ "fast track" donor finance (i.e., "ODA funding"). As described in section two, $4.0 billion has been committed for the period 2010-2012 through the "Paris-Oslo Process" to support national REDD readiness plans, nested projects and to directly address drivers of deforestation;
- If U.S. climate legislation eventually becomes law, there could be additional revenues set aside for REDD+ capacity building activities in Brazil and elsewhere. Some potential sources of public funds to pay for REDD activities could include, the sale of set-aside GHG emission allowances, an energy intensity tax or a marginal tax on renewable energy certificates.
- Domestic (Brazilian) public finance from non-carbon market activities, including general debt financing and tax revenues to support domestic REDD policies, such as low-interest loans proposed by the Ministry of Agriculture, Livestock and Supply (MAPA), as described in section three.
- Publicly-managed carbon finance, which could include:
    - The trading of emissions reductions between nations, such as through the JI program and AAU trades under the Kyoto Protocol. These trades could occur between Annex 1 countries and Brazil for emission reductions Brazil achieves beyond an internationally negotiated target or crediting baseline;
    - Government sale of credits through an auctioning mechanisms (see below); and,
    - Traditional and new kinds of "carbon–linked" government bonds (see below).

Project Activities and Legal Compliance

There are many challenges associated with establishing a crediting baseline below BAU or historical emissions for the purpose of crediting offsets. In the Brazilian REDD context, one of these challenges is getting existing landowners to comply with the Forest Code. Policies are likely to be needed that can reduce the cost to landowners of complying with the Forest Code in order for this to occur. Implementation of existing regulations that allow landowners to meet their forest conservation legal requirements by paying for forest conservation beyond compliance on other properties could lower costs and increase compliance.

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[71] Stickler, C. M. "The Economic and Ecological Trade-Offs of Alternative Land-Use Policies on Private Lands Along the Amazon's Agro-Industrial Frontier." University of Florida, 2009.

[72] Chomitz, Kenneth M. 2007. At Loggerheads?: Agricultural Expansion, Poverty Reduction, And Environment Washington, DC: World Bank.

For example, landowners who are not in compliance could be permitted to acquire C-REDD credits from landowners who have been allocated these credits in exchange for formally forgoing the right to clear the forests in excess of the Forest Code requirement. The compensation for private forest reserve deficits through the acquisition of forest reserves in excess of the legal mandate is an option permitted by Brazilian regulations at the scale of the micro-basin, but has not been implemented yet. One of the innovations that could be explored as part of the development of a Xingu REDD project would be a system to compensate private forest reserve deficits within the indigenous lands of the Xingu River basin, achieving the forest coverage percentages stipulated by the Forest Code within each of the tributaries of the Xingu Basin.

Many indigenous communities will need long-term incentives to increase the viability of their forest-based livelihoods and to help them to protect their forestlands from encroachment. These needs include basic social services, such as hospitals, schools, and health care, and vehicles and boats to patrol their perimeters. Funding also will be needed to support development of alternative economic models, such as sustainable forest management, development and marketing of scalable and secure supplies of non-timber forest products, and training and development capital for other forest-based enterprises. The development of long-term financial plans, and the structuring and funding of endowments and restrictions on access to endowment funds to protect against potential carbon stock reversals, will be a critical components of the future development of any large-scale REDD project. Financing for some of these activities may be needed just to reach the project-level crediting baseline.

Appropriate legal and contractual mechanisms that ensure the flow of benefits to landowners, communities and investors to whom credits/payments are due for getting to – or going beyond – crediting baselines even when sub-national and national programs have not achieved these goals, will be important to maximize private investment. This is one of the most difficult challenges facing the development of any sector-based crediting system, and is not unique to REDD.

These mechanisms could include a separately controlled and established "buffer pool" that ensures a certain number of credits will be available, or the creation of an international bilateral agreement for crediting countries, such as the U.S., to issue offset credits to those projects regardless of whether national crediting baselines have been achieved. In the case in which bilateral agreements may be used, this will result in a debit to the crediting country's national carbon accounts. While this is not an ideal approach, a bilateral agreement can include mechanisms to provide disincentives to countries like Brazil for not achieving their crediting baselines, such as limits on their future access to international carbon finance until the debit is rectified and the crediting country is made whole.

Private Sector Entry Points to REDD

There are four distinct "entry points" that could be built into the evolving state-level REDD architecture that could help to encourage needed private sector investment:

1. **Future rights to C-REDD credits** from projects with clear carbon accounting boundaries, including establishment and enforcement of protected areas, sustainable forest management and maintenance of forest cover beyond legal reserve requirements. The private sector potentially could engage in these activities through the creation of future rights to, and trading of, C-REDD credits as described in section three.

2. **Sale of government-owned carbon credits** to fund activities that do not have traditional carbon accounting boundaries, including incentives to promote productive use of degraded lands, agriculture productivity improvements, and compliance with zero net deforestation commodity certification schemes. Private land owners and indigenous and farm settlement communities could participate in carbon finance through performance-based government payments or low-interest subsidized loans and tax credits, which could be financed from the sale of carbon credits held at the State or National level and sold to international compliance buyers.
3. **Government auction of C-REDDS** to support Federal, State, or municipal programs that require additional financing to implement and enforce established regulations, such as policing illegal logging and enforcing the Forest Code. This approach would allow compliance buyers to purchase credits from either State or Federal Governments through either Government auctioning of C-REDDs (or their international credit equivalent) or by investing in government-backed carbon bonds as described below.
4. **Provision of low-interest loans and commodity floor prices** to promote sustainable land use, and other government programs that support sustainable commodity production. These approaches could be used to finance federal, state or municipal programs that (i) support and accelerate landowners efforts to comply with the Forest Code during a transition period, (ii) support creation of endowments to be used to increase the viability of forest-based livelihoods of indigenous communities and support for these communities to protect their forests; and (iii) provide assistance to commodity producers so they can achieve zero net deforestation targets and still be price competitive in the trade of global commodities.

Compliance buyers could engage in these entry points by acquiring credits directly from government or through investing in government-backed carbon bonds. As part of a state or national REDD+ program, REDD+ payments based on rights to offset credits that could be traded as part of international and/or domestic cap-and-trade schemes are expected to be based on verified performance-based activities. In addition to existing offset credit markets based on trading of offsets from project-based emission reductions projects, private finance potentially could be channeled to performance-based, verified REDD+ activities through a variety of public-private financing mechanisms including:

1. **The sale of government-verified REDD+ credits:** Compliance buyers and traders could acquire REDD credits via government auctions. The private sector buys trillions of dollars of government debt through similar processes. Similar to the issuance of other government debt, these auctions could be managed through financial intermediaries, such as international investment and commercial banks.
2. **Carbon revenue government bonds.** Low cost national or state medium-term debt (e.g., 10 years) could be issued at a cost of borrowing below traditional government debt securities of similar maturities, and could be linked to specific REDD+ future financing plans. The bonds either could be exchangeable at the investors' option in whole or in part for rights to a certain number of carbon credits or they could be sold with rights to a certain number of credits to allow investors to justify the lower-than-average yield. This structure likely would be of interest to governments that require upfront funding for their REDD+ activities and do not want to bear complete exposure to price volatility in the carbon markets.

This approach also may appeal to private investors and compliance buyers who are interested in receiving current income on their investments, but also may desire exposure to the potential rise in carbon prices.

For example, an exchangeable REDD-based carbon bond could be structured so every $1,000 bond could be converted into 200 C-REDD credits. If exchanged, this would mean the investors effectively would be paying $5 for each C-REDD credit. If the price of C-REDD credits was trading above $5 per credit, than investors would be expected convert the bonds and take ownership of the credits. If the market price for C-REDD credits was below $5 per credit, than investors likely would redeem the bonds and receive their $1,000 at maturity. The conversion ratio could vary, depending on expected future prices for carbon credits and the income on the bond that investors are willing to forgo for the rights to the credits.

The same mechanism could be applied to a bond with rights to carbon credits. In this case, investors always would redeem their bonds. In exchange for receiving a low interest rate on the government debt, investors would receive a right to buy C-REDD credits in the future at a discounted price. This kind of bond structures may be attractive to pre-compliance buyers, as their downside risk would be managed if no regulated market emerges, or if they have no compliance obligations, or if the international price of carbon is low.

3. **Carbon project level debt to finance future REDD+ activities.** To date, the carbon markets largely have been ineffective as sources of up-front project finance. Most carbon offset contracts are based on payments being made at time of the delivery of verified offset credits by the project developer. Carbon project-level debt effectively would serve as an upfront loan to finance project activities that would be exchangeable into a certain number of expected carbon credits or carbon payments as described above. In the event that anticipated carbon revenues do not materialize, the bondholders would have the security of the underlying cash flows from the project (e.g., agricultural production or timber revenues) or, perhaps the value of the land itself. (This security may be more difficult to obtain or of reduced value for carbon projects implemented indigenous land). These bonds also could carry a government-backed guarantee that would remain in effect so long as the project remains in compliance with certain requirements.

   There is a variety of real-world scenarios that could transpire which could be mitigated by this kind of project finance. For example, one scenario may involve a project that performs, but there are no credits available because national or sub-national crediting baselines are not reached. Projects may not deliver credits due to a *force majeure* event. Finally, a project could achieve other environmental objectives, yet fail to deliver C-REDD credits.

4. **Performance-based REDD+ feed-in tariffs to facilitate debt and equity investment in land activities that support REDD-related policies.** Substantial investments are likely to be made in the Brazilian forestry and agriculture sectors in the future. Policy and financial incentives could be structured to help shape these investments to accelerate REDD+ compatible infrastructure investments.

   These kinds of structures could be modelled along the lines of renewable energy policies designed to subsidize one type of energy generation over another while allowing the private sector to decide where and how to invest. While these kinds of feed-in tariffs can succeed in stimulating investment in desired activities, many economists oppose feed-in tariffs and similar kinds of subsidies because they are not economically efficient as they do not rely on markets to allocate scarce resources.

The kinds of structures could include tax credits or REDD+ performance-based government payments similar to the European feed-in tariffs designed to accelerate private investment in renewable energy generation. Renewable energy feed-in tariff guarantees are widely used in Europe to guarantee a certain payment for production of renewable electricity and allow for debt and equity investors to achieve more stable financial returns. As a result, investors may require lower overall financial returns because of the existence of the government guarantees.

A REDD+ feed-in tariff could provide a fixed payment over time based on verified REDD+ activities. This could provide the added benefit of reducing the cash flow volatility in the agricultural and forestry spot markets. REDD+ payments could be structured to support market-clearing returns for investors and land managers (i.e., producers and stewards) for a fixed period of time while favoured sustainable land-use practices and technologies can achieve cost-effective scale and carbon can be priced into the global commodity supply chains. The debt and equity finance could come from big agricultural producers and financial investors, commercial banks, export credit facilities and government supported subsidized finance organizations, such as the Overseas Private Investment Corporation (OPIC).

5. **Public-private partnerships to fund REDD activities and acquire REDD credits.** To encourage up-front investment by the private sector in REDD programs and project activities, public finance through the mechanisms described above – or provided by the international donor community – could be used to invest alongside private capital in a way that lowers risk for the private investors. Using this approach, any offset credits that might accrue to the public sector would be subordinated to private sector participants in the early verification periods. Incentives could include the private sector receiving all C-REDDs generated by a REDD project or activity until the private investor has received a minimum number of credits before the donor country or public fund receives rights to credits. The Amazon Fund and other REDD+ public funds could be structured to incorporate this kind of private sector leverage to facilitate up front funding of REDD+ activities once there is a regulated carbon market.

In the absence of regulatory clarity and the creation of an international price for forest-based carbon offsets, bonds structured either with government guarantees and/or rights to underlying project cash flow, along with the government feed-in tariffs, may be the most effective mechanisms that can be used to attract substantial amounts of private investment.

In pre-compliance carbon markets, investors and potential compliance buyers may be interested in acquiring options to rights to acquire future REDD+ credits, given that REDD+ credits are expected to be one of the most cost-effective sources of large-scale offset supplies. However, these payments likely will be nominal, unless they are coupled with public-sector funding, such as the $4 billion “fast start” funding being provided by the international community as part of the Copenhagen Accord. REDD payments derived from investors seeking options on future REDD credits most likely will not cover the financial cost to set up project level activities and are not likely to have a material impact on financing REDD activities.

However, ODA funding linked with private sector option payments could be a very effective public-private mechanism to engage the private sector during an initial period of market uncertainty, mitigate some of the risks of early action to leverage additional funding, help ensure public sector finance is deployed efficiently to address the real drivers of deforestation, and facilitate engagement between landowners, communities and government.

Such a public-private partnership could be structured so REDD projects meet the majority of their short-term funding needs from public funding. In the event a regulatory-based carbon market emerges, the projects would have been structured to have gain access to long-term investors. This structure also would provide needed confidence at the project level that the private sector can be engaged. Meaningful private sector participation in REDD offsets during this interim finance period will be limited so long as a high degree of regulatory and market uncertainty remains in the regulated carbon markets.

Finally, federal, state, or local lawmakers that take into consideration mechanisms for reducing private sector risks may benefit over time as private sector funding could quickly exceed public sector funding for REDD+ implementation, and be more agile in terms of capital deployment.

Risks to the Private Sector

To leverage the private sector at scale, REDD+ policies could try to mitigate risks of early action private sector participation and help to establish regulatory clarity as soon as practical. Obviously, it would be helpful to the development of the emerging market for REDD finance, if emerging mandatory programs to reduce GHG emissions, like California's AB-32 program, include clear provisions to include REDD+ offset credits and robust standards and protocols to determine how REDD credits can be developed for compliance purposes.

According to one recent report on the evolving forest carbon market,[73] the private sector has invested $150 million in forestry and REDD-related carbon activities. In contrast, more than $60 billion has been invested in the CDM offset market. The private sector contribution is much smaller than public funds, because there simply is too much regulatory risk for private sector investors and potentially regulated parties to have a meaningful pre-compliance interest in funding forest carbon and REDD-based activities at the present time.

In the absence of meaningful pre-compliance market signals, the voluntary carbon market will be important to catalyze investments, but likely will be negligible in terms of achieving climate-related impacts at large scale. Significant private sector participation during the interim financing phase and beyond is possible if public sector interim finance helps to mitigate some of the risks faced by private sector investors and potential compliance buyers. From the perspective of private investors, some of the potential risks that could be mitigated with the help of public sector finance include:

- Risks that cap-and-trade based carbon markets do not develop to support a reasonable minimum price for REDD-based offsets;
- Risks that international or domestic cap-and-trade programs are not effective, even if regulatory systems are implemented that create demand for REDD+ offsets;
- Risks that emission reductions are counted within developing nations' accounting inventories and applied to their NAMAs, and so may not be available as offsets to third-parties for compliance purposes;

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[73] Hamilton, K., U. Chokkalingam, and M. Bendana, State of the Forest Carbon Markets 2009: Taking Root and Branching Out, January 2010. Available online at http://moderncms.ecosystemmarketplace.com/repository/moderncms_documents/SFCM_2009_smaller.pdf .

- Risks of changes in crediting baselines as early action initiatives become formalized within nested frameworks;
- Risks that state and national targets are not achieved despite successful nested activities, resulting in insufficient payments for successful nested activities;
- Risks that nested activities receiving up-front funding but do not address successfully the drivers of deforestation and do not achieve expected emissions reductions;
- Risks that mechanisms to address permanence for forest carbon projects (e.g., insurance and buffer pools) are not accepted by the carbon markets, or that substantial and costly discounting is required to generate fungible credits;
- Risks related to legal and contractual complexity for private investors to enter into REDD agreements directly with state and national counterparties; and,
- Risks that national governments expropriate REDD+ credits over time, perhaps during changes in governments.

Mitigating the Risks of Private Sector Participation:

To mitigate risks that threaten private REDD+ investment, interim finance could provide a buffer pool of emission reduction units at the state or national levels to facilitate pre-payments by the private sector (i.e., up-front financing of projects that will create future emissions reductions). These insurance pools could hedge against risks of reversals (impermanence). Other risk-mitigation structures could include:

1. Principle repayment guarantees against regulatory failure;
2. Allowance for private sector entities to invest alongside public-sector funding where private sector emissions reductions generated are considered to be senior to public sector interests; and,
3. Balanced returns for the private investors derived from direct cash flow in underlying low carbon land-use activities and the rights to potential future carbon revenues.

In the absence of the existence of a compliance carbon market that directly includes REDD, there will be limited interest among private sector financiers and organizations in funding implementation of REDD activities. Available public funding, including the committed four billion of fast start funding through 2012 could be used to leverage private sector investment, both through public-private partnerships and through the creation of buffer pools of credits that could be used as an insurance mechanism against risks of impermanence.

In addition, it is critical to create mechanisms to pre-fund ambitious REDD+ activities and policies. Public-private partnerships utilizing ODA funds could facilitate upfront private sector investment. Carbon-linked debt instruments could be an important way to raise the vast amount of capital to provide up-front finance for REDD+ programs. Carbon-linked debt could limit the financial exposure of projects and governments to carbon markets and provide low cost finance.

REDD+ has the opportunity to use traditional debt finance, ODA funding, and bi-lateral agreements to fund REDD+ policies that can attract substantial private investment in the underlying REDD+ activities. A critical component of any successful REDD+ financial architecture is to understand the costs of meeting REDD+ crediting baselines and the effectiveness of policies in terms of leveraging private capital.

Section Summary

- In the absence of regulatory clarity, private investor interest in REDD projects has waned and is likely to be very limited in the future. Over the next few years, REDD projects and programs will be funded primarily by public funds committed by developed nations. In the longer term, however, private finance will be needed to achieve the level of funding necessary to implement REDD programs at large scale.
- Interim REDD public funding could be designed to fund activities to reduce deforestation and associated emissions to the level of the crediting baseline, including programs that will be necessary to bring private landowners into compliance with Brazil's Forest Code.
- Public finance also could be structured to provide innovative entry points to private investors and mitigate risks associated with direct investment in REDD projects while providing exposure to the emerging REDD market. For example, Brazil could create medium-term government bonds that would provide relatively low yields, but would also provide private investors with the right to REDD credits and first priority over the first offset credits to be issued. Interim public finance (e.g., the Amazon Fund) could acquire a large volume of bonds, but with second priority over any credits eventually created.
- Risk also can be reduced by securing investments in low-emission land-use projects through agro-industrial enterprises targeted by these investments. This kind of securitization is likely to be more difficult to accomplish for investment in activities located on indigenous territory.

REDD+ has the opportunity to use traditional debt finance, ODA funding, and bi-lateral agreements to fund REDD+ policies that can attract substantial private investment in the underlying REDD+ activities. A critical component of any successful REDD+ financial architecture is to understand the financial costs to meet REDD+ crediting baselines and the effectiveness of policies in terms of their ability to leverage private capital.

7
THE XINGU RIVER BASIN AND THE POTENTIAL TO ACHIEVE REGIONAL EMISSIONS REDUCTIONS

The Xingu River Basin

The Xingu River is one of the Amazon's main tributaries. It drains into the main stem of the Amazon River from the southeast, as shown in Figure 7-1. The Xingu basin covers 51 million hectares, and is larger than the state of California (40 million hectares in size). Thirty million hectares of the Xingu basin are protected through a "mosaic" of inter-connected indigenous reserves, extractive reserves, parks, and ecological reserves. Twenty million hectares of this mosaic are indigenous reserves (Figure 7-1, Table 7-1). Twenty-five different indigenous tribes and dozens of traditional riverine communities live in the Xingu basin. The Xingu protected area mosaic is the largest contiguous area of protected tropical forest in the world.

The Xingu River begins in the semi-deciduous forests and woodland-savannas of Mato Grosso state, and flows north for 2,700 km through tall, dense, moist forests before emptying into the main channel of the Amazon River west of Belém in Pará state. The Xingu drains a landscape of ancient crystalline Precambrian shield, and is a clear water river that picks up sediments and nutrients primarily from the forests through which it flows. This sediment load is increasing as forests are converted to cattle pastures and farms with higher levels of soil erosion.[74]

The Xingu basin straddles two states in Brazil: Pará to the north and Mato Grosso to the south (Figure 7-1). It contains two main biomes: (i) Closed-canopy dense forests of the Amazon; and, (ii) Woodland savanna, or "Cerrado," at the southern extreme of the Basin. It is the site of intense agricultural expansion, especially in the headwaters region of Mato Grosso, where many of the remaining forests are situated on lands that are suitable for soy production and cattle ranching. Another center of agricultural expansion is found in Pará, around the city of Sao Felix do Xingu, a regional cattle ranching hub. The Transamazon highway cuts east-west across the Basin to the north, where federally-planned colonization projects began to be built in the 1970s, and where agricultural expansion continues today.[75]

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[74] Coe, M.T., M.H. Costa and E.A. Howard, 2007: Simulating the surface waters of the Amazon River Basin: Impacts of new river geomorphic and dynamic flow parameterizations, Hydrol. Procs. 21, doi: 10.1002/hyp.6850.

[75] Lima, Eirivelthon, Frank Merry, Daniel C. Nepstad, Greg Amacher, Claudia Azevedo-Ramos, Paul A. Lefebvre, and F. Resque. 2006. Searching for Sustainability: Forest Policies, Smallholders, and the Trans-Amazon Highway. *Environment* 48 (2):36.

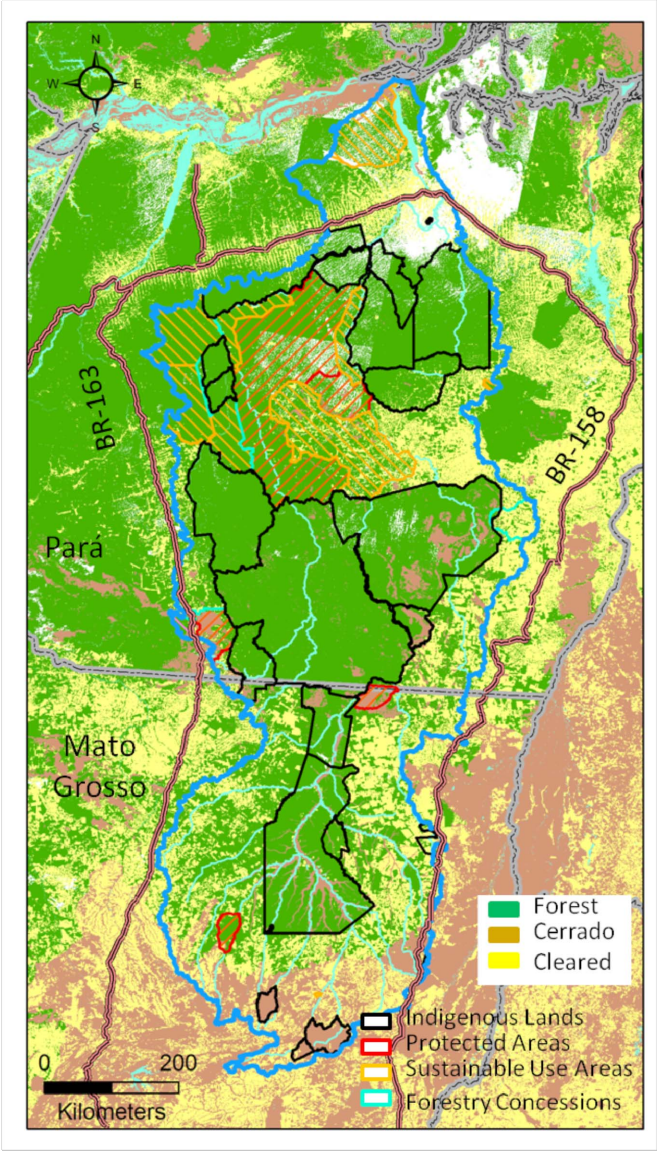

Figure 7-1
The 51 million-hectare Xingu River basin (outlined in blue), in the eastern end of the Amazon Basin (Figure 3-1) lies at the transition zone between Brazil's woodland savanna *Cerrado* (tan) and the dense, tall forests the Amazon region interior (green). It is flanked by highways; BR-163, BR-158, and the Transamazon highway to the north. It straddles the states of Pará and Mato Grosso, and its network of indigenous lands and protected areas is one of the last barriers to the advancement of the agricultural frontier into the core of the Amazon region. The EPRI Xingu Avoided Deforestation project focuses on the indigenous lands of the Xingu (delimited in black) that comprise 40% of the Basin. (Map Source: C. Stickler, WHRC/IPAM.)

Throughout the past two centuries, there has been a great deal of migration into the region from other parts of Brazil. As a result, today the Xingu forms a cultural mosaic representing the whole of Brazil. The region is typical of the modern Amazon frontier dynamic, in which multiple social, economic, cultural, and environmental interests dispute the distribution and use of a wealth of natural resources in the region.

Table 7-1
The allocation of land in the Xingu River basin by land tenure type. Sixty percent of the basin is in some form of governmental protection; nearly 40% of the basin lies within formally demarcated indigenous lands.

Land Tenure Type	Area (ha)	Area (km)	% Total
Indigenous Lands	19,619,376	196,194	39
Protected Areas	4,398,456	43,985	9
Sustainable Use	3,188,428	31,884	6
Military Areas	73,332	733	0
Private Lands	20,550,836	205,508	40
Forest Districts	3,017,012	30,170	6
TOTAL	**50,847,440**	**508,474**	**100**

The large contiguous mosaic of protected areas in the Xingu basin is the result of a long history of interventions beginning in the 1960's, when two pioneers and explorers, Orlando and Claudio Villas Boas, conceived of the Xingu Indigenous Peoples' park in the headwaters region and convinced the government to create it. Subsequent recognition and demarcation of other indigenous tribal territories in Pará state over the subsequent 30 years expanded the area of formal indigenous lands in the Xingu. Beginning in the late 1990s, a novel alliance of small landholder organizations led by the Transamazon movement of smallholder farmers, NGOs, and indigenous groups succeeded in designing and formalizing a large number of new reserves and protected areas in the Pará region known as the "Terra do Meio" (i.e., land in the middle).[76]

Deforestation in the Xingu River Basin

In recent years, the Xingu has come under increasingly intense deforestation pressure as the agricultural frontier has expanded north and west into the watershed (Figure 7-1). The process of occupation and agricultural expansion, often accompanied by violent land conflicts on the lawless frontier, has intensified over the past 40 years following construction of a federal highway network around the perimeter of the river basin, including: BR-364 (the Transamazon highway) that cuts east-west along the northern end of the Basin; BR-163 running north to south from Santarem to Cuiaba, along the western edge of the Basin; and, BR-158/PA-150 on the eastern edge of the Basin (Figure 7-1). Paving these highways – which likely will lead to increased immigration and deforestation – remains a priority of the Brazilian government.

Due to the existence of road access, infrastructure (e.g., grain storage facilities and meat-packing plants), suitable soils, and a reliable rainy season, the Xingu headwaters region has become an important center of soybean production and cattle production, which occupies the largest tracts of land. The Xingu's forests also are sought for selective logging (almost all of which is conducted illegally), and its streams are excavated for gold. Dozens of towns have sprung up alongside roads in the region to support frontier activities and hundreds of thousands of people depend on the frontier economy. Deforestation reached a peak during the 2002-2004 period,

[76] Campos, M. T., and D. C. Nepstad. "Smallholders, the Amazon's New Conservationists." Conservation Biology 20, no. 5 (2006): 1553-56.

when a combination of high soy prices, a weak currency, and other factors triggered a rapid expansion of the soy industry into the forested regions of northern Mato Grosso. This clearing was particularly dramatic in the Xingu River headwaters region, where approximately 1,000 km^2 of forest were cleared annually.[77]

At the same time as this wave of forest destruction threatens to engulf the region, a 30 million hectare (ha) mosaic of protected areas (including both officially recognized indigenous territories and conservation areas) is helping to ensure legal – and on the ground – protection of 56% of the Xingu basin (Figure 7-1). The protected areas mosaic is a central element of any strategy or program that hopes to slow deforestation in the Brazilian Amazon given its location in the pathway of the expanding agricultural frontier. At stake is a wealth of biodiversity, indigenous cultures, and ecosystem services, including the storage of nearly 20 $GtCO_2e$ of carbon in trees (discussed in section 10). Recent studies demonstrate that the protected area mosaic of the Xingu River basin is large enough to help maintain the rainfall regime of the eastern Amazon in the face of further deforestation and climate change.[78]

The indigenous groups that occupy half of these reserves have a history of successfully defending their perimeters against encroachment[79, 80, 81], but it is not clear if they will be able to continue this forest guardian role without additional support. If the region's borders are not carefully monitored, ranchers, colonists, illegal land developers, commercial fishermen, loggers and gold-miners inevitably will invade the protected areas. If they cannot gain clandestine entry, loggers will seek to buy off certain members of indigenous communities to obtain access to the rich timber stocks on their lands. In the absence of information and alternatives, indigenous peoples are vulnerable to outside pressure to liquidate their resources. Without viable sustainable economic alternatives, the likelihood of degradation and deforestation of indigenous lands is likely to increase over time.

The keys to the long-term ecological and cultural integrity of the corridor are capacity-building for territorial control by the indigenous inhabitants, strengthening governance in the lawless frontier, and restoration of degraded riparian forest in the Xingu headwaters. Restoration of the riparian zone forests in the upper headwaters of the Xingu is the goal of regional multi-stakeholder initiative launched in 2004 called "Y'Ikatu Xingu" (www.yikatuxingu.org.br). This

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[77] Stickler, C. M. "The Economic and Ecological Trade-Offs of Alternative Land-Use Policies on Private Lands Along the Amazon's Agro-Industrial Frontier." University of Florida, 2009.

[78] Coe, M.T., M.H. Costa, and B.S. Soares-Filho. 2009. The Influence of historical and potential future deforestation on the stream flow of the Amazon River -- Land surface processes and atmospheric feedbacks, *J. Hydrol*. doi:10.1016/j.jhydrol.2009.02.043

[79] Schwartzman, S., A. G. Moreira, and D. C. Nepstad. 2000. Rethinking tropical forest conservation: perils in parks. *Conservation Biology* 14 (5):1351-1357.

[80] Nepstad, D. C., S. Schwartzman, B. Bamberger, M. Santilli, D G. Ray, P. Schlesinger, P. A. Lefebvre, A. Alencar, E. Prins, G Fiske, and A. Rolla. 2006. Inhibition of Amazon deforestation and fire by parks and indigenous lands. *Conservation Biology* 20 (1):65-73.

[81] Soares-Filho, B., P. Moutinho, D. Nepstad, A. Anderson, H. Rodrigues, R. Garcia, L. Dietzsch, F. Merry, M. Bowman, L. Hissa, R. Silvestrini, and C. Maretti. 2010. Role of Brazilian Amazon protected areas in climate change mitigation. *Proceedings of the National Academy of Sciences* 107 (24):10821-10826.

initiative also provides important opportunities for the Xingu avoided deforestation project to be discussed and assimilated.

Potential for Future Emissions Reductions in the Xingu

Some of the key objectives for future efforts to reduce emissions from deforestation in the Xingu River basin could be to prevent deforestation and maintain the existing carbon stocks, biodiversity and associated ecosystem services in the forests of the indigenous lands or other protected areas in the Xingu watershed, while demonstrating that avoided deforestation projects can produce substantial direct benefits to local communities and possibly provide emissions reductions offsets to those entities who fund project-related activities. The indigenous peoples and other local communities who inhabit the Xingu basin ultimately will be the ones to determine the specific objectives of any REDD project that may be implemented in the future on indigenous lands and protected areas in the region.

A basic pre-requisite for any effort to sustainably reduce emissions in the regions is to prevent frontier expansion into indigenous lands and protected areas, maintain near-zero deforestation in protected areas, improve community living standards and increase incomes. Efforts to reduce deforestation in the region could also help to further develop REDD-related capacities in Brazil and around the world and help lay the foundation for REDD-based offsets to be created and traded in the world's evolving carbon markets.

EPRI and the members of the project team deeply respect the rights of the indigenous people who inhabit the Xingu River basin to managed their own affairs and determine their own destiny. Only they have the authority to decide if they wish to become involved in any potential future project in the Xingu basin that is designed to reduce deforestation and forest degradation in the region. Furthermore, only the indigenous peoples and local communities themselves can decide if implementing a potential future REDD project in the region is in their best interests and will provide significant benefits to them. No REDD project can be designed and implemented in the region without the explicit informed consent of the indigenous and local peoples who live in the Xingu basin.

The project team's original conception of a potential future Xingu avoided deforestation effort has evolved over time in response to the larger transition going on in the international REDD policy that is now focused on crediting REDD projects in the more advanced developing countries like Brazil as part of sub-national or "sectoral" emissions reduction programs and not as isolated, stand-alone projects. This policy transition is described in more detail in section two of this report.

Two other important changes have taken place since this EPRI supplemental project was conceived – the failure of the international community to achieve regulatory clarity on REDD at COP15 and the failure of comprehensive climate change legislation to be enacted in the United States. For the next three years, interim public finance, committed and designed in the Paris-Oslo process, will play a crucial role in determining the level of private investor engagement with REDD.

The architecture of REDD in Brazil also has evolved rapidly since this EPRI project began, with state-level REDD programs taking important steps forward prior to COP15 and subsequently. The transition in thinking and expected policy design from "project-based" offsets to the need to "nest" REDD projects within sectoral crediting programs that credit emissions reductions against

a national or sub-national crediting baseline required the project team to manage adaptively by adjusting its work plan to become more directly involved in policy analysis and evaluation of proposed REDD nesting architectures than was planned at the beginning of this project.

Additional expertise was added to the project team while the project was being implemented to address the issues related to the design of a nested, "scale-neutral" REDD architecture, and the exploration of financing mechanisms that could be used to encourage private investor participation in REDD programs despite the ongoing lack of regulatory clarity.

At the same time, these changes in the REDD policy trajectory have allowed this EPRI project and project team to be involved more directly in evaluating and helping policy makers in the international community, Brazil, and in the U.S. to better understand different potential approaches that could be used to nest REDD projects within sectoral programs, and how these different designs may or may not support either REDD-project activities or larger-scale adoption of REDD policies and programs.

As a consequence of this overall transition in thinking and the policy environment much of the work done as part of this EPRI project has focused on laying the groundwork to establish a workable REDD architecture in Brazil that can facilitate the nesting of large-scale REDD projects into a more comprehensive sub-national and national architecture to reduce deforestation in Brazil and generate compliance-quality REDD offset credits in some fashion.

EPRI's support positioned the project team to synthesize information on the very rapidly evolving REDD policy designs on several key issues (e.g., nesting architecture, innovative financial instruments for attracting private investment, the Brazilian REDD architecture, baseline determination), and is the only analysis of its kind providing an up-to-date assessment of the emerging REDD regime in Brazil and internationally. Many of the concepts and policy options discussed in this report already have been incorporated into the ongoing REDD policy formulation process in Brazil.

Consultations and Capacity Building with Xingu Indigenous Groups

One of the most important challenges to implementing any kind of project that involves indigenous people, including REDD projects, is conducting effective consultation with the potentially affected parties. Indigenous people must understand the implications of the project for their livelihoods and culture, they must have the opportunity for informed discussion and deliberation about the potential commitments and benefits that the project could bring to them, and they must have the freedom to decide whether or not they want to participate in the project.

In late 2008 and 2009, staff from the Instituto Socioambiental (ISA) and the Environmental Defense Fund (EDF) facilitated a number of regional and village level meetings with indigenous peoples in the Xingu region that were designed to explain climate science and related policy, to clarify the role of forests in climate change, and to explore on a preliminary basis possible project-related options with local leaders and communities. While a number of consultations have been held with indigenous communities, these consultations are ongoing and the indigenous peoples and their leaders have not yet reached any definitive conclusions regarding their potential interest in developing future REDD projects on indigenous lands.

Two unforeseen factors intervened with completion of the consultation process with indigenous groups in the region. First, the indigenous groups' concerns about the potential spread of H1N1

"Avian Flu" in late 2009 led them to postpone some of the consultation meetings in late 2009 and early 2010. In addition, the Brazilian government's decision to build a 12,000 MW hydroelectric dam on the Xingu River called the *Belo Monte* project caused Xingu indigenous leaders to put the carbon consultation process on hold as they launched a public campaign to stop development of the dam.

Although the consultation process has not been completed, it appears some indigenous leaders and communities in the Xingu region favor exploring further options for proposing an indigenous avoided deforestation project in the future.

The indigenous participants also have expressed the view that they do not wish to consider development of any future REDD-based emissions reduction project that involves participation by other countries or organizations unless the other countries or organizations also are committed to reducing their own GHG emissions.

Some participants also expressed the view that the benefits of any potential project should not come in the form of cash payments to individuals or groups, but instead should be transformed into on-the-ground projects that can improve their lives. More support for health and education are high priorities, as are territorial monitoring and control, creation of sustainable economic alternatives, and strengthening local institutions. In addition, the indigenous groups want projects to reinforce and strengthen traditional culture and ceremonial life that are viewed as central to sustaining their traditional identities over time.

Section Summary

- The Xingu River is one of the Amazon's main tributaries. The Xingu River basin covers 51 million hectares, and is larger than the state of California. Twenty million hectares of the basin is contained in indigenous reserves. The Xingu protected area mosaic is the largest contiguous area of protected tropical forest in the world.
- The Xingu River basin is the stage on which a dramatic struggle is taking place between indigenous and traditional forest inhabitants and a rapidly expanding, violent agricultural frontier. The indigenous peoples' remarkable historical success in protecting the perimeters of their ancestral lands (which cover 40% of the Basin) against incursions from land grabbers, ranchers, gold miners, and loggers is threatened by the growing pressures for new land. Understanding this context is critical to the development and implementation of any future efforts to control deforestation in the basin.
- Since the original discussions of this EPRI research project began, important changes have taken place in the emerging international REDD policy framework and global carbon markets. International negotiations within the UNFCCC and the U.S. legislative process have failed to provide regulatory clarity for the development of REDD-based offset projects and activities. It is now apparent that there likely will be little opportunity for stand-alone REDD pilot projects to yield fungible, compliance-grade offset credits in large, well-developed tropical nations such as Brazil. In response to these changes, the project team expanded and adapted the scope of work for this project. The resulting analyses now are being absorbed by the Brazilian REDD policy formulation process and policy-related discussion focused on how best to design the application of interim REDD finance, and into the state-level REDD design processes now underway in Mato Grosso, Acre, and Pará states.

- In the future, it may be possible to discuss providing compensation for reducing deforestation with the indigenous tribes that inhabit the Xingu River basin. The indigenous peoples who inhabit the Xingu River basin have the rights and authority to manage their own affairs and determine their own destiny. Only they have the authority to decide if they wish to become involved in any potential future project in the Xingu basin that is designed to reduce deforestation and forest degradation in the region. Furthermore, only the indigenous peoples themselves can decide if compensation for reducing deforestation in the region is in their best interests and will provide significant benefits to them. No REDD project can be designed and implemented in the region without the explicit informed consent of the indigenous peoples who live in the Xingu basin.
- In late 2008 and 2009, staff from ISA and EDF facilitated a number of regional and village level meetings with indigenous peoples in the Xingu region to explain climate science and policy, clarify the role of forests in climate change, and present possible REDD project options to local leaders and communities.
- While a number of consultations have been held with indigenous communities, these consultations are ongoing and the indigenous peoples and their leaders have not yet reached any definitive conclusions regarding their potential interest in developing future REDD projects on indigenous lands.

8

WHO OWNS THE FOREST CARBON ON BRAZIL'S INDIGENOUS LANDS?

Clearly established property rights are an important foundation for any market to operate effectively. One of the tasks undertaken by the project team was to review the legal status of forest carbon on indigenous lands in Brazil. This review was designed to shed light on critical questions related to the development of future REDD-based offset projects in cooperation with indigenous communities, including:

- Does carbon stored in the forest belong to the indigenous people who live in these reserves?
- Do they "own" it in a technical and legal sense?
- Can indigenous tribes buy, sell and trade their stored carbon to others?
- Would the benefits derived from an eventual REDD program implemented on indigenous lands of the Xingu River basin necessarily flow to its indigenous inhabitants?
- How can this be contractually arranged?

These are only some of the many legal questions that will need to be addressed before a privately-financed REDD project can be implemented in the Xingu basin.

Existing Legal Analyses

Three existing legal analyses have been conducted to date that have evaluated the rights of Brazilian indigenous groups to the actual carbon stored in their forests and the benefits that may flow from forest carbon markets or investments.

The first analysis was done by the law firm Trench, Rossi, and Watanabe, the Brazilian affiliate of Baker and McKenzie International, through a contract from the Katoomba Group and Amazon Conservation Team in support of the Surui indigenous lands forest carbon project, in the Brazilian Amazon state of Rondônia.[82] This project is developing both emissions reductions from avoided deforestation and forest enhancement through forest restoration work.

The second study was conducted by the ISA with support from EDF, and provides a comparative analysis of the legal status of forest carbon on the indigenous lands in Brazil, Peru, Ecuador, Colombia, Bolivia, and Venezuela.[83]

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[82] Sales, Won, and Frederighi. 2008. "Legal Aspects of the Surui Community Project: Safeguarding the Biocultural Diversity of the Surui Land", Memo. Trench, Rossi, & Watanabe.

[83] Garzón, Biviany Rojas 2008. REDD en Territorios Indígenas de la Cuenca Amazónica. ¿Serán los pueblos indígena los directos beneficiarios? El Instituto Socioambiental

The third study also was conducted by ISA and addressed the ownership of carbon credits derived from forest activities on indigenous lands.[84] This study analyzed property rights to carbon credits, and the juridical feasibility of carbon credit projects on indigenous lands.

In addition, the Brazilian government agency known as FUNAI has issued a "concept note" in response to demands by indigenous organizations for clarification about indigenous rights to forest carbon credits and the legal framework to be used for REDD projects on indigenous land. FUNAI is the Brazilian government agency responsible for protecting the rights of indigenous people and maintaining many of the social services on which indigenous tribes depend.

Summary of Existing Legal Analyses

Below is a brief summary of some of the key aspects of Brazilian law as it relates to the management of lands occupied by indigenous peoples, as well as some of the key issues related to implementing REDD projects on indigenous lands. This summary is based on the project team's review of the three existing legal analyses identified above.

Although there are still no specific government regulations in Brazil related to implementing REDD+ projects or activities on indigenous lands, existing national and international laws on indigenous territorial rights already provide some clarity on the definition of rights to the "benefits" associated with REDD projects. These laws include the Brazilian Federal Constitution of 1988, the Indigenous Statute (Law 6.001/73), and two international conventions – the ILO Convention 169[85] and the United Nations Declaration on the Rights of Indigenous People (UNDRIP). Brazil has ratified both of these international conventions.

The Brazilian Federal Constitution of 1988 and the Indigenous Statute guarantee to indigenous peoples permanent possession and exclusive use of their traditional lands, including natural resources necessary for their well-being and cultural survival. The constitution recognizes the right of indigenous peoples to benefit from natural resource activities on their lands while also protecting those lands from alienation. It further provides that indigenous peoples be allowed to develop their natural resources according to their own usages, customs, and beliefs.

Article 40 of the Indigenous Statute states that the exclusive use and occupation of lands by indigenous communities confers ownership of natural resources on these lands to these communities. However, ownership does not extend to sub-soil resources, such as minerals and petroleum. This law has important implications for REDD projects that involve more than one indigenous group, like the Xingu REDD project described in section seven. Under this law, projects that would involve participation by more than one indigenous group must respect the indigenous people's group decision making regarding the community's ownership of any carbon credits that may be generated by the project.

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[84] do Valle, R.S.T. and Yamada, E.M. 2009. Brasil: Titularidade Indígena sobre Créditos de Carbono gerados por Atividades Florestais em Terras Indígenas. Instituto Socioambiental, www.socioambiental.org.br.

[85] Indigenous and Tribal Peoples Convention, 1989 is an International Labour Organization Convention, also known as ILO-convention 169, or C169. It is the major binding international convention concerning indigenous peoples, and a forerunner of the Declaration on the Rights of Indigenous Peoples.

The Brazilian government generally is not permitted to intervene unilaterally to alter the management of indigenous lands or natural resources, but the government can do so in limited circumstances in the "interest of indigenous peoples."[86] Consequently, under Brazilian law it does not appear to be the government's role to decide on the relevance of reforestation or avoided deforestation projects that may be implemented on indigenous lands. Additionally, Brazilian law does not provide for the government to gain title to benefits generated by these kinds of projects.

Under Brazilian law, indigenous peoples cannot be contractually obligated to refrain from traditional activities (e.g., hunting, fishing, forest clearing to farm, and construction of villages or houses) on their lands. The Brazilian constitution clearly guarantees indigenous peoples the right to perform these kinds of activities freely in their territories. Should any legal contract threaten these indigenous rights, the legal contract or the specific clause(s) that threatens these rights likely would be considered void. According to the Brazilian Constitution, indigenous lands and forest resources are inalienable, and unavailable for third-party use. Consequently, under no circumstances can indigenous lands or resources be offered as security under contractual terms.[87] In terms of the development of future REDD projects in Brazil, this means that indigenous lands or forest resources cannot be offered as security against non-performance.

In August 2010, a series of meetings were held in Brazil to define the role and jurisdiction of FUNAI with regards to forest carbon projects implemented on indigenous lands. One of FUNAI's government functions is to monitor activities in indigenous communities to determine if any activities violate national laws or international agreements ratified by the Brazilian government. If FUNAI identifies a violation, the agency can intervene in community activities via the Public Ministry to cancel contracts threatening the communities and their traditional livelihoods. According to Law 5.371/67 (which created FUNAI), FUNAI also can receive a portion of the benefits that may derive from contracts with indigenous communities to support its governmental role in protecting and supporting these communities. However, the constitutional rights to self determination of indigenous tribes in Brazil with regard to their use of the natural resources in their territories appears to preclude any claim FUNAI or other government agencies might have on the actual carbon credits generated by REDD projects.[87] Nevertheless, FUNAI provides administrative and other support functions for Brazil's indigenous groups and territories, and is an important stakeholder that must be engaged in the development of REDD projects on indigenous lands.

Brazilian law indirectly stipulates that indigenous peoples should be the principal beneficiaries of any indigenous land REDD program in the country because of their rights to use, manage, and benefit from the forests and associated carbon stocks on their lands.[87] The recent legal analyses reviewed by the project team indicate that indigenous communities have the freedom and autonomy to develop REDD projects within their territories and to sign contracts for carbon credit transactions.[87] This interpretation is supported by FUNAI's concept note, although this is not a formal legal document.

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[86] The only exception to this rule is the possibility of mining and hydroelectric use on indigenous lands, both activities foreseen in the constitution.

[87] do Valle, R.S.T. and Yamada, E.M. 2009, op. cit.

However, the autonomy of indigenous communities to enter into such contracts is constrained in several ways. First, no contracts can alter the rights of indigenous communities to their natural resources and their traditional livelihoods. Second, all contracts must be consistent with international conventions ratified by Brazil (e.g., ILO 169 and UNDRIP). Finally, FUNAI and other government agencies responsible for monitoring and controlling illegal activities in the indigenous territories may have rights to receive a portion of the revenues associated with REDD project contracts to compensate the agencies for the costs incurred in exercising these functions on indigenous lands.

Mechanisms to Compensate Indigenous Peoples

Beyond the legal framework described above, scientific evidence demonstrates that indigenous reserves in the Brazilian Amazon have strongly inhibited deforestation historically, and this inhibitory effect is strongest in the indigenous reserves located in the Xingu River basin.[88]

Aside from monetary compensation, there are a variety of other mechanisms that could be used to compensate indigenous communities for the environmental protection services they provide. These mechanisms may include undertaking activities that indigenous peoples themselves might undertake to achieve forest protection, such as surveillance, fire control, planned forest clearing for swidden field preparation and maintenance, and the monitoring of forests across different indigenous lands to prevent displacement of deforestation activities (i.e., "leakage"). These activities would combine the sustainability associated with traditional indigenous maintenance of the forest with the protection of their lands from illegal deforestation by third parties. This approach would help to support indigenous peoples' ways of life and their special relationship to their lands, and prevent interference with their lifestyle and the subdivision of indigenous territories based on externally imposed land use restrictions. Culturally adapted forms of benefit-sharing also can be developed with the indigenous peoples directly involved in a REDD project.

Demarcation of, and respect for, indigenous lands has been shown to be an effective instrument for protecting tropical forests. However, these activities likely are not sufficient on their own to provide long-term protection of the forest. Similarly, REDD projects also may not be sufficient on their own to protect forests, if REDD projects are externally planned and forest protection measures are imposed from outside on indigenous peoples. The project team believes efforts to reduce deforestation are more likely to succeed over the long term if they form part of the long-term vision of the indigenous and local peoples involved. As such, REDD projects are more likely to be successful if they are designed and implemented by indigenous peoples themselves or in conjunction with outside parties, and not simply imposed on them.

It is clear under both Brazilian law and international conventions that indigenous peoples have the right to develop or reject REDD projects, according to their own understanding and interests, and according to specific conditions for recognition of their rights in each country. Therefore, it is important that policies designed to reduce deforestation are consistent with existing protection of indigenous peoples' rights in national and international law, including the fundamental

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[88] Nepstad, D. C., S. Schwartzman, B. Bamberger, M. Santilli, D. G. Ray, P. Schlesinger, P. A. Lefebvre, A. Alencar, E. Prins, G. Fiske, and A. Rolla. 2006. Inhibition of Amazon deforestation and fire by parks and indigenous lands. Conservation Biology 20 (1):65-73.

principles of free, prior and informed consent regarding the use of indigenous territories and resources.

Is Carbon Sequestration an Economic "Good" or "Service"?

In addition to the legal questions surrounding ownership of carbon stored in forests on indigenous lands, there is a related issue that also must be addressed in the development of REDD projects in Brazil.

Under Brazil's federal "Tax on the Circulation of Goods and Services" (ICMS), economic "goods" and "services" are subject to different levels of taxation that can be as high as 17%. The domestic tax treatment for REDD projects depends on whether REDD-based project payments are considered to be compensation for forest carbon stocks per se *(i.e., an economic "good"),* or rather for changes in land use practices and forest protection activities that reduce emissions of forest carbon to the atmosphere (i.e., an *environmental "service"*).

Within the context of the evolving international carbon markets, carbon has been treated as an economic good that can be bought, sold and traded. However, the issue of whether stored forest carbon is an economic good or an environmental service currently is being debated within Brazil and has not been resolved yet.

Section Summary

- Indigenous communities in Brazil enjoy a constitutional right to carry out their traditional livelihoods in their territories with full control over and possession of their natural resources. This right does not extend to sub-soil resources, such as minerals and petroleum.
- Recent analyses of the legal framework for indigenous rights to carbon offset credits that could be generated by REDD-based projects within their territories indicate that these communities have the legal autonomy to sign contracts to engage in REDD and other forest carbon projects. However, this autonomy is constrained by the Brazilian constitution and international conventions to which Brazil is a party that protect the rights of indigenous communities to natural resources and to engage in traditional livelihoods.
- FUNAI, the Brazilian agency charged with supporting, protecting, and monitoring indigenous communities, could require a portion of the benefits from carbon contracts to cover the costs of providing these services. Other government agencies responsible for law enforcement also could demand a portion of the flow of carbon project revenues.
- Indigenous lands and forest resources cannot be used as collateral or security to guarantee performance as part of a REDD project contract.
- The determination whether stored forest carbon is an economic "good" or an environmental "service" has not been resolved yet in Brazil, and may have important implications with regards to the amount of taxes that may be required to be paid associated with offset credits generated by REDD projects.

9
CARBON EMISSION BASELINES FOR THE XINGU

Introduction

One of the key elements of any forest carbon project or program is the determination of the baseline against which emissions reductions or forest carbon enhancements will be measured.[89] In the perfect world, we would know the exact future trajectory of GHG emissions that would occur in the absence of REDD-related interventions. The changes in GHG emissions, either positive or negative, that can be attributed to project-related interventions simply would be measured as the difference between the "baseline" trajectory of emissions without the project, and actual measured emissions that occur following implementation of the project. Unfortunately, no such crystal ball exists. As a result, we must estimate the trajectory of expected future BAU emissions using the best information and modeling approaches available.

The project team approached the task of determining a baseline for a Xingu REDD project that could be implemented in protected areas by applying a few core principles that are common among existing carbon offset standards, such as the VCS. First, the team's approach would need to be rigorous. It would need to stand up to the scrutiny of scientific peer review. Second, it would need to be replicable. It would need to be conducted with sufficient methodological clarity and reliable data that other technical teams could repeat the baseline analysis and come up with identical results. Third, the team felt the baseline should be "conservative." More precisely, the team decided the baseline would be estimated so there would be a low probability that the actual emissions baseline would be lower. Finally, calculation and establishment of the baseline would need to be affordable to implement from a financial perspective.

Causes of Variations in Estimates of Deforestation, Forest Degradation, and Forest Regrowth

The forest transition: Understanding of the processes that determine the rates of deforestation, forest degradation through logging, and forest regrowth or restoration is necessary to develop REDD baselines and reduce potential errors. Over decades and centuries, deforestation and changes in forest cover in nations that have large amounts of tropical forests generally follow a predictable pathway highlighted by initial rapid loss of forest cover, followed by forest stabilization, and subsequent increase in forest cover in what has been referred to as the "forest transition."[90] This forest transition is illustrated in Figure 9-1.

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[89] Angelsen, A. (ed.). "Moving Ahead with Redd: Issues, Options and Implications." 172. Bogor Barat, Indonesia: Center for International Forestry Research, 2008.

[90] Rudel, T. K., O. T. Coomes, E. Moran, F. Achard, A. Angelsen, J. C. Xu, and E. Lambin. "Forest Transitions: Towards a Global Understanding of Land Use Change." Global Environmental Change-Human and Policy Dimensions 15, no. 1 (2005): 23-31.

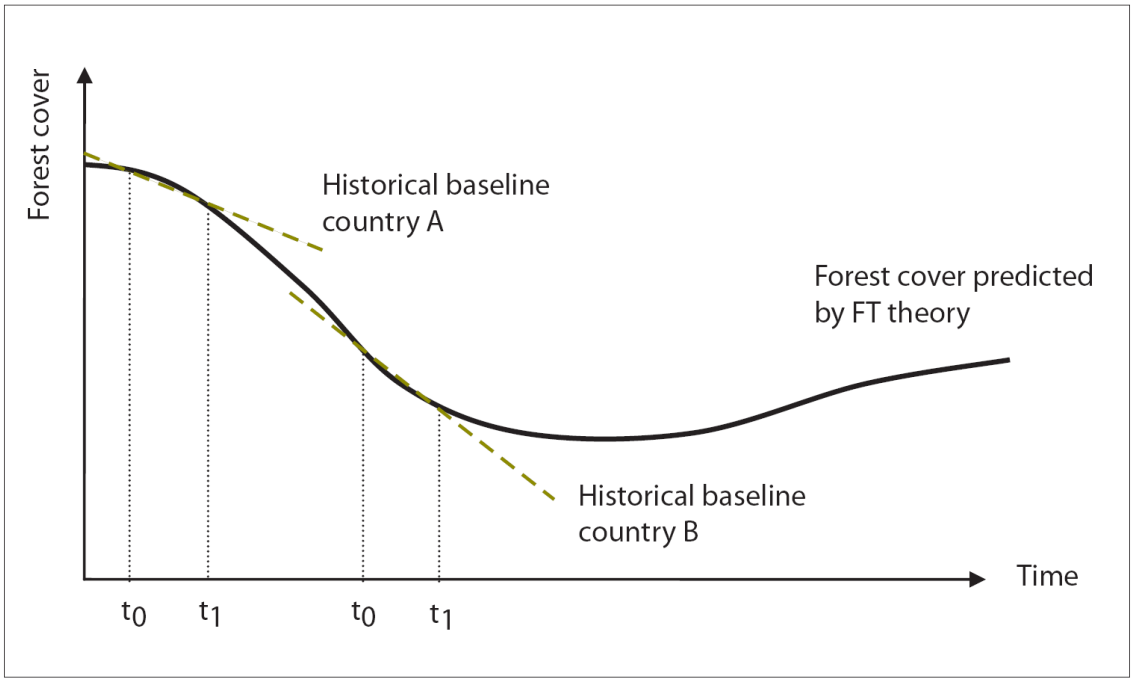

Figure 9-1
Schematic representation of the forest transition curve, and its implications for the selection of reference periods upon which to calculate baselines of historical deforestation. As shown, Country "A" is at the beginning of the forest transition, and is likely to experience increasing deforestation rates in the near future. Country "B" is at the end of the period of the most rapid forest conversion, and probably will undergo a decline in deforestation, even without REDD-based interventions. (Source: Angelsen et al. 2008[91])

Forest cover remains high and stable in a nation so long as the forests are not in the immediate path of the expanding agricultural or timber harvesting frontiers, or as long as war keeps economic enterprises out of the forest. The Democratic Republic of the Congo, Guyana, and the state of Amazonas in Brazil are among the best examples today of regions that are now entering the early phase of the forest transition. As the agricultural frontier expands and moves into a forested region, accompanied by the establishment of transportation infrastructure, electric transmission grids and social services, forest loss can accelerate rapidly as the "boom" phase of frontier expansion is consolidated. The Amazon region of Brazil, Peru, and Bolivia, as well as several islands in Indonesia (e.g., Sumatra and Borneo) now are in this early phase of the forest transition. Over time, forest loss diminishes as the area of forestland available for conversion to agriculture or livestock declines either because of scarcity or because of policy interventions (i.e., the creation of protected areas). The Philippines and India have reached this "bottom" of the forest transition.

The "upside" of the transition represents the period when forest cover increases through regrowth and reforestation on marginal lands that previously were converted to agriculture or livestock use during the boom phase of frontier expansion, through the migration of labor forces

[91] Angelsen, A. (ed.). "Moving Ahead with Redd: Issues, Options and Implications." 172. Bogor Barat, Indonesia: Center for International Forestry Research, 2008, Figure 6-2.

into cities, and through the expansion of forest plantations as national timber and cellulose supplies grow scarce, although many people do not consider monoculture forest plantations to be "forests." REDD can be seen to be a way of building a "bridge" across the low portion of the forest transition curve shown in Figure 9-1.

The Brazilian Amazon: The main challenge for determining a deforestation baseline in the Amazon is that there are many factors that influence GHG emissions from forests, including land clearing for agriculture and ranching, forest thinning through logging and fire, and enhanced forest carbon storage through forest restoration and regeneration. Complicating things further is the fact that all of these factors change over time. Based on previous work completed by key members of the project team, it is clear that food prices, agricultural input prices (e.g., for fertilizer and pesticides), changes in land use regulations, changes in law enforcement, agrarian reform, and the availability of forested land all influence the rate of deforestation and forest degradation and, therefore, baseline GHG emissions.

Forest clearing and degradation rates in the eastern Amazon region vary largely as a function of potential returns on investments. It is expensive to clear forests to establish crop fields and pastures, or to extract and process timber. Expected economic returns for these kinds of investment are equal to the revenues that can be derived from the eventual sale of crops or cattle minus the costs of acquiring and clearing the land and establishing, maintaining, and harvesting crop fields and pastures. Deforestation rates vary as a function of both the prices of soy, beef, and other agricultural products and the prices of inputs to the production system, such as fertilizer, lime, and pesticides. Financial returns on products that are sold into export markets are strongly influenced by currency exchange rates.

The appreciation of land values represents one of the most significant returns on investments in forest conversion to crops or pasture. Pasture formation is the most inexpensive way to demonstrate "productive use" of the land in Brazil, which is the main legal criterion for determining the legitimacy of land claims in remote forest frontiers of the Amazon. In an extreme example, land acquired for $0-100 per hectare can be sold for $1000 per hectare or more a few years later in areas where soil and climate are suitable for soy production, and where roads and storage facilities have been established.

Land speculation and agricultural expansion are responsive to governmental regulations. News of the imminent paving of the BR163 highway across 1,000 km of sparsely populated Amazon forestland, in western Pará state, stimulated a frenzy of deforestation activities as land speculators positioned themselves to stake claims.[92] The frenzy subsided only after the federal government declared most of this region's land off limits to private landholders.[93] The Brazilian national government now has effectively reduced the availability of large areas of forested land

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[92] Nepstad, D. C., D. McGrath, A. Alencar, C. Barros, G. O. Carvalho, M. Santilli, and M. del Carmen Vera Diaz. "Frontier Governance in Amazonia." Science 295 (2002): 629-31.

[93] Campos, M. T., and D. C. Nepstad. "Smallholders, the Amazon's New Conservationists." Conservation Biology 20, no. 5 (2006): 1553-56.

for agriculture and livestock through a 50% increase in the area of indigenous lands, parks, and other types of reserves.[94]

The susceptibility of deforestation to swings in economic circumstances, such as currency exchange rates, and governmental actions, such as a decision to pave a road into largely unoccupied forest regions, varies by agent. In the case of the Brazilian Amazon, the deforesters who most predictably clear forests for conversion to agriculture or pasture are those who depend upon forest clearing and burning for their subsistence. This category includes most smallholder farmers, indigenous groups, and traditional people (e.g., rubber tappers, Brazil nut gatherers). Many of these farmers have very low incomes, and cannot deviate easily from their annual deforestation cycle because of their dependence on swidden agriculture.

Cattle pastures occupy two-thirds of the land that has been cleared of forest, and cattle producers are an important determinant of deforestation rates. The cattle industry has a complex relationship with economic cycles because cattle can serve multiple functions on the agricultural frontier. Extensive cattle operations used, at least in part, to help consolidate land claims[95] and capture the value of rapidly escalating land prices,[96] are responsive to changes that influence land values (e.g., infrastructure development). Consolidated cattle operations, such as those found in much of Mato Grosso, are highly professional, vertically integrated operations that are responsive primarily to beef prices. Smallholders rely on cattle as a versatile investment that provides numerous benefits (e.g., milk, manure, traction), enjoys a consistent local market (beef), and literally can walk to market. Soy farmers are highly responsive to agricultural economic cycles that influence international demand for Brazilian soy, and the costs of producing soy far from ports and fertilizer suppliers in Mato Grosso, the main soy-producing region of Brazil and the Amazon. The inter-relationship between these larger macro-economic trends and deforestation rates is shown in Figure 9-2

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[94] Soares-Filho, B., P. Moutinho, D. Nepstad, A. Anderson, H. Rodrigues, R. Garcia, L. Dietzsch, F. Merry, M. Bowman, L. Hissa, R. Silvestrini, and C. Maretti. "Role of Brazilian Amazon Protected Areas in Climate Change Mitigation." Proceedings of the National Academy of Sciences 107, no. 24 (2010): 10821-26.

[95] Soares-Filho, B., P. Moutinho, D. Nepstad, A. Anderson, H. Rodrigues, R. Garcia, L. Dietzsch, F. Merry, M. Bowman, L. Hissa, R. Silvestrini, and C. Maretti. "Role of Brazilian Amazon Protected Areas in Climate Change Mitigation." Proceedings of the National Academy of Sciences 107, no. 24 (2010): 10821-26.

[96] Hecht, S. B., R. B. Norgaard, and G. Possio. 1988. The economics of cattle ranching in eastern Amazonia. *Interciencia* 13 (5): 233-240.

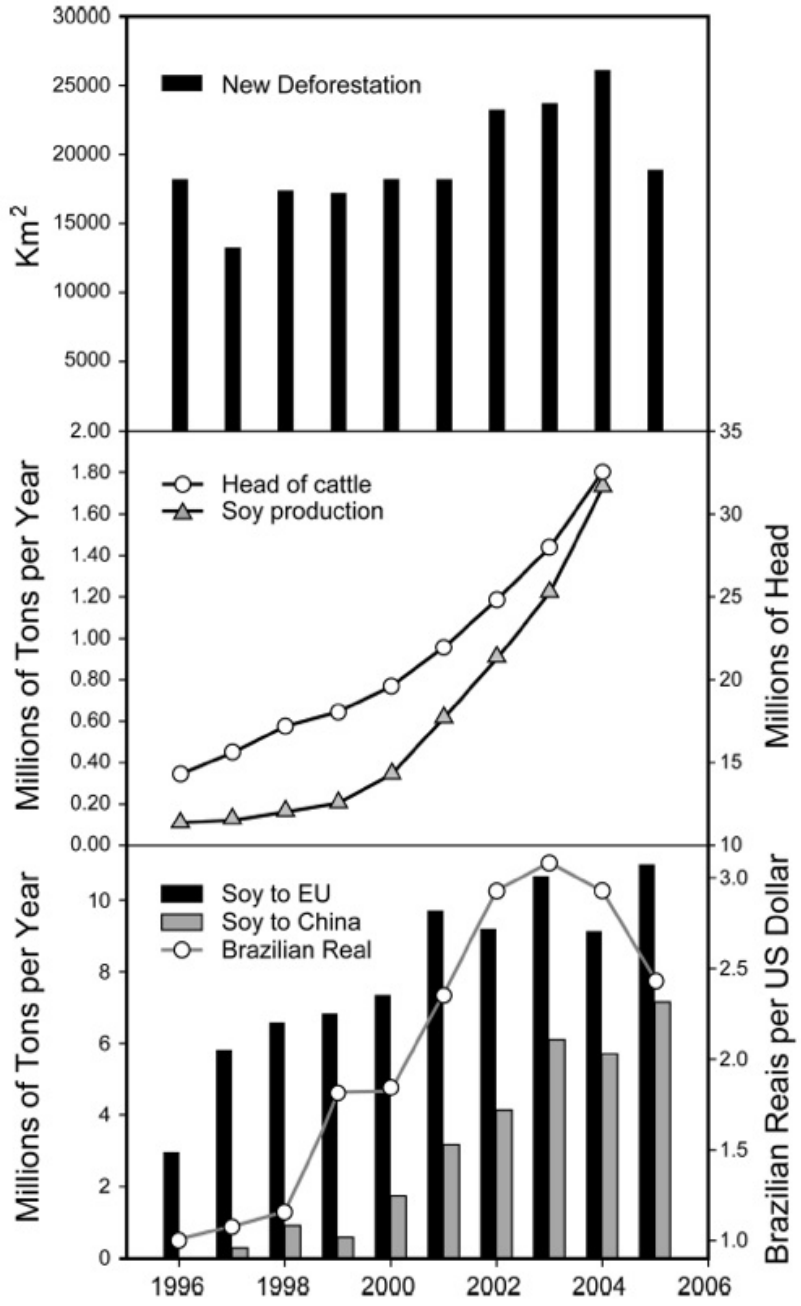

Figure 9-2
Trends in annual Amazon deforestation, the Amazon cattle herd, Amazon soy production, total soy exports from Brazil to the European Union (EU) and China, and the value of the Brazilian Real (in $U.S). A weak Brazilian Real (relative to the dollar) increased demand for Brazilian soy, contributing to the period of greatest deforestation in the Amazon (2002-2004). (Source: Nepstad et al. 2006a[97]).

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[97] Nepstad, D. C., C. M. Stickler, and O. T. Almeida. 2006. Globalization of the Amazon soy and beef industries: opportunities for conservation. Conservation Biology 20 (6):1595-1603.

Different Types of Reference Levels

The concept of the "reference baseline" originally was developed in the CDM program to quantify the amount of offset credits that could be issued for a CDM project under the Kyoto Protocol. A project baseline in the CDM is defined as the scenario that "…reasonably represents the sum of the changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the proposed project activity.[98]" The concept has been modified to fit the specific goals of REDD and REDD+ and is defined as follows[99]:

- For REDD, the **Reference Emissions Level (REL)** is the amount of gross emissions from a geographical area estimated within a reference time period;
- For REDD+, the **Reference Level (RL)** is the amount of net emissions (gross emissions minus removals) from a geographical area estimated within a reference time period.

Further, the REL and RL, can be estimated three ways: (i) historical, (ii) BAU, and (iii) "crediting." The historical reference level reflects the amount of carbon that has been emitted through deforestation and forest degradation (and/or sequestered in the case of REDD+) in the past, averaged over a given time period and carried into the future at the average rate.

The BAU reference level reflects the carbon emissions (and/or sequestration) that are expected to occur in the future, based on a best estimate of rates and patterns of deforestation and degradation (and/or sequestration in the case of REDD+) that are likely to take place in the absence of any REDD intervention. The BAU reference level may simply reflect historic rates and trends of emissions, or may include projections of future change in rates and location of deforestation, degradation, and reforestation in response to a plausible scenario of social, economic, and political change.

The "crediting" reference level is the net level of emissions below which offset credits can be issued to a project, state or nation that achieves the emissions reduction, or above which liabilities are incurred, as shown in Figure 9-3.[100] The crediting baseline is likely to be based on some combination of quantitative estimates derived from the historical and BAU reference levels and political negotiations. In the case of REDD, all three types of reference levels typically are measured or estimated currently – as appropriate – in units of area deforested and/or degraded and then multiplied by a carbon content factor. As direct methods to monitor biomass continuously over large landscape areas improve in the coming years, reference levels are likely to be represented in units CO_2e.

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[98] 5/CMP.1, Annex, paragraph 19.

[99] REDD-UNFCC Expert Meeting on "Methodological Issues relating to Reference Emission Levels", 23-24 March 2009.

[100] Angelsen, A. (ed.). "Moving Ahead with Redd: Issues, Options and Implications." 172. Bogor Barat, Indonesia: Center for International Forestry Research, 2008.

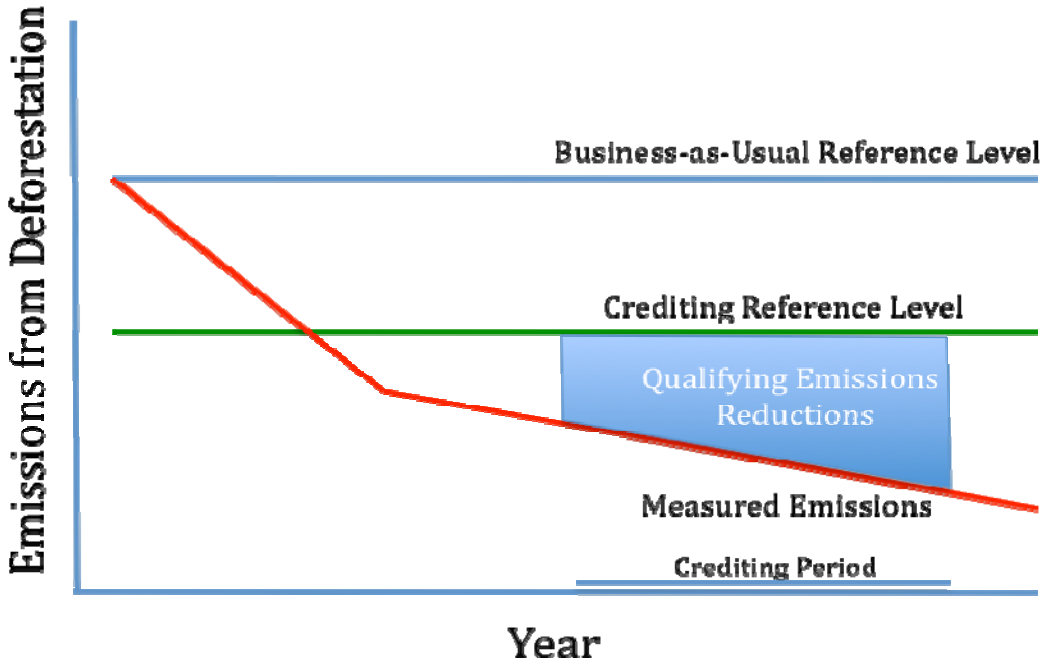

Figure 9-3
The relationship between the BAU reference level, the crediting reference level, and actual emissions. Only the emissions reductions represented in blue would qualify for REDD credits under the current interpretations of "sectoral crediting" mechanisms.

Estimating Reference Levels

Historical reference levels are estimated based on observed measurements of forest clearing and degradation. Because few tropical nations have adequate forest monitoring systems, deriving a historical R(E)L can be a critical challenge. Nevertheless, it is the most common method to establish a reference level. In fact, most approaches used to establish BAU and crediting reference levels in forest carbon projects, state REDD regimes, and national REDD regimes do not attempt to predict future trends in any of the factors that influence deforestation rates, but rather simply extrapolate average historical rate of deforestation or carbon emissions into the future that have been reduced by a formula (crediting reference level).

In the case of Brazil, as shown in Figure 3-1, the national government simply extrapolated the 10-year historical reference level of deforestation for the period 1996-2005 into the future to determine the BAU reference level, then reduced this future projection at five-year intervals by 20% in the first interval and 55% from the historical reference level in second interval to arrive at the crediting reference level for Brazil's National Appropriate Mitigation Action (NAMA), presented at COP15.

This crediting reference level may be subject to international negotiation to determine the amount of emissions reductions that Brazil may be allowed to issue as offsets credits within a future international REDD regime. By offering to substantially reduce its own deforestation, Brazil reduced its crediting reference level voluntarily to less than half of its historical reference

level. (It is important to note that Brazil still opposes market mechanisms to finance REDD, so the concept of "crediting reference level" may not be entirely appropriate to use in the Brazilian context. It also is important to note that under VCS, project proponents are required to revisit a project's BAU or reference level at least once every 10-years.)

A simple linear extrapolation of the historical reference level into the future as a means to estimate BAU or crediting reference levels is vulnerable to several types of errors. First, error is associated with the nation's position on the forest transition curve, illustrated in Figure 9-1, and as a result BAU estimates may either under-estimate future emissions as would be the case for Country A, or over-estimate future emissions as would be the case for Country B. Furthermore, for nations or regions with historically low deforestation rates like Country A, the use of the historical reference level as the crediting reference level would all but prevent low-deforestation nations from participating in future REDD-based programs, even though they may be on the verge of increases in deforestation rates. This is the situation that may face countries like the Democratic Republic of Congo, Guyana and several other tropical nations that have historically very low rates of deforestation.

The second type of error is associated with economic cycles that are longer in time than the reference time interval. This type of error takes place when the historical averaging of variation in annual emissions from deforestation does not include a complete economic cycle.

The third type of error is associated with past or future government which may increase deforestation (e.g., policy changes or other interventions that increase access to remote forest regions or that provide economic incentives to clear forests) or decrease deforestation (e.g., large-scale removal of forests from the land market).

Approach One: Using Historical Deforestation Rates to Calculate a Reference Level for the Xingu Basin

We estimated the BAU reference level for the Xingu River basin indigenous territories and private lands using an ensemble of approaches intended to bracket the range of plausible future deforestation and emission rates. In keeping with the principle of conservatism, the project team estimated the crediting reference level as the lower end of the range of plausible future rates.

Using the first approach, the team relied on data from Brazil's Amazon forest monitoring program (INPE/PRODES 2009) to calculate the average annual rate of forest clearing for the 1997-2008 period for the indigenous territories, the lands that fall outside of indigenous territories, and the private farms and ranches that are part of the "Registry for Socio-Environmental Responsibility" (RSR) in the Xingu River basin. These deforestation rates than were multiplied by published estimates of spatially-explicit (i.e., satellite-derived) aboveground carbon storage.[101] The resulting estimates of the annual flux of carbon to the atmosphere subsequently was corrected by subtracting the average carbon content of the pastures and crop fields that typically replace forests in the Xingu region following deforestation.[83]

Approach one can be summarized mathematically as:

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[101] Saatchi, S., R. A. Houghton, R. C. Dos Santos Alvala, J. B. Soares, and Y. Yu. "Distribution of Aboveground Live Biomass in the Amazon Basin." Global Change Biology 13, no. 4 (2007): 816-37.

Average Annual Carbon Emissions = [(Average Annual Deforestation) x (Average Aboveground Forest Carbon)] – [(Average Annual Deforestation) x (Average Aboveground Carbon Content of Pastures and Crop Fields)]

***Deforestation rates**:* We estimated deforestation rates using the INPE/PRODES dataset (www.inpe.br/prodes). The INPE/PRODES deforestation data has the advantage that it is produced annually using a consistent methodology, in which all individual deforestation polygons are digitized and made available to the public. Once a tract of land falls into a deforestation polygon, it permanently enters a "deforestation" category in a spatially-explicit database that prevents future misclassification of the clearing of secondary forest as deforestation. The INPE/PRODES monitoring system only covers closed-canopy forests, and does not map deforestation in the savannas and woodlands of the Cerrado biome that occupy the southern edge of the Xingu River basin, as shown in Figure 7-1. Consequently, Approach 1 underestimates carbon emissions from deforestation by omitting carbon emissions from Cerrado vegetation. However, only three percent of the indigenous territories and eight percent of the lands outside of indigenous territories are classified as Cerrado vegetation, and the above-ground carbon content of Cerrado vegetation is only one-quarter to one-third that of closed canopy forests. The INPE/PRODES data also do not provide information on secondary forest that has regrown. As a result, approach one is likely to overestimate forest carbon emissions to the extent that regrown secondary forests offset some carbon emissions from deforestation through carbon uptake. Finally, the INPE/PRODES methodology does not detect deforestation on patches of land smaller than 6.25 hectares in area. We assumed the minimum patch size is irrelevant when averaging deforestation over a ten year period, since deforestation tends to take place as contiguous patches that eventually exceed the 6.25-hectare threshold.

***Aboveground carbon**:* The Saatchi et al. (2007) map of aboveground live biomass shown in Figure 9-4 was produced through a combination of remote sensing products (including usage of both optical and radar sensors) and field measurements of forest plots. The project team validated the Saatchi map by measuring aboveground live biomass at three locations, with four one-hectare forest plots per location,[102] and found that Saatchi overestimated forest carbon at these sites by approximately 10-20%, but accurately represented the variation among plots, as shown in Figure 9-5.

[102] Forest plots were 10 x 1000 meters in size. All trees with diameter at breast height of 10 cm or more were inventoried, and smaller trees measured in subplots. The project team estimated aboveground biomass using the allometric equations of Chambers et al. (2001) and an average wood density of 0.69 g cm^{-3}.

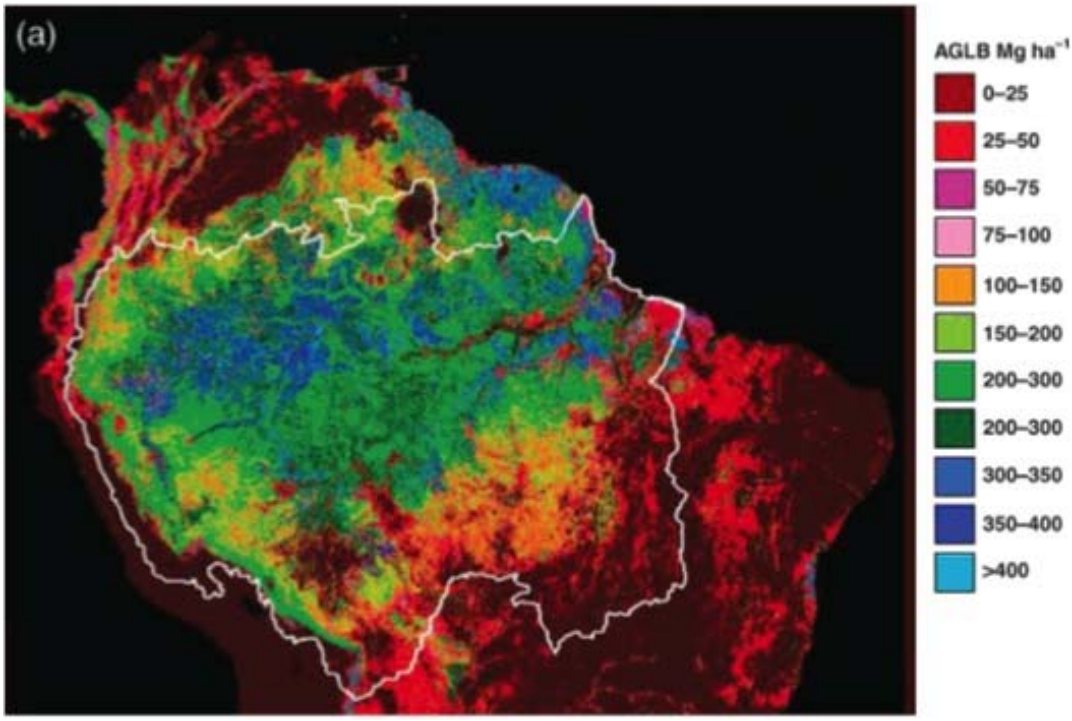

Figure 9-4
Above-ground live biomass of the forests of the Amazon region as estimated by Saatchi et al. (2007) using a combination of optical and radar sensors and field measurements. There is a gradient of increasing above-ground live biomass from the southeast to the northwest associated with a gradient of increasing rainfall.

Results for Baseline Approach One

As of 2008, the Xingu River basin supported 80% forest cover and contained an estimated 4.7 GtC (17.2 $GtCO_2e$) in its aboveground live biomass. In the Xingu River headwaters region, located in Mato Grosso, primary forests still cover 66% of the landscape and contain 1.1 GtC (3.9 $GtCO_2e$) in aboveground live biomass. In the indigenous territories of the Xingu River basin, more than 99% of the primary forest cover is still standing, containing 1.3 GtC (4.9 $GtCO_2e$). Ranches and farms participating in the RSR program are 43% deforested, and contain 39 MtC (143 $MtCO_2e$). These results are shown in Table 9-1.

The Xingu River basin has been deforested at high rates since 1997 that range from 0.8-2.0% of the remaining forest being deforested per year, as shown in Figure 9-6. Within this very dynamic agricultural frontier, the indigenous territories of the Xingu region which occupy nearly one-third of the watershed have been remarkably well defended against incursions by deforesters, with average annual deforestation rates of only 0.03% of the remaining forest.

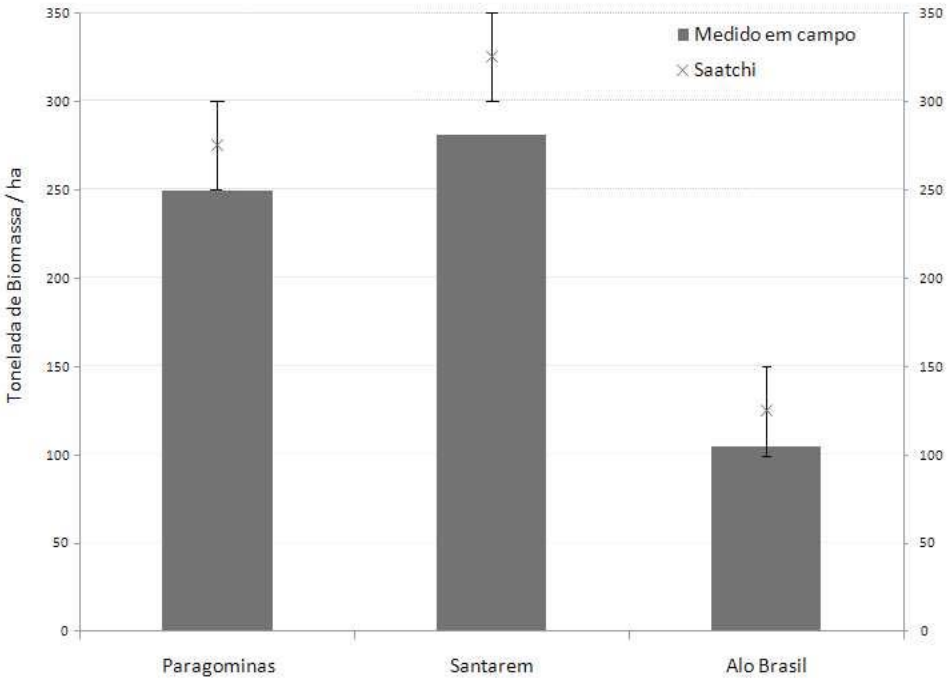

Figure 9-5
Comparison of above-ground live biomass estimated by Saatchi et al. (2007, brackets = 95% confidence interval around average "x"), and estimated using one-hectare forest plots (n=4) at each of three locations in the Amazon.

In contrast, deforestation has been vigorous on private farms and ranches, as exemplified by the properties that participate in the RSR, where annual deforestation ranged from 1-5%. The headwaters region of the Xingu River basin in Mato Grosso supports a very dynamic agricultural frontier with large areas of forestland located on soils suitable for soy production. Here, deforestation rates ranged from 1-3.5% per year, representing 98% of all deforestation in the basin between 1997 and 2008, as shown in Figure 9-6.

Table 9-1
Area, original forest area, forest area remaining in 2008, and forest carbon stocks in the Xingu River basin. Data are presented for the entire Xingu River basin, for the headwater region, for the Indigenous Territories, and for the properties that are participating in the Registry for Socio-Environmental Responsibility (RSR).

	Area ('000 ha)	Original Forest Area ('000 ha)	Forest Area, 2008 ('000 ha)	Percent Deforested	Carbon Stocks (million tC)	CO2eq (million tC)
Xingu River Basin	50,959	44,288	35,613	20%	4,693	17,223
Headwaters (Mato Grosso)	17,731	12,921	8,457	34%	1,071	3,931
Indigenous Lands	13,893	12,362	12,284	0,6%	1,322	4,852
Private Farms and Ranches in Land Registry	822	671	288	57%	39	143

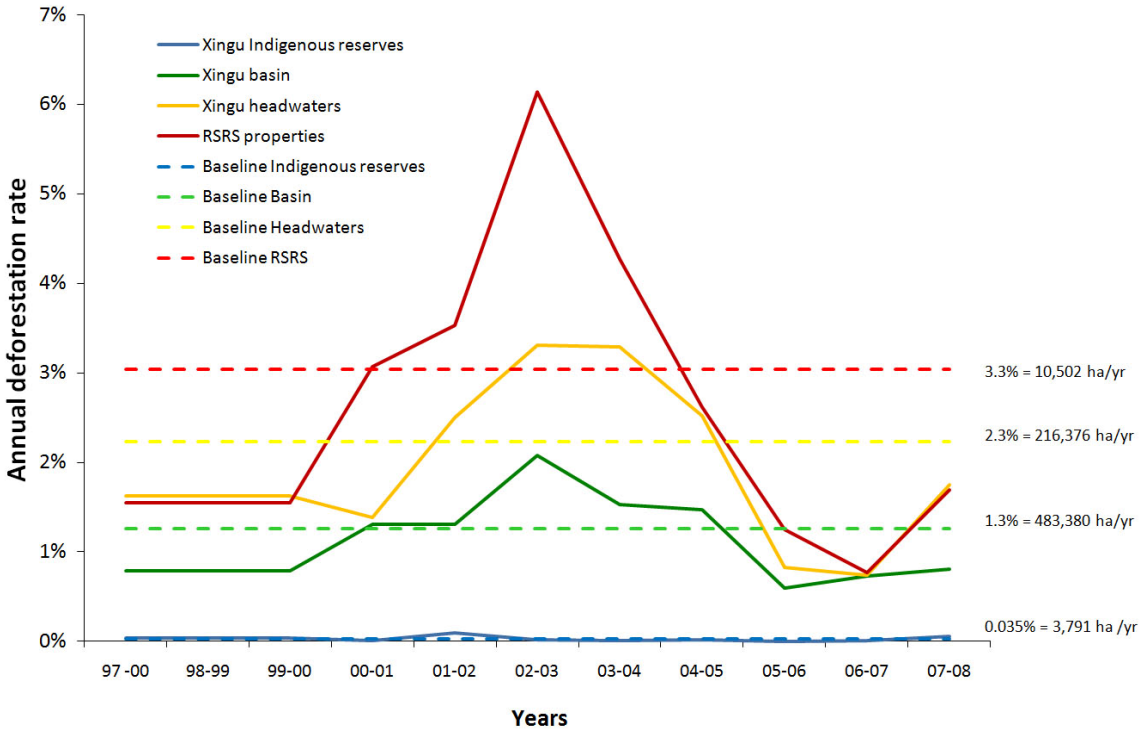

Figure 9-6
Xingu Deforestation. Annual deforestation rate (solid lines, percent of original forest cover that has been deforested) and average deforestation (dashed lines, percent of original forest cover and absolute area) in the entire Xingu River basin (green), the indigenous territories of the Xingu (blue), the Xingu River headwaters region (yellow) and the RSR properties (red).

By extrapolating the average annual rate of forest clearing in the Xingu River basin indigenous territories (3,791 hectares per year) into the future, the project team estimated an additional 85,000 hectares of forest will be cleared by the year 2030, as shown in Figure 9-7. With average aboveground carbon content of 110 metric tons per hectare, and an average carbon content of 10 metric tons per hectare for the pastures and crops that replace cleared forests, the team estimates a net **30 $MtCO_2e$ would be released from the indigenous territories in the Xingu River basin if historical rates continue over the next 20 years.** This represents a lower-bound the emissions that can be avoided on the indigenous lands of the Xingu between 2010-2030.

Approach Two: Using Spatial Simulations to Calculate a Reference Level for the Xingu

***Overview**:* The indigenous territories of the Xingu River basin provide a classic example of the limitations of using extrapolations of historical reference levels to estimate future contribution of indigenous people to forest conservation. Using approach one to generate reference levels for the Xingu indigenous territories would result in a negligible margin for indigenous groups to earn offset credits by reducing deforestation-related carbon emissions below the historical average, and private landholders would be eligible to receive the bulk of potential offset credits by virtue of their comparatively high level of forest clearing in the basin. Clearly, if the Indians who inhabit the Xingu River basin cease their ongoing efforts to defend the perimeters of their lands against incursions, the rates of deforestation would increase rapidly.

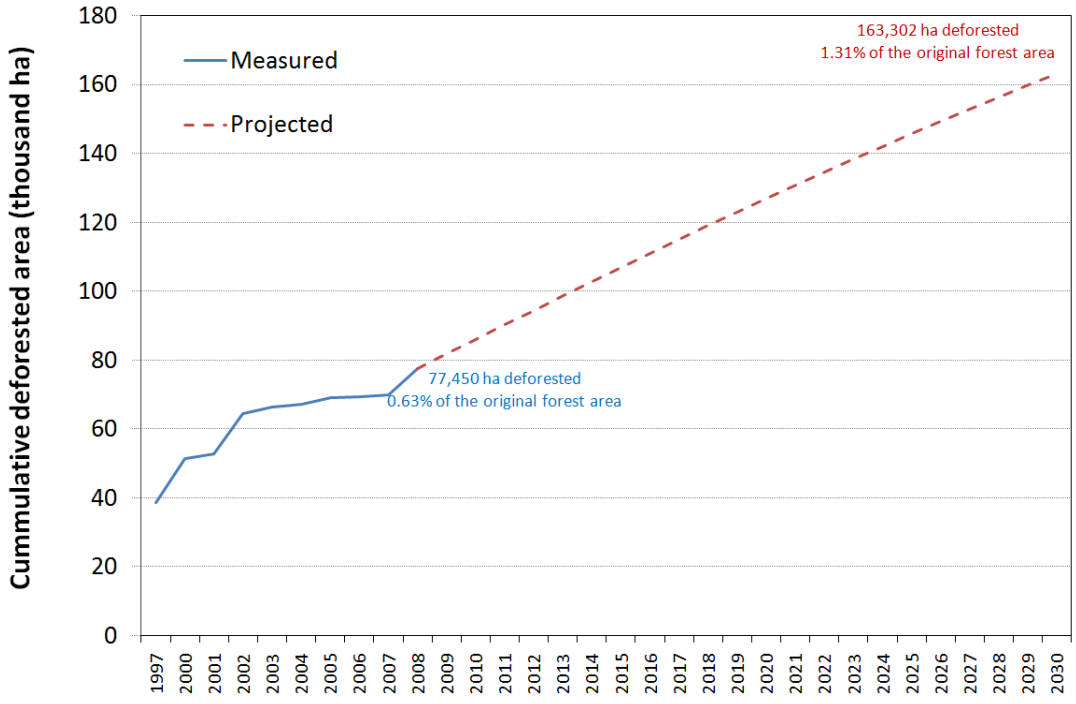

Figure 9-7
Measured historical deforestation and projected future deforestation in indigenous territories of the Xingu River basin. The projected deforestation was shown was developed using the average annual absolute deforestation (3790 hectares) measured from during the period 1997-2008, as shown in Figure 9-6.

The second approach used by the project team to calculate the reference level for the Xingu was done using a sophisticated spatial simulation model that makes it possible to simulate the interaction between deforestation on indigenous lands and private lands, the likely deforestation rate in the absence of ongoing protection against incursions by indigenous communities, and the effect of prevailing land-use policy alternatives on deforestation rates.

The indigenous groups of the Xingu have been extraordinarily successful defending the perimeters of their lands from incursions, but it is not appropriate to assume this success will continue into the future without incentives or other measures to assist them. As the agricultural frontier has expanded around the indigenous territory mosaic, the number of potential points of conflict has increased, taxing the tribes' capacity to monitor and defend their perimeter. As the area of unclaimed forest in the region diminishes, pressures from land seeking ranchers and farmers who want to invade the indigenous territories may increase, particularly since a great deal of the indigenous lands – especially in the Xingu headwaters region – occupies land that is ideally suited for mechanized agriculture, as shown in Figure 9-8. At the same time, there is a powerful campaign underway in Brazil to weaken the existing Forest Code significantly. The Forest Code establishes limits on the amount of each private property that can be converted to agriculture or livestock production. If this effort is successful, it could reduce pressure to clear forests in indigenous territories as clearing increases on private forest lands. However, it also could increase the impunity of the illegal operators who invade indigenous lands to grab land and other natural resources. Recently, in Mato Grosso, the state legislature radically altered the state land-use zoning plan eliminating several indigenous territories.

We incorporated some of these factors into the development of a second set of estimates of future carbon emissions from the indigenous territories of the Xingu River basin. The project team believes this alternate approach to estimating future BAU emissions represents a more realistic assessment of the additionality presented by the continued protection of indigenous territories in the Xingu River basin by their inhabitants than an approach that relies purely on the extrapolation of historical deforestation rates described above. This simulation model made it possible for the project team to address the following important analytic questions:

If the low level of private-land compliance with the Forest Code observed in the Xingu Basin in the past continues into the future, what will deforestation rates on the Xingu indigenous lands be under the following conditions:

1. The inhibitory effect of indigenous lands on deforestation is curtailed for some reason?
2. The BAU deforestation rate is varied based on different historical periods?
3. Indigenous lands, like private lands, are allowed to clear up to 20% of the forests on the lands (calculated at the level of the micro basin)?

The project team estimated future trajectories of deforestation and associated carbon emissions based upon alternative scenarios that assume (i) historical deforestation rates ***in the region as a whole*** continue, and (ii) the spatial pattern of deforestation continues as in the past ***for the region as a whole*** in response to a set of predictor variables that serve as proxies for actual drivers of deforestation. However, because the model simulates the advance of the agricultural frontier over the whole region, it more realistically represents the rates and patterns of deforestation that would occur on different categories of land (e.g., indigenous lands, private lands) in the absence of REDD-related interventions.

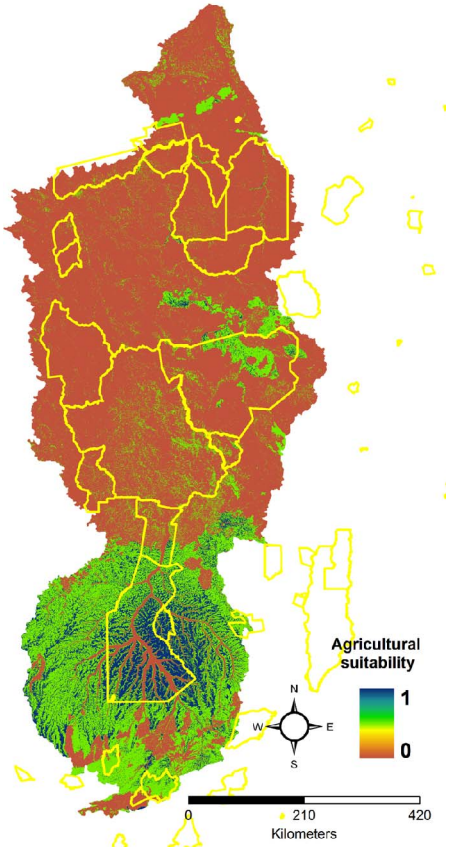

Figure 9-8
Map indicating the level of suitability of lands within the Xingu River basin for mechanized or industrial agriculture, ranging from 0 to 1, where 0 represents lowest suitability and 1 represents highest suitability. The boundaries of indigenous lands are indicated in yellow. Source: Stickler 2009. [71, 103]

The project team modeled six sets of scenarios defined by combinations of two key variables to capture the range of likely BAU trajectories in the Xingu region. These variables are: (i) The Inhibitory Effect of Indigenous Lands (with and without the historical inhibitory effect of indigenous reserves on deforestation); and, (ii) Historical BAU Deforestation Rate (i.e., high, low, and average).

To create different historical BAU rates, the team used historical rates that correspond to the highest and lowest historical rates over the past 15 years, in addition to the average historical rate corresponding to the official Brazilian government reference period 1996-2005. The "high" BAU rate of deforestation corresponds to the period 2002-2004, and represents land cover change under conditions of rapid expansion of mechanized agriculture, favorable currency, and relatively low levels of government intervention to counteract these economic drivers. The "low" BAU rate of deforestation corresponds to the period 2005-2007, and represents land cover change under unfavorable conditions for agricultural expansion and includes effective

[103] Stickler, C. M. "The Economic and Ecological Trade-Offs of Alternative Land-Use Policies on Private Lands Along the Amazon's Agro-Industrial Frontier." University of Florida, 2009.

government interventions to limit forest clearing. These different average rates of annual deforestation are shown in Figure 9-9.

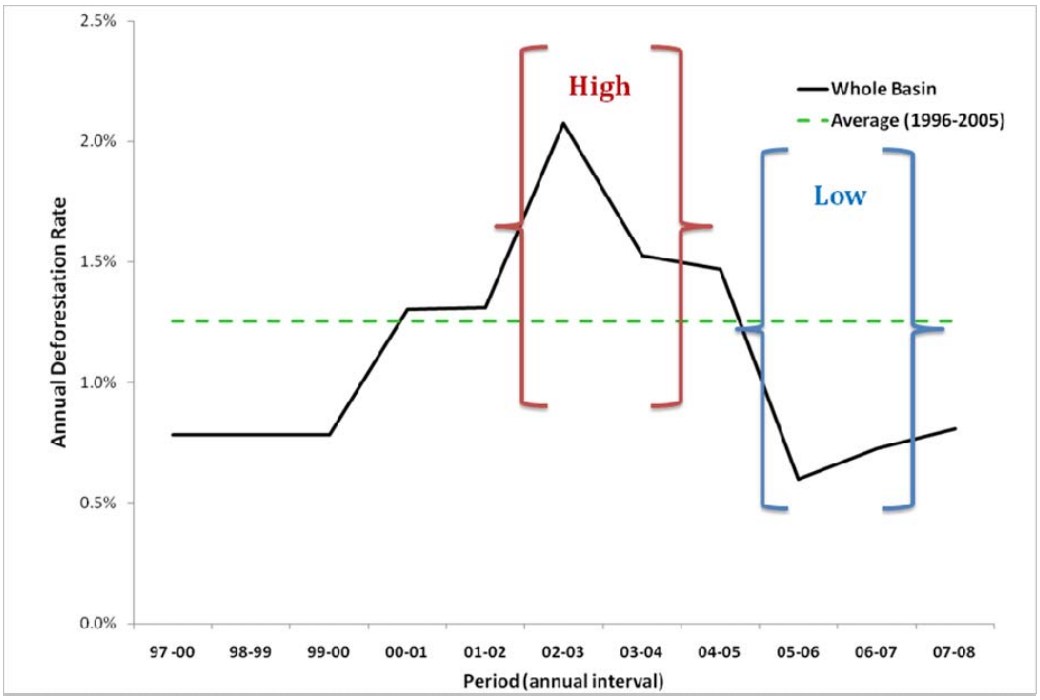

Figure 9-9
Comparison of the observed rate of deforestation between 1997 and 2008, compared with the average rate calculated for the official 1996-2005 reference period, which is the basis of the BAU Average scenario. The reference periods used to calculate the base rates for the BAU High and BAU Low scenarios also are shown.

To conduct these analyses, the project team developed a spatially-explicit simulation model that assigns a probability of deforestation to every 0.2 km x 0.2 km pixel in the Xingu River basin based upon historical correlations between spatial attributes of the landscape (e.g., distance to roads, distance to pastures and agriculture, distance to urban centers, topography, drainage, protected status and agricultural suitability) determined using data from the Xingu River basin.

The simulation model used by the project team to conduct this analysis is the most sophisticated land-use model that WHRC and the Universidade Federal de Minas Gerais have developed to date. An earlier version of this model, published in the journal Nature[104], provided policy-sensitive estimates of future deforestation and associated carbon emissions that have been used to estimate reference levels for the Juma project in the state of Amazonas, Brazil, and the Surui indigenous land project in Rondônia, Brazil. Another model developed by the same institutions provided the reference level estimation for the REDD pilot project in the northwestern portion of Mato Grosso state. The government of Acre is using the same sophisticated modeling system as part of its state-wide REDD program development process.

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[104] Soares-Filho, B. S., D. C. Nepstad, L. M. Curran, G. C. Cerqueira, R. A. Garcia, C. A. Ramos, E. Voll, A. McDonald, P. A. Lefebvre, and P. Schlesinger. 2006. Modeling conservation in the Amazon basin. *Nature* 440 (7083):520-523.

Spatial Simulation Model Development for the Xingu Basin

The dynamic landscape model used for this analysis was developed to simulate future landscape trajectories corresponding to a set of alternative policy proposals. The model is based on spatial-statistical analyses of land-use change derived from a land-use and land-cover change analysis. It uses a Geographical Information System (GIS) consisting of data related to the location and neighborhood context of different land-cover transitions. The model is described in detail in Appendix C.

Each of the scenarios used in the modeling is based on recent, existing and/or proposed legislation, and was compared with a range of BAU simulations that assume no REDD interventions. The basic assumptions underlying each scenario, including the reference scenarios, are as follows:

1. Business as Usual (BAU) scenarios

The BAU scenarios assume the historical rate and pattern of deforestation continues into the future. The project team developed three different BAU scenarios to represent alternative development trajectories with no additional REDD or other governance interventions (e.g., creating or enforcing protected areas on public, indigenous or private lands).

The average BAU scenario uses the average deforestation rate calculated for this region over the 1996-2005 period and applies it over 30 years into the future, beginning in 2008. The reference period corresponds to the same period used to establish crediting levels for the Amazon Fund.[105] For the Amazon Fund, the reference scenario was estimated by extending the average deforestation rate for the 10-year period 1996-2005 calculated as an *absolute* (gross) rate of deforestation into the future. In the analysis presented here, the BAU scenario is more conservative, applying the same annual rate of clearing as a *percentage* (net rate) of the remaining forest; thus, the absolute amount of land cleared each year decreases proportionally with the decrease in total forest cover. This is a more realistic reference scenario for a region like the Xingu River basin, because it has historically high levels of deforestation in the southern and eastern regions, which are unlikely to be sustained at the same absolute level in the future because of the diminishing supply of forestland. Applying a declining rate of deforestation over time with disaggregation of the rate by sub-region in a large river basin characterized by agricultural frontier expansion provides a realistic approximation of how deforestation is likely to proceed in the region as a whole. For the Amazon Fund, the reference scenario was extended only through 2020. In the analysis presented here, however, the simulation extends through 2037 to provide an assessment of how policies aided by carbon offsets to create incentives might protect ecological resources over a longer time horizon.

We also modeled two additional BAU scenarios – BAU High and BAU Low – using higher and lower annual deforestation rates, respectively, than the original BAU. These scenarios use deforestation rates observed in the region for the 2005-2007 and the 2002-2004 periods respectively, to provide a range of reference values that reflect BAU under alternative economic conditions, as shown in Figure 9-9. These are the periods of highest and lowest observed

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[105] Government of Brazil (GOB). Presidential Decree 6.263/2007: National Climate Change Plan. Plano Nacional cobre Mudança do Clima. 2008. [cited. Available from http://www.mma.gov.br/estruturas/smcq_climaticas/_arquivos/plano_nacional_mudanca_clima.pdf.

deforestation rates in the region, and so provide realistic "book ends" for bracketing historic land-cover change patterns into the future.

2. Policy Scenarios

We modeled four scenarios representing the Xingu River basin landscape under alternative existing or proposed federal and state policies that may be enforced or implemented in the future, and may either affect the extent of additionality in the region and/or be the basis for a more politically negotiated crediting reference level.

Scenario 2a – The Forest Code Scenario

The Forest Code scenario represents the future landscape based on the assumption that the current Forest Code is implemented perfectly and enforced. The Forest Code was established as a federal law in 1965. Since 1996, the Forest Code has required private properties located in the forest biome in the Legal Amazon region to maintain 80% of the native vegetation in a permanent legal reserve. Properties in the *Cerrado* biome are required to maintain 35% of the native vegetation in a legal reserve. In those places where less than these amounts of native vegetation are present, the law requires the vegetation to be restored. In addition, vegetation on private property within 50 meters of each stream must be strictly protected or restored if it is absent. Indigenous territories and state and federal protected areas are strictly protected and no clearing of native vegetation is permitted. Compliance with the Forest Code on private lands – particularly in the forest biome – has been low, and efforts to significantly alter the law since the 1996 amendment are ongoing by those who oppose it.

Scenario 2b – The S*tate* Zoning Plan Scenario

The State Zoning Plan scenario assumes the proposed Mato Grosso and Pará state land zoning plans are implemented. Under federal law, zoning plans approved by state legislatures may – among other things – modify application of the Forest Code on private lands to take account of variations in agricultural suitability and environmental vulnerability. Each zoning plan has four major zones, which determine the percent of legal reserve that is required to be protected on properties falling within each zone. In the case presented here, the scenario assumes strict protection of areas falling in any one of three areas described as requiring special attention and protection under the respective state zoning plans.[106] Finally, as in the Forest Code scenario, all riparian areas within 50 meters of streams are strictly protected and reforested, as are indigenous territories and other protected areas. Neither state has approved the plans modeled here, although Pará state has approved the zoning plan for the western portion of the state.

[106] Stickler, C. M. "The Economic and Ecological Trade-Offs of Alternative Land-Use Policies on Private Lands Along the Amazon's Agro-Industrial Frontier." University of Florida, 2009.

Scenario 2c – Crediting Level for Indigenous Lands

In this scenario, each of the policy-based scenarios described above (i.e., 2a, 2b) was modified to permit clearing within indigenous territories of up to 20% of the total area of native vegetation of each of the indigenous lands to represent a crediting reference level for these territories.[107]

Each of the scenarios described above was modeled with the "Inhibitory Effect of Indigenous Lands" present and absent. As a result, the project team modeled a total of six policy-based scenarios, that is, Scenarios 2a, 2b, and 2c, both with and without the inhibitory effect of indigenous lands on deforestation.

Analysis: Once all the spatial simulation modeling was completed, the project extracted data estimating areas of total forest clearing, total remaining native vegetation, area in regeneration or reforestation, and the total carbon balance for each of three regions: (i) The entire Xingu basin; (ii) All indigenous lands in the region; and, (iii) All private lands in the region.

Results of Baseline Analysis Approach Two – Simulation Modeling

Scenario 2a

Scenario 2a – Deforestation in the Xingu River watershed

Annual deforestation rates for the three BAU scenarios (average, high and low) ranged from 440,000-740,000 ha (0.9 -1.4% annual rate of deforestation) in 2008, and decline to 290,000-310,000 hectares (0.6% annual rate of deforestation) by 2037 over the entire Xingu watershed, as shown in Figure 9-10. The variation in simulated deforestation rates associated with inhibition of deforestation by indigenous lands (i.e., with and without this inhibitory effect) was small compared to the variation associated with the three BAU scenarios. This result suggests that **substantial deforestation is predicted to take place on the Xingu indigenous lands even if historical levels of deforestation inhibition by indigenous groups continue into the future**. Below we present the average values for each of the scenarios with and without the "Inhibitory Effect" for each general category.

In absolute terms, total deforestation over the 30 year period under the three BAU scenarios is expected to range from 10.7-14.1 million ha (see Table 9-2 and Figure 9-11), leaving 45-52% of forest cover in the basin intact. Carbon stocks at the end of the period are expected to range from 4.1-4.6 million MtC (14.9-16.9 $MtCO_2e$) as shown in Table 9-2.

In contrast, the scenario that assumes ideal implementation of the current Forest Code is expected to lead to deforestation of only 1.1 million ha, and would leave 70% of the basin with intact native forests and *Cerrado*.

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[107] The idea of allowing 20% deforestation of indigenous territories in the estimation of emissions reference levels originally was proposed by Marcio Santilli of ISA.

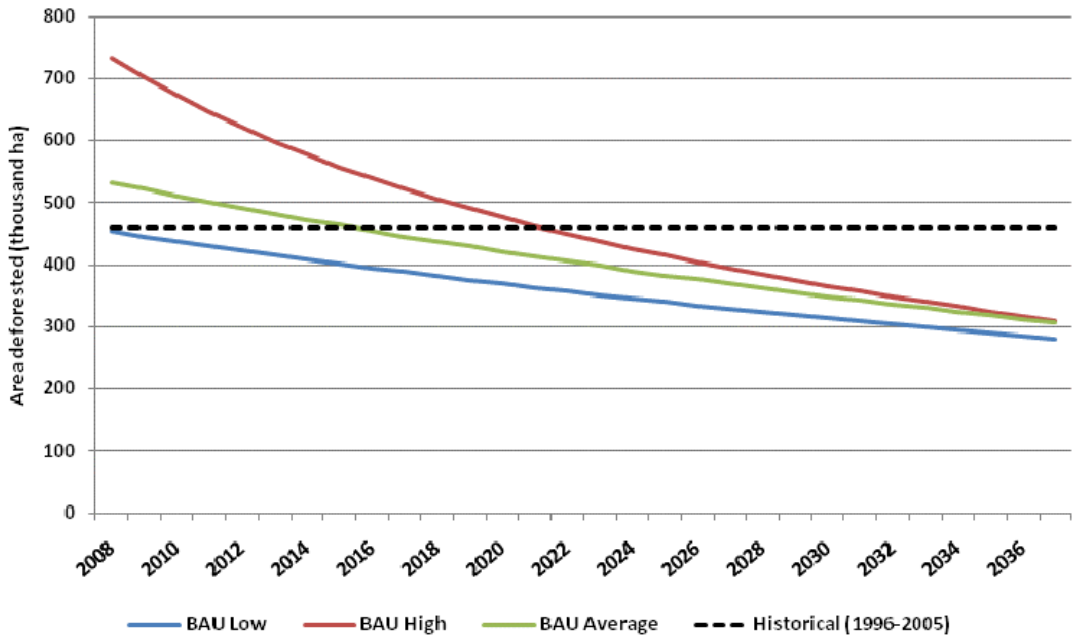

Figure 9-10
Deforestation in the Xingu River basin projected for 2008 through 2037 using high and low periods of deforestation for the 1996-2008 period to estimate BAU deforestation rates.

Implementation of the state zoning plans would lead to removal of only a further 300,000 ha of forest beyond the results for the Forest Code scenario. Carbon stocks contained in the aboveground biomass under the Forest Code and Zoning scenarios were 6 MtC (22 $MtCO_2e$) and 5.9 MtC (21.8 $MtCO_2e$) respectively, as shown in Table 9-2.

The future of the Xingu River basin landscape varies dramatically depending upon the BAU deforestation scenario and the policy assumptions imposed, as shown in Figure 9-11 and Figures 9-12(a-f).

Under future deforestation scenarios that ignore policies to protect forest reserves (e.g., private, public, or indigenous), most of the forests outside of indigenous lands (IL's) and large portions of the IL's themselves are expected to be cleared, as shown in Figure 9-12b.

Full protection of IL's and full implementation of the Forest Code is expected to result in a largely forested watershed, and a greatly reduced area of agricultural and grazing land, as shown in Figure 9-12c and Table 9-2.

Implementation of the state zoning plans with strict protection of indigenous lands is expected to lead to a more forested watershed than the BAU scenarios, but would permit more extensive agricultural lands, as shown in Figure 9-12e. Opening up indigenous territories to 20% forest clearing of each micro basin is expected to foster diffuse deforestation throughout the ILs, as shown in Figures 9-12d and f.

Table 9-2
Modeled estimates of the Xingu River basin land cover, vegetation carbon stocks, and carbon emissions (calculated relative to the current landscape) in year 2037, compared with those in 2008.

Model Scenario	Remaining Forest ('000 ha)	Cleared Land ('000 ha)	Carbon (MtC)	Carbon ($MtCO_2e$)	Carbon Emissions* (MtC)	Carbon Emissions* ($MtCO_2e$)
Initial (2008)	37,024	11,072	6,209	22,787	-	-
BAU Average (2037)	24,775	23,322	4,316	15,841	1,893	6,946
BAU Low (2037)	26,249	21,848	4,595	16,864	1,614	5,923
BAU High (2037)	22,932	25,165	4,062	14,907	2,147	7,880
Forest Code (2037)	35,894	8,214	6,000	22,020	209	767
Zoning Plan (2037)	35,614	9,757	5,943	21,811	266	976

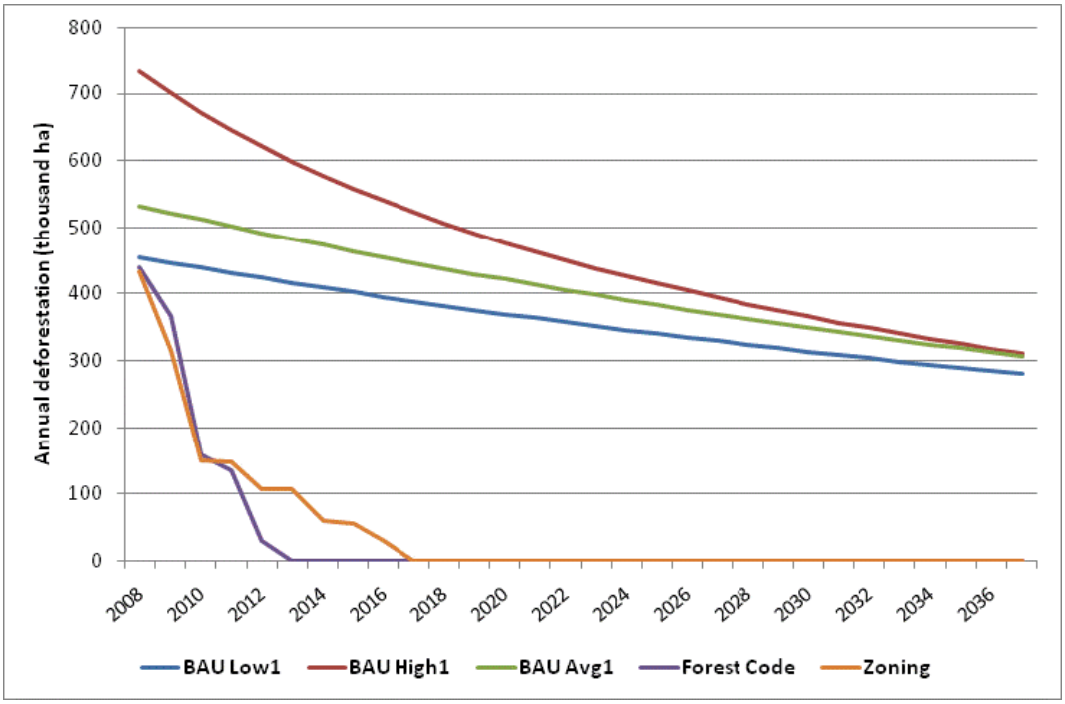

Figure 9-11
Deforestation in the entire Xingu River basin projected for 2008-2037under three BAU scenarios and two alternative policy scenarios.

Scenario 2a – Carbon fluxes from indigenous lands

One way to estimate the contribution of the Xingu indigenous territories to future carbon emissions is to compare the IL vegetation carbon content of the current Xingu landscape

(see Figure 9-12a) with future simulated IL landscapes in which the strong inhibitory effect that these territories exert on deforestation has been removed (see Figure 9-12b) or partially removed (see Figures 9-12d,f). These simulations provide a range of emissions estimates from a low of 1.4 $GtCO_2$ (low BAU estimate of deforestation) to a high of 2.1$GtCO_2$ (high BAU estimate) over the 2008-2037 period (Table 9-3).

If up to 20% of each indigenous territory is made available to be cleared (as is allowed today for private properties in the Amazon), than 1.8 $GtCO_2$ is expected to be released relative to the 2008 landscape by 2037 (Table 9-3). These emissions reductions are 50 to 70 times larger than the estimate based upon a simple extrapolation of historical deforestation rates into the future (see Figures 9-7 and 9-13).

These scenarios result in dramatic changes in deforestation over time within indigenous territories (see Figure 9-12). If the Forest Code is strictly enforced outside of IL's and the total area of forest clearing each year is held constant, than allowing indigenous territories to clear up to 20% of their lands would stimulate a pulse of deforestation that would end abruptly as the available forest becomes depleted (see Figures 9-12d, f and Figure 9-14).

Table 9-3
Modeled estimates of the *Xingu indigenous territory* land cover, vegetation carbon stocks, and carbon emissions (calculated relative to the current landscape) in year 2037.

Scenario	Remaining Forest ('000 ha)	Cleared Land ('000 ha)	Carbon Stocks (MtC)	Carbon Stocks ($MtCO_2e$)	Changes in Carbon Stocks (versus "Strict Protection") ($MtCO_2e$)
Initial Landscape (2008) (Figure 9-9a)	18,234	365	3,037	11,147	-
BAU Average (2037) (Figure 9-9b)	15,166	3,433	2,574	9,447	1,691
BAU Low (2037)	15,493	3,106	2,641	9,691	1,447
BAU High (2037)	14,314	4,284	2,449	8,988	2,150
Strict Protection (2037)	18,234	351	3,035	11,138	-
Allow 20% Deforestation in IL's (Figure 9-9d)	15,014	3,559	2,532	9,291	1,847

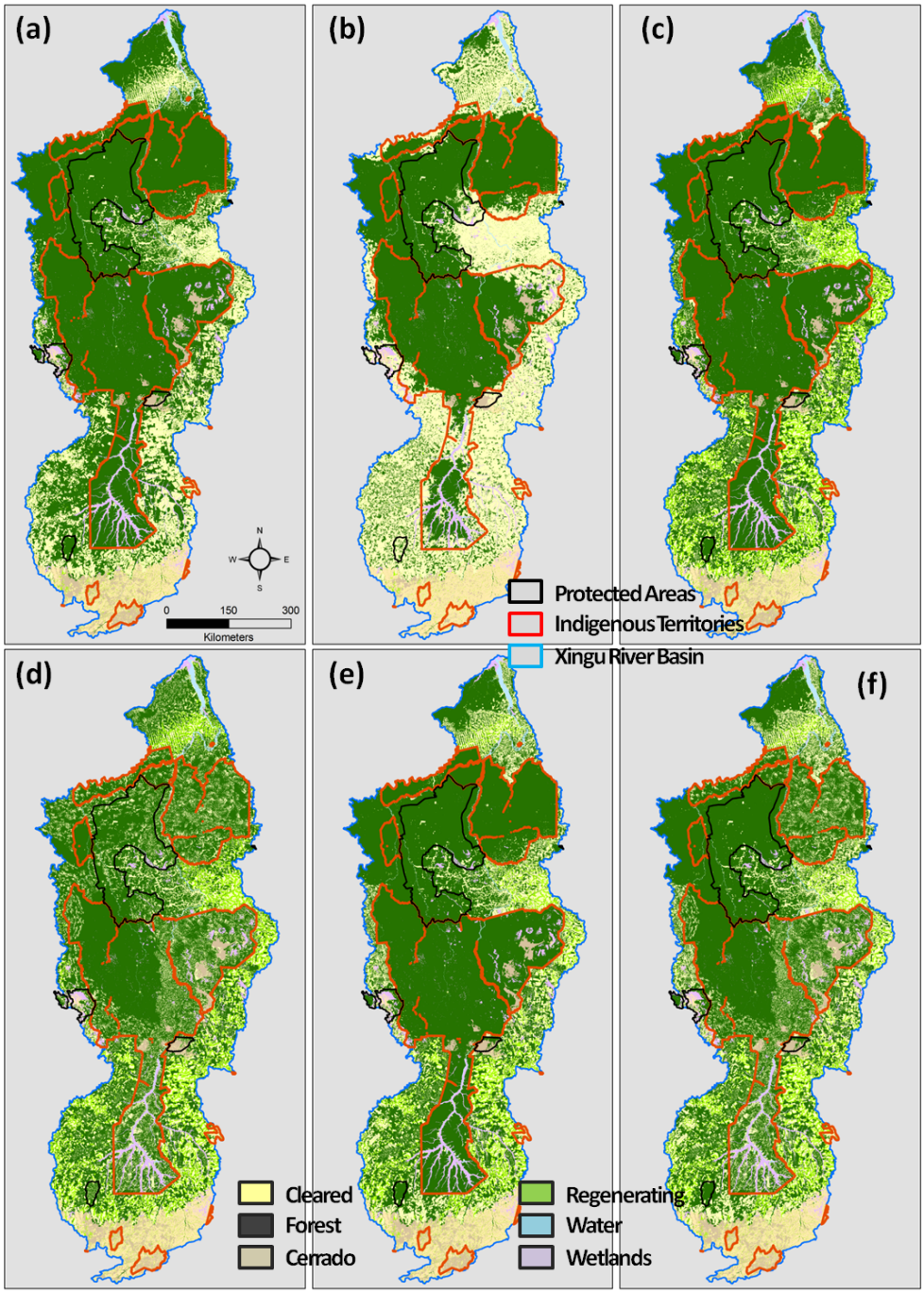

Figure 9-12
The Xingu River basin landscape in 2008 (a) and simulated for 2037 under a range of deforestation and policy assumptions (b-f). The scenarios illustrated here include: (b) BAU (average) with no compliance with Forest Code; (c) Strict enforcement of Forest Code on private lands and strict protection (zero deforestation) on indigenous territories; (d) Strict enforcement of Forest Code and up to 20% of indigenous territories open to clearing; (e) State zoning plan fully implemented with strict protection of indigenous territories; and (f) State zoning plan fully implemented with up to 20% of indigenous territories open to clearing.

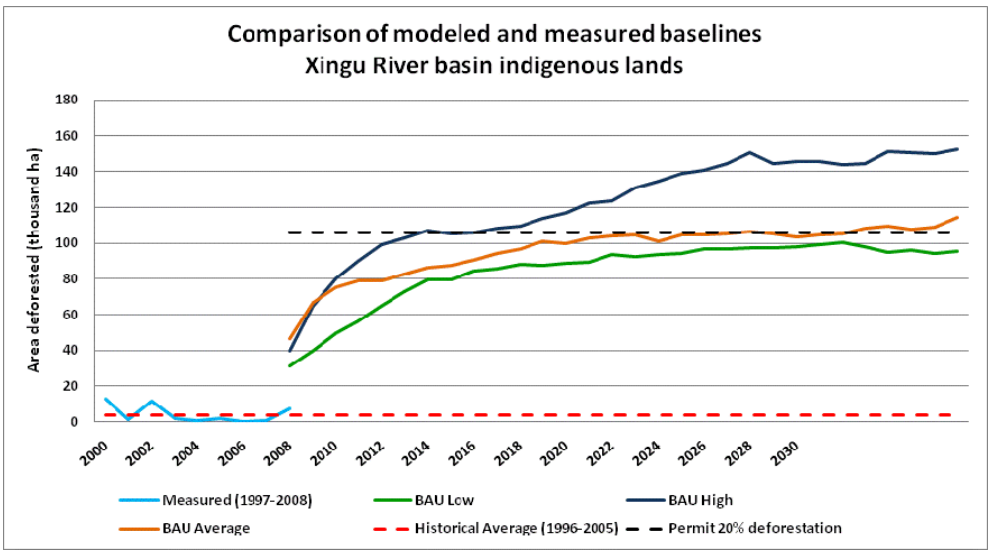

Figure 9-13
Deforestation on indigenous lands in the Xingu River basin projected for 2008-2037 under three BAU scenarios. Average annual deforestation for a scenario permitting 20% of indigenous lands to be deforested over the 2008-2037 time period also is shown. The measured deforestation for the 2000-2008 period, and the historical average rate corresponding to the official Brazilian reference period 1996-200) extrapolated over the same period is shown for comparison.

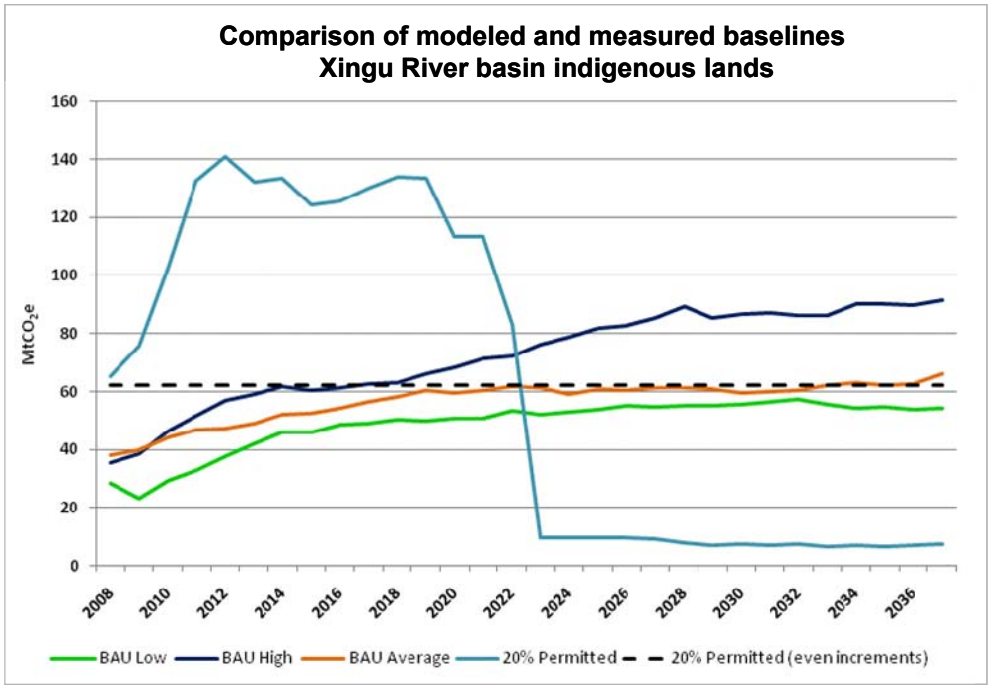

Figure 9-14
Trajectory of carbon emissions from the indigenous territories of the Xingu River basin under a range of BAU deforestation scenarios, and one that allows 20% clearing of each territory (aqua). (The black dashed line represents the 20% scenario spread evenly throughout the time period.)

Scenario 2b

Scenario 2b – Carbon fluxes from private lands

Historically, private lands in the Xingu River basin have been responsible for approximately 98% of deforestation in the region and a similar proportion of carbon emissions, despite representing only about 40% of the total land area. Under the BAU scenarios, these lands would continue to be responsible for a similar percentage of emissions from the landscape, as shown in Figure 9-15. However, by stratifying emissions by land tenure type and excluding possible expansion of private lands into unprotected indigenous lands (as projected under the BAU scenarios), private lands would account for only 50-60% of estimated emissions from the entire region, ranging from 3-4 MtC (5-8 $MtCO_2e$) as their baseline (Table 9-3). However, under either the Forest Code or state Zoning Plan scenarios, these emissions would be cut by 0.6-0.9 MtC (2.2-3.3 $MtCO_2e$) compared to the BAU scenarios, and would represent emissions of 0.2-0.3 MtC (0.7-1 $MtCO_2e$) relative to the current (initial) landscape.

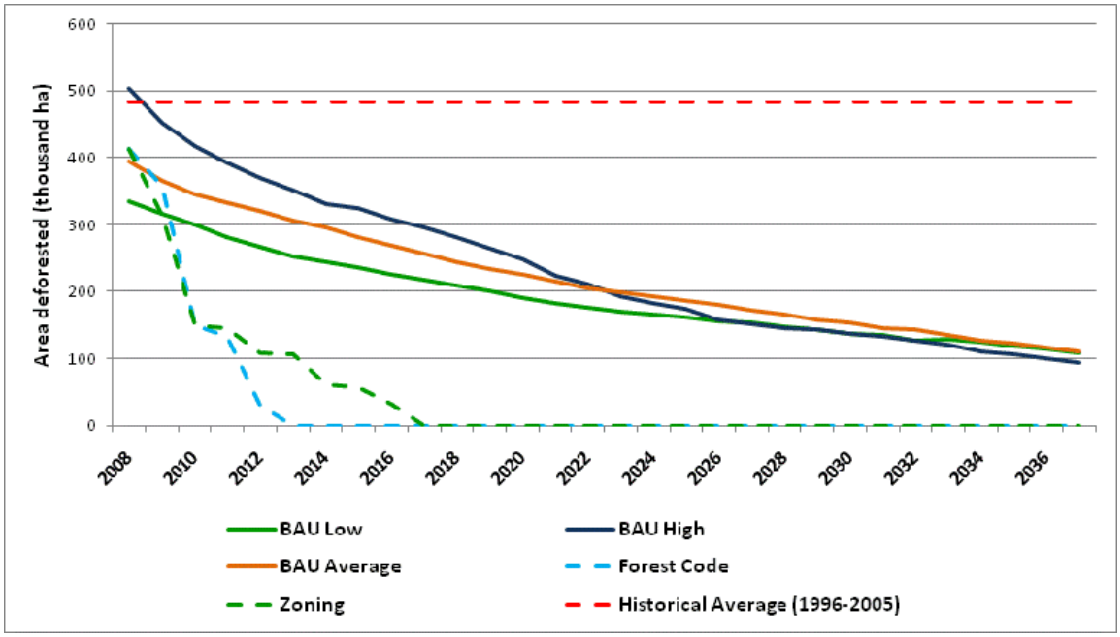

Figure 9-15
Deforestation on private lands in the Xingu River basin projected for 2008-2037 under three BAU scenarios and two alternative policy scenarios. For comparison, the historical average rate corresponding to the official Brazilian reference period 1996-2005 extrapolated for this period is shown.

Potential Offset Credits from REDD-based Emissions Reductions

Conventional approaches to defining the baseline for the Xingu indigenous territories indicate that BAU carbon emissions over the next 20 years cumulatively would total approximately 30 $MtCO_2e$. Using this approach, the phenomenal effectiveness of these territories – and the tribes that inhabit them – to stop deforestation are assumed to continue unaltered into the future, even though the pressures for others to invade these territories is mounting.

In the absence of the indigenous lands and their forest-defending inhabitants, carbon emissions from the indigenous lands are expected to exceed a total of 1.4 $GtCO_2e$ by 2037, 30 -50 times higher than the total under a BAU reference level estimated using the conventional approach that relies on extrapolation of the average historical rate of deforestation, as shown in Table 9-5.

Emissions from forests outside of the IL's are even more responsive to policy and BAU scenarios. A similar level of BAU emissions is estimated when it is assumed that forest clearing on indigenous lands is not allowed to exceed 20% of a given micro basin, which is the regulatory standard that applies to private lands. Based on this assumption, a total of 1,150-1,600 $MtCO_2e$ is estimated to be emitted from the Xingu indigenous lands by 2030 (Table 9-5).

Table 9-4
Modeled estimates of the land cover, vegetation carbon stocks, and carbon emissions (calculated relative to the current landscape) in year 2037 on private lands in the Xingu River basin.

Scenario	Remaining Forest ('000 ha)	Cleared Land ('000 ha)	Carbon Stocks (MtC)	Carbon Stocks ($MtCO_2e$)	Changes in Carbon Stocks (versus "Strict Protection") ($MtCO_2e$)
Initial Landscape (2008) (Figure 9-9a)	18,234	365	3,037	11,147	-
BAU Average (2037) (Figure 9-9b)	15,166	3,433	2,574	9,447	1,691
BAU Low (2037)	15,493	3,106	2,641	9,691	1,447
BAU High (2037)	14,314	4,284	2,449	8,988	2,150
Strict Protection (2037)	18,234	351	3,035	11,138	-
Allow 20% Deforestation in IL's (Figure 9-9d)	15,014	3,559	2,532	9,291	1,847

Scenario 2c – Carbon emissions reductions

One advantage of spatial modeling is that it permits the analysis of deforestation in an integrated manner which includes the spatial interactions among deforesters and forest defenders. The project team compared vegetation carbon stocks estimated for 2037 under a range of BAU and policy scenarios to examine the spectrum of possible GHG emissions that could be anticipated from the entire Xingu River basin as shown in Table 9-4, and how these emissions are likely to vary across time, as shown in Figure 9-16. The deepest reduction in future emissions (7.1 $GtCO_2e$) is achieved if the current Forest Code is fully implemented and the future deforestation BAU baseline assumes the high range of estimates (Table 9-4, Figure 9-16).

The project team believes a reasonable crediting reference level for the Xingu basin could fall between the projected historical rate (30 $MtCO_2e$ by 2030) and the scenario of simulated deforestation using a low historical BAU and a 20% cap on forest clearing for individual micro basins (1,150 $MtCO_2e$, Table 9-5). The team believes that historical deforestation in the Xingu indigenous reserve will be difficult to suppress in the future given the growing scarcity of forestland available to be converted to soy and cattle production. A conservative estimate of the

possible surge in deforestation that could take place is provided by applying the lowest historical rate of deforestation to a modeling scenario in which indigenous lands are allowed to clear as much land as neighboring private landowners.

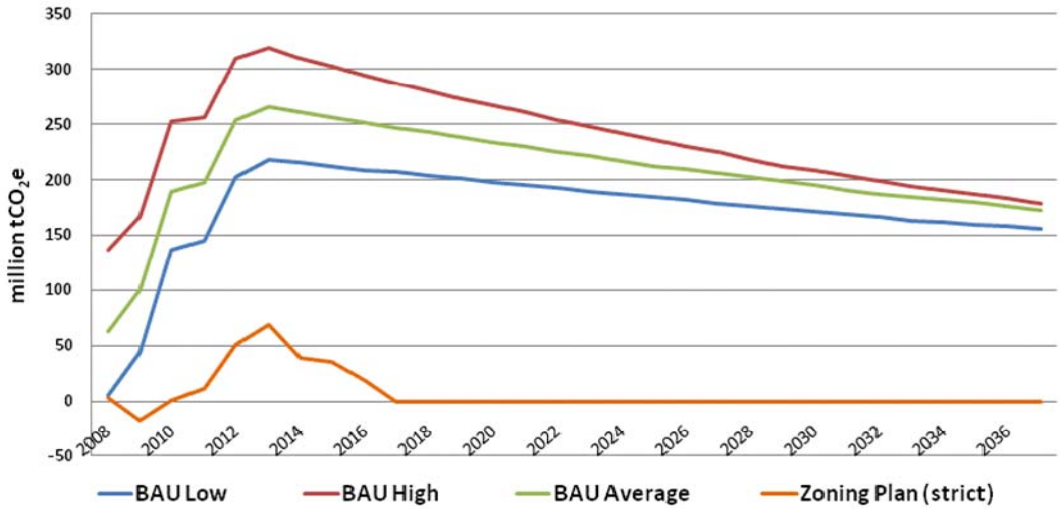

Figure 9-16
Modeled estimates of avoided emissions fro vegetation carbon stocks for the entire Xingu River basin under implementation of the Forest Code, relative to three BAU projections and one policy scenario in annual increments.

Table 9-5
Modeled estimates of avoided emissions from vegetation carbon stocks for the entire Xingu River basin under three BAU projections and two policy scenarios as baselines in 2037. (These values were calculated as the difference between total aboveground vegetation carbon stocks for each scenario comparison.)

	Cumulative Avoided Emissions 2008-2037 ($MtCO_2e$)				
	BAU Average	BAU Low	BAU High	Forest Code (strict)	Zoning Plan (strict)
Forest Code (strict) (2037)	5,970	5,156	7,113	-	209
State Zoning Plan (strict) (2037)	5,970	4,947	6,904	-209	-

The analyses presented here by the project team are designed to provide the basis for an informed, nuanced discussion and definition of a Xingu REDD reference level. For the purposes of illustration, these analyses are focused on indigenous and private lands in the Xingu basin. With the shift towards development of a nested REDD policy architecture in Brazil, the project team believes it is likely there will be a sectoral allocation of REDD benefits made to indigenous lands that constrains the number of REDD-based offset credits that eventually can flow to specific indigenous lands or mosaics both across the Amazon region and within each state. The presentation of a range of baseline options with analytic assessments of the degree to which they

might be acceptable in both voluntary and compliance carbon markets is critical to supporting these decision-making processes, which ultimately will have strong impact on the availability of REDD-based offsets.

Table 9-6
Comparison of estimated emissions and carbon credit potential for indigenous lands in the Xingu River basin from 2008 to 2030.

Metrics	Baseline Approach 1 Historical Average	Baseline Approach 2 Model Simulation
Additional forest clearing ('000 ha) (2030)	85	1,857 – 2,618
Estimated emissions (MtC) (2030)	8.2	292 - 420
Estimated emissions ($MtCO_2e$) (2030)	30	1,070 – 1,539
Average tons C per ha (corrected)	96.5	157 - 160
Avoided emissions (MtC) (if deforestation declines to zero)	8.2	289 - 417
Avoided emissions ($MtCO_2e$) (if deforestation declines to zero)	30	1,061 – 1,530
Avoided emissions 2030 (MtC) (restrict clearing to max. of 20% deforestation in IL's)	377	312 - 441
Avoided emissions 2030 ($MtCO_2e$) (restrict clearing to max of 20% deforestation in IL's)	1,383	1,146 – 1,615

Section Summary

- REDD-based offsets are likely to be determined as the difference between measured emissions and a crediting reference level over a specific crediting period. If the crediting reference level is lower than the BAU baseline (which is likely as part of the international evolution of sectoral emissions reduction programs), then deforestation and associated reductions in emissions can decline without yielding any offset credits if the crediting baseline is not surpassed. An accurate assessment of the crediting reference level is an important aspect of REDD project design.
- The most commonly-used method to estimate a crediting reference level is to project historical emissions levels (or deforestation rates) into the future. The average annual rate of deforestation within the Xingu River indigenous lands during the 1996-2005 period was 3,800 hectares per year. If this rate is extended into the future, then 30 $MtCO_2e$ is expected to be emitted from Xingu indigenous lands by 2030.
- The growing scarcity of forest land available to be converted to soy and cattle pasture could increase the pressure to convert forests of the Xingu indigenous lands. This situation will increase the likelihood that deforestation will expand beyond the 1.3% of the Xingu area expected to be deforested in the Xingu predicted based on historic patterns of land-use.
- The project team developed a policy-sensitive, spatially-explicit, deforestation model for the entire Xingu River basin to develop rigorous projections of the potential changes in deforestation in the Xingu indigenous lands that could take place if agricultural and livestock

expansion invade these territories and are no longer restricted to private lands outside of these lands. The simulations were conducted using a sophisticated computer simulation model that represents the Xingu's historic relationships between deforestation and predictors of deforestation (e.g., distance to roads, clearings, cities, plus soils and other factors). The model also is designed to simulate prevalent existing land-use policies (e.g., the Forest Code) and those under discussion (e.g., land-use zoning), but have not yet been implemented. Simulations were run using three scenarios of absolute deforestation rates into the future based upon measured deforestation during historical periods of high and low clearing.

- Based on historical rates of forest clearing measured within Xingu indigenous territories, only 30 $MtCO_2e$ is expected be released to the atmosphere cumulatively by 2030 under BAU, providing a lower-bound estimate of the volume of emissions reductions from the Xingu indigenous lands.
- If a maximum of 20% of indigenous lands in the Xingu basin are allowed to be cleared in the future as is the case on private forest lands, than 1.15 $GtCO_2e$ of emissions are predicted from the Xingu indigenous territories. This estimate changes little if the inhibitory effect of indigenous lands is removed, or if deforestation within indigenous lands is capped at 20% of a given microbasin.
- The biggest differences in the amount of simulated future deforestation on indigenous lands are associated with the historical deforestation rate used to extrapolate into the future. This assumption plays a far greater role in estimating future levels of deforestation in the region than the level of inhibition exerted by the indigenous reserves on deforestation.
- Conventional approaches to defining baselines for the Xingu indigenous territories indicate that BAU carbon emissions over the next 20 years is expected to total cumulatively approximately 30 $MtCO_2e$. Using this approach, the phenomenal effectiveness of these territories – and the tribes that inhabit them – are assumed to continue unaltered into the future regardless of the increasing pressure to invade these territories.
- The project team believes a reasonable crediting reference level could fall between the amount of projected emissions based on the historical rate of deforestation (i.e., 30 $MtCO_2e$ by 2030) and a scenario of simulated deforestation based on a low historical BAU and a 20% cap on forest clearing for individual micro basins. This latter approach could yield emissions reductions up to 1.15 $GtCO_2e$ cumulatively over the same period.

10
POTENTIAL NEXT STEPS – PHASE II PROJECT

Today there remains to be a great deal of capacity-building and related work to be done to lay the foundation for the development of large-scale REDD-based actions in Brazil and around the world. A potential second phase of this EPRI supplemental project could include tasks and analyses that would help to surmount important conceptual and analytical hurdles in the development of the Brazilian REDD regime. The project team anticipates these phase two activities would provide important insights and innovations that could help to inform the rapidly-evolving REDD regime in Brazil and in other countries, and help to realize the potential of REDD to lower GHG emissions, conserve tropical forests, and defend forest-dwelling peoples. This kind of phase two project could help to increase the likelihood that Brazil will be able to offer substantial volumes of REDD-based offsets for sale to regulated entities in the future and the speed with which these offsets may be able to come to market and be transacted.

The EPRI project summarized in this report has led to a number of REDD innovations that now are being absorbed by the REDD policy process in Brazil and more broadly. Some of project results described here already are being incorporated into REDD legislation under consideration at both the federal and state levels (i.e., Mato Grosso, Acre) levels in Brazil. The project team anticipates a similar level of "policy uptake" in the policy process of any work completed as part of a phase two Xingu avoided deforestation project.

Three inter-related analyses could help Brazil, and other nations watching the Brazilian experience, bring to fruition a multi-scale REDD regime that is sufficiently flexible to interact with at least three flows of funding into REDD. These analyses include:

1. A comparison of evolving state- and province-level approaches to REDD system design within the Governors' Climate and Forest task force;
2. Further design of an integrated and operational land planning and carbon registry that would operate across project, state and national scales; and,
3. Development of early action financial structures that could make it possible for private-sector investors to invest in near-term REDD-based activities in exchange for access to future REDD-based offset credits.

The project team believes the path to creating compliance-grade REDD offsets from any future Xingu REDD initiative is via development of a nested sectoral REDD architecture that would allow private investors to acquire a portion of REDD certificates that may be allocated to various programs of each state in Brazil (e.g., Mato Grosso, Pará) and potentially indigenous territories within the federal REDD framework.

While it may be possible in the future to develop a collaborative REDD project with the indigenous tribes that inhabit the Xingu River basin, the indigenous peoples of the region have not reached any consensus on their interest in moving forward to design and implement either stand-alone REDD projects or projects that are designed to be nested within the broader REDD policy architecture evolving today in Brazil.

11
KEY INSIGHTS

Broadly speaking, there is substantial policy and market uncertainty surrounding development of a coherent and comprehensive approach to climate change. COP15 in Copenhagen simply did not deliver a binding and operational international agreement to mitigate climate change. Despite the uncertainty in the overall UNFCCC negotiation process, REDD+ continues to progress and to attract significant interest and funding. In response, several developing nations have initiated legal reform processes, stakeholder engagement activities, and pilot processes to map and monitor their forests so they will be prepared to implement a future REDD+ policy regime.

Within the U.S. and in California, substantial opposition and roadblocks remain to implementing GHG emissions cap-and-trade programs that would create a market demand for international offsets such as REDD, but the legislative and regulatory processes continue to progress and to provide some level of support for REDD.

Many nations have a high level of interest and enthusiasm for REDD+. This interest is best exemplified by the substantial pledges made by developed nations, including the U.S., to support REDD capacity building efforts in the near term. In all areas of REDD design and implementation, the drive to move to large-scale implementation continues to grow. In Brazil and Indonesia, state- and province-level REDD programs and large-scale REDD projects nested within government programs are crucial to implement in the next two to three years. States and provinces actively are engaging with their federal counterparts on linking their programs as part of the development of national REDD strategies. Policy and financial architectures that can drive private sector investment to support reducing deforestation at multiple scales have not yet been created, but are actively being pursued.

In Copenhagen, the Brazilian delegation announced Brazil's national commitment to reduce its domestic GHG emissions 36-39% below BAU levels by 2020. Most of the reductions necessary to achieve this target are expected to come from an 80% reduction in Amazon deforestation in conjunction with a 40% reduction in clearing of the *Cerrado*, the savanna-woodland formation to the south of the Amazon region, which is South America's principal agricultural region. Since Copenhagen, Brazil has transformed into law its National Policy for Climate Change (NPCC), which includes the GHG emission reduction targets announced in Copenhagen. This is Brazil's "nationally appropriate mitigation action" (NAMA) as reported in the Copenhagen Accord.

Brazil's unilateral adoption of the NPCC suggests that at least some portion of the envisioned future avoided deforestation will be accomplished by the Brazilians themselves as part of its commitment to the global community to reduce its GHG emissions. Reducing deforestation emissions from the BAU to a sectoral crediting baseline level could be funded domestically, or be accomplished using in part using public funds provided by other nations and philanthropic donors. The larger the "gap" between BAU emissions and the lower crediting baseline, the fewer REDD-based offsets potentially will be available to third-parties that may be interested in buying compliance-quality offsets, such as electric companies and others who may become "covered entities" in the U.S. if comprehensive climate change legislation becomes law and establishes a large-scale CO_2 cap-and-trade program that allows international offsets to be used for compliance

purposes. But, the international availability of Brazilian REDD-based offset will be determined in part by the regulations designed to implement the NCCP, the specifics of Brazil's national REDD policy which is still to be determined, and ongoing international negotiations related to RED and post-2012 commitments by countries to reduce their GHG emissions.

The project team has laid out some of the issues and challenges that needed to be tackled to develop a workable system of REDD that "nested" within a sectoral crediting architecture and which is internally consistent. One of the key elements of the proposed nesting architecture is the clear setting of reference levels from the national to the individual stakeholder levels that are internally consistent across scales. In addition, the project team believes broad participation in the REDD design process will be an important factor that can help to limit risks that are external to individual implementing entities.

The project team has proposed several options for the design of a nested REDD architecture. In essence, for regulated entities interested in buying REDD-based offsets or investing in REDD activities, it is important to have an environment in which all of the key institutions are engaged to make the REDD system operate effectively and in which risk can be managed as part of the normal business process. The project team has argued that Brazil is making steps in this direction, and has provided insights on the different approaches and options that could be used.

From the point of view of the private investor, a clear layout of how reference levels will be determined and how risks of non-performance at different scales may impact potential crediting for a project will be important elements in project design, along with the specific implementation aspects associated with the project itself.

A nested REDD architecture could be supported by state-level carbon offset registries that are linked to spatial datasets that track individual land holdings, reserves, land-use restrictions and other types of information. No carbon registry exists in the world today that operates at multiple geographic scales and that is capable of supporting registration of sector-based offset credits. Development of this kind of state-level spatial registry will involve substantial institutional commitment and resources.

In the absence of a compliance carbon market, there will be limited traditional private sector carbon finance interest in REDD-based activities. Available public funding, including the currently committed four billion dollars of "fast start" funding through 2012, could be used to leverage private sector investors both through public-private partnerships and through the creation of buffer pools of credits that could be used as an insurance mechanisms against risks of impermanence and the potential failure of governments to achieve their crediting baseline.

In addition, it is critical to create mechanisms to pre-fund ambitious REDD+ activities and policies. Public-private partnerships utilizing ODA funds can facilitate upfront investment by the private sector. Carbon-linked debt instruments could be an important way to raise the vast amount of capital required to provide up-front financing for REDD+ programs. Carbon-linked debt instruments also could be used to limit the exposure that projects and governments have to carbon markets while providing low-cost finance. Traditional debt financing, ODA funding, and bilateral agreements all could be used to fund REDD+ policies and attract substantial private-sector investment in underlying REDD+ activities. A critical component of any successful REDD+ financial architecture will be to understand the costs of meeting REDD+ crediting baselines and the effectiveness of policies to leverage private capital.

The Xingu indigenous territories comprise about 20 million hectares of land – an area more than one-half the size of the United Kingdom and more than twice the size of Costa Rica. The Xingu region (i.e., Kayapo, Panara and PIX) is inhabited 11,000 indigenous people in 18 separate indigenous groups who live in more than 50 villages and speak 17 different languages.

The Xingu River basin is located in the Brazilian states of Mato Grosso (headwaters) and Pará. If a REDD project is to be implemented on indigenous lands or other protected areas in the Xingu basin, it will need to be connected to the state and national REDD systems under development and it must be implemented within these two states.

In late 2008 and 2009, staff from the ISA and EDF facilitated a number of regional and village level meetings with indigenous peoples in the Xingu region that were designed to explain climate science and related policy, to clarify the role of forests in climate change, and to explore on a preliminary basis possible project-related options with local leaders and communities. While a number of consultations have been held with indigenous communities, these consultations are ongoing and the indigenous peoples and their leaders have not yet reached any definitive conclusions regarding their potential interest in developing future REDD projects on indigenous lands.

Recent legal analyses conclude that indigenous communities in Brazil have legal rights to their natural resources (excluding sub-surface resources such as minerals or petroleum), including the carbon credits that may be generated by avoided deforestation projects. These analyses also conclude that indigenous communities have the right to enter into carbon project contracts with certain limitations, so long as these contracts meet the legal requirements defined in the Brazilian Constitution and in the Indigenous Statute, as well as the international conventions to which Brazil is a signatory (e.g., ILO 169, UNDRIP) regarding protection of indigenous peoples' rights to use their natural resources as the basis of their traditional livelihoods. Carbon contracts transacted by indigenous communities may have to share some revenues with the Brazilian indigenous peoples agency (FUNAI) to support its monitoring and support functions, and to other government agencies responsible for law enforcement.

In the future, it may be possible to discuss providing compensation for reduced deforestation with the indigenous tribes that inhabit the Xingu River basin. The indigenous peoples who inhabit the Xingu River basin have the rights and authority to manage their own affairs and determine their own destiny. Only they have the authority to decide if they wish to become involved in any potential future project in the Xingu basin that is designed to reduce deforestation and forest degradation in the region. Furthermore, only the indigenous peoples themselves can decide if compensation for reduced deforestation in the region is in their best interests and will provide significant benefits to them. No REDD project can be designed and implemented in the region without the explicit informed consent of the indigenous peoples who live in the Xingu basin.

Given precipitous decline in deforestation in Mato Grosso since 2005, emissions reductions that are likely to be achieved for during the period 2006-2010 period are estimated to be 850 $MtCO_2e$ below the official federal baseline for Mato Grosso of 1.4 $GtCO_2e$.[108] Looking ahead, this state target could provide 17,000 km^2 of deforestation reduction beyond the federal target over the

[108] We estimated the federal baseline for Mato Grosso assuming the same proportional stepwise reduction for the Brazilian Amazon that is established by the federal government.

2010-2020 period, and could yield 600 $MtCO_2e$ of emissions reductions beyond the federal target, and 2.4 $GtCO_2e$ of emissions reductions below the federal baseline for Mato Grosso.

When the project team extrapolated the average annual rate of land clearing in the Xingu River basin indigenous territories (3,791 hectares) into the future, we estimated an additional 85,000 hectares of forest potentially will be cleared in the basin by 2030. This corresponds to net expected emissions of 30 $MtCO_2e$ that would be released from the indigenous territories of the Xingu River basin if historical rates of deforestation continue over the next 20 years.

Model-based simulations of future deforestation on the Xingu indigenous lands, however, provide a much higher range of emissions estimates from a low of 1.1$GtCO_2$ (based on low BAU deforestation) to a high of 2.1$GtCO_2$ (high BAU deforestation) over the same period. If up to 20% of each indigenous territory is allowed to be cleared, as is the case for private properties in the Amazon today, at least 1.1$GtCO_2$ would be released into the atmosphere relative to the 2008 landscape. These potential emissions reductions are more than 30 times larger than the estimate based upon a simple extrapolation of historical deforestation rates into the future.

The project team believes a future phase two of this project would be best directed towards supporting analytical work that needs to be done to overcome some of the remaining conceptual and architectural obstacles to finalizing the design of a nested sectoral REDD policy design for Brazil.

Some of the other key findings and potential benefits to EPRI members and others from this research project include:

- REDD could be used to compensate developing nations for their success in lowering GHG from deforestation and forest degradation, and also could be used to reward forest carbon enhancement. It is the strongest component of the UN climate treaty now being negotiated for the post-2012 period, when the Kyoto Protocol expires. Many of the technical issues associated with REDD have been resolved, and interim public funding of four billion dollars has been committed by developed nations for the period 2010-2012 to fund REDD capacity building activities.
- Despite passage of the "Waxman-Markey" climate legislation (H.R. 2454) in the U.S. House of Representatives in June 2009, the probability that comprehensive climate and energy legislation will become law in 2010 is very low. Several key existing pieces of proposed U.S. federal legislation, including H.R. 2454, the "Kerry-Boxer" bill (S. 1733), and other bills would allow entities covered by a U.S. GHG emissions cap-and-trade program potentially to purchase international REDD-based emissions offsets to help achieve compliance with future U.S. GHG emissions caps.
- State regulations being developed by the California Air Resources Board (CARB) pursuant to California's AB-32 climate law are likely to include an option for covered entities to use international REDD+ offsets for compliance purposes, and other U.S. states and regional programs like the Western Climate Initiative (WCI) could follow California's lead.
- Since the inception of this EPRI project, interest in the voluntary market for REDD-based forest carbon projects has waned. Future forest carbon credits are most likely to be created within state- and national-level REDD+ programs, and pilot projects that formally are linked to these governmental programs.

- Brazil is the world leader in developing a REDD framework. It has the largest forest, the highest rate of carbon emissions from deforestation and forest degradation, a sophisticated forest monitoring system for the Amazon region, and it has successfully reduced deforestation by two thirds since 2005.
- Brazil also has made important advances towards developing a national REDD framework through its adoption of its National Policy on Climate Change (NPCC), which establishes a target for reducing emissions up to 39% by 2020 below 2005 levels. This target includes 80% and 40% deforestation reduction targets for the Amazon and *Cerrado*, respectively. Brazil is expected to finalize the design of its national REDD framework in time to announce it at COP16 in Cancun in December 2010. In one concept, credits flowing from national emissions reduction efforts would be allocated to states on the basis of the forest carbon stock, the decline in deforestation, and the state's success in achieving its deforestation reduction targets. There is also some discussion in Brazil about possible implementation of a domestic economy-wide CO_2 cap-and-trade system.
- Many of the emissions reductions achieved by Brazil through its NPCC, which can be considered to be a Nationally Appropriate Mitigation Action (NAMA), may not be available as offsets to third parties, such as U.S. entities that may be regulated by cap-and-trade policies, because these emissions reductions cannot be counted twice – i.e., once towards Brazil's international commitment and again as an offset. However, so long as Brazil has no international legal obligation to reduce its GHG emissions, it is free to negotiate any bilateral or multilateral arrangement it wants to finance its emissions reductions, including developing an approach like Joint Implementation or through the sale of emission offsets.
- Brazilian states in the Amazon region (i.e., Mato Grosso, Pará, Acre, Amazonas) also have made progress developing state-based REDD programs. In Mato Grosso, a multi-stakeholder State Forum on Climate Change is considering a REDD program design in which credits (referred to as "C-REDDs") would be allocated among sectoral programs (i.e., indigenous peoples' lands, smallholder settlements, private properties, and protected areas).
- Formal REDD nesting frameworks that effectively allocate benefits across scales must address the challenge of defining reference levels (baselines) at each scale, and distributing the errors that will inevitably arise from this definition. The project team recommends a "scale-neutral" framework that constrains total emissions nationally, and accommodates both REDD projects and state-based policies.
- A carbon offset registry that tracks the creation, transfer, acquisition, and status of every ton of REDD-based carbon emission reductions has not yet been developed for multiple-scale, nested frameworks. The project team recommends modifying one or more existing registries to operate at the state level, supported by a spatial database that tracks REDD projects and information that is relevant to REDD programs.
- In the absence of regulatory clarity, REDD projects and programs are likely to be funded primarily by public funds committed by developed nations over the next few years. Interim REDD public funding could be designed to provide entry points for private investors and reduce risk and attract the large amounts of private capital that will be needed in the long term to pay the substantial costs to implement REDD programs. For example, Brazil could create medium-term government bonds that provide lower yields and returns than current bonds, but provide buyers with the right to REDD credits, with private investors given priority for the first credits yielded. Interim public finance (e.g., the Amazon Fund) could acquire a large volume of bonds but with second priority on credits.

- Indigenous people in Brazil have clear constitutional rights to their land and aboveground natural resources and are free to negotiate contracts – with certain limitations – for the sale of REDD-based emissions reduction credits.
- A potential future REDD project implemented on indigenous lands in the Xingu River basin could yield at least 30 $MtCO_2e$ of emission reductions over the period 2010-2030 (below the most conservative baseline), but the potential for reducing emissions is much higher. Using a sophisticated spatial simulation model of land use for the Xingu River basin, the project team estimates that more than $1GtCO_2e$ of emissions would be released from forests on indigenous lands by 2030, even if historically-observed levels of inhibition of deforestation by indigenous groups continue into the future. These emissions could be avoided through successful implementation of a large-scale REDD project. Further discussions and negotiations involving both indigenous residents and other stakeholders will be needed to develop an appropriate reference level for a Xingu REDD project and to determine the amount of emissions reductions that may be counted as offsets as part of the development of a sectoral REDD program in Brazil.

A
APPENDIX A – GLOSSARY OF TERMS

ACR	Winrock International's American Carbon Registry.
Additionality	The degree to which GHG benefits achieved by an emission mitigation project would not have occurred in the absence of the added incentive of creating GHG emission mitigation.
Afforestation	An activity included under Article 3.3 of the Kyoto Protocol; more generally, establishing new forests on land that has not ever, or in recent times, been forested.
Annex I countries, non-Annex I countries	Countries listed, or not listed, in Annex I of the UNFCCC; Annex I is a list of industrialized countries, non-Annex I countries are developing countries.
Annex B countries	Annex B of the Kyoto Protocol is a list of industrialized countries; they must also then ratify the Kyoto Protocol.
A,R & D	Afforestation, Reforestation and Deforestation.
Assigned amount	The number of emission units that an Annex B country holds; the initial amount for the first compliance period of 2008-2102 equals the emissions target for the country times five.
Assigned Amount Unit (AAU)	An emissions unit under the Kyoto Protocol; AAUs are issued by Annex B countries equal to their "initial assigned amount."
A&R Activities	Afforestation and Reforestation activities.
Baseline	The schedule of GHG emissions related to a project that would be expected to occur in the absence of a project.
BAU	Business As Usual.
CAR	The Climate Action Reserve. Previously the California Climate Action Registry.
CCBA	The Community Conservation and Biodiversity Alliance.
Clean Development Mechanism (CDM)	A provision described in Article 12 of the Kyoto Protocol that allows tradable credits, called CERs, to be generated through projects in developing countries that can be used by industrialized countries for compliance with their Kyoto commitments.
CDM Executive Board (EB)	The executive body that is charged by the UNFCCC COP to oversee the operation of the CDM.
Certified Emission Reduction (CER)	An emissions unit under the Kyoto Protocol that is issued under the procedures of the CDM.
CITL	The Community Independent Transaction Log (CITL). This is the carbon accounting registry used to track compliance in the EU Emissions Trading Scheme.
Conference of the Parties (COP)	The main operational body of the UNFCCC, representing all countries that have ratified the Convention. It meets annually. COP15 was held in Copenhagen, Denmark in December 2009.
COP15	The 15th Conference of the Parties to the UNFCCC that took place in Copenhagen, Denmark in December 2009.

Crediting Baseline	The baseline emissions level against which actual sectoral emissions will be compared. If actual sectoral emissions fall below the sectoral crediting baseline than offset credits can be issued. If actual emissions are above the crediting baseline, than offsets cannot be issued. The crediting baseline is generally lower than the "business-as-usual" baseline.
Cropland management	An activity included under Article 3.4 of the Kyoto Protocol; more generally, the management of croplands to reduce emissions of carbon and/or increase the sequestration of carbon.
CRT	Climate Reserve Tonnes. Offsets issued by the Climate Action Reserve program.
Deforestation	An activity included under Article 3.3 of the Kyoto Protocol; more generally, the conversion of forested land to some other land use following forest clearance (e.g.,, by harvesting or forest fire).
Emission Reduction Unit (ERU)	An emissions unit under the Kyoto Protocol from projects under the Joint Implementation (Article 6) mechanism.
EUA	European Union (emissions) allowance in the EU ETS.
EU ETS	European Union Emissions Trading Scheme.
FAO	United Nations Food and Agriculture Organization.
FEPAF	The Foundation of Agricultural and Forest Study and Research in Brazil.
Forest management	An activity included under Article 3.4 of the Kyoto Protocol; more generally, the management of forests to reduce emissions of carbon and/or increase the sequestration of carbon.
FUNAI	Brazil's National Indian Foundation. The government ministry that establishes and carries out policies relating to indigenous peoples.
GCF	The Governors' Climate and Forest Taskforce. The GCF was formed in 2008 and currently has 14 member states from the U.S., Brazil, Indonesia, Mexico and Nigeria.
GHG	Greenhouse gas. This term usually is used to refer to the collection of all six types of GHGs regulated by the Kyoto Protocol (CO_2, CH_4, N_2O, SF_6, PFCs and HFCs)
Gigatonne	1,000 million tonnes (1 billion tonnes) (e.g.., $GtCO_2$)
GIS	Geographical Information System.
Grazing land management	An activity included under Article 3.4 of the Kyoto Protocol; more generally, the management of grazing lands to reduce emissions of carbon and/or increase the sequestration of carbon.
IBAMA	The Brazilian Environmental and Renewable Resources Institute.
IDESA	The Economic and Environmental Development Institute of Brazil.
IPCC	The United Nations Intergovernmental Panel on Climate Change.
ITL	The Independent Transaction Log. A computer database system used to track the issuance, transfer and retirement of Kyoto Protocol compliance emissions allowances and offsets.
Joint Implementation (JI)	A provision described in Article 6 of the Kyoto Protocol that allows tradable credits called ERUs to be generated through projects in Annex B (industrialized) countries that can be used by Annex B countries for compliance with their Kyoto commitments.
Kyoto Protocol (KP)	A protocol under the UNFCCC where, *inter-alia*, industrialized countries took on binding commitments to reduce their greenhouse gas emissions in a first commitment period (cp1), 2008-2012.
lCER	Long-term CER; a particular form of CER issued under the CDM for LULUCF A&R projects.

Leakage	A GHG effect occurring outside the boundary of what is being reported or accounted for a project or activity that, however, is caused by the project or activity and reduces its environmental benefit.
LUCF	Land use change and forestry, a sector for emissions reporting purposes under the UNFCCC.
LULUCF	Land use, land use change and forestry, a sector covered under Articles 3.3 and 3.4 of the Kyoto Protocol; becoming used more generally than just related to the Kyoto Protocol.
MMV	Monitoring, measurement and verification of emissions or sequestration.
Permanence, non-permanence, reversal	Generally, the issue that removals of carbon from the atmosphere by biological processes, such as the growing of forests, are not permanent and can be reversed (i.e., sinks can become sources) as a consequence of fire, disease, die-off, timber harvesting, and other activities.
NPCD	Brazil's National Plan for the Control of Deforestation.
NPPC	Brazil's National Climate Change Plan. This plan calls for Brazil to reduce its GHG emissions by 80% by 2020 as compared to a 2005 baseline. This plan is based on reducing deforestation in the Amazon region by 80% and in the Cerrado (savanna) region by 40% by 2020.
PIX	The Xingu Indigenous Park (Parque Indigena do Xingu in Portuguese).
REDD	Reduced emissions from deforestation and degradation.
REDD+	Reduced emissions from deforestation and degradation combined with net forest sequestration from regrowth and afforestation activities.
Reforestation	An activity included under Article 3.3 of the Kyoto Protocol; more generally, establishing forests on land that has in recent past times been forested but in more recent times has been under some other land use.
Removals	The sequestration of carbon from the atmosphere (the opposite of emissions); a process that does this is a "sink."
Removal Unit (RMU)	An emissions unit under the Kyoto Protocol that is issued by Annex B countries for LULUCF activities under Articles 3.3 and 3.4.
RSR	The Registry of Socio-Environmental Responsibility (RSR). This registry includes landowners in the Xingu basin headwaters region in Mato Grosso state who have agreed to implement specific best management practices associated with land management and stewardship.
Sequestration	The absorption of carbon from the atmosphere by some process; normally of CO_2 but can be for other greenhouse gases (e.g., methane).
Sink	A process that removes carbon from the atmosphere (e.g.., a growing forest).
Storage	Keeping sequestered carbon out of the atmosphere.
tCERs	Temporary CER; a particular form of CER issued under the CDM for LULUCF A&R projects.
UNFCCC	United Nations Framework Convention on Climate Change, the multilateral environmental agreement to address the risk of global climate change.
VCSA	Voluntary Carbon Standard Association. The VCS is the offset program standard operated by the VCSA.

B

APPENDIX B – SCALE-NEUTRAL REDD NESTING FRAMEWORKS: ERRORS IN THE ESTIMATION OF REFERENCE LEVELS AND EXPECTED EMISSIONS REDUCTIONS

This Appendix presents a theoretical structure for describing and linking the errors associated with estimating reference levels and emissions reductions at multiple scales.

Let C_{NAT} be the avoided emissions credited at the national accounting level to be distributed as credits to individual stakeholders (C_{STKHLD}), projects (C_{PROJ}), and credits associated with indirect regional actions such as policies (C_{REG}). We assume for cross-scale consistency that credits allocated sub-nationally have to sum to observed reductions in emissions. Given these assumptions, the following identity must hold:

$$C_{NAT} = C_{STKHLD} + C_{PROJ} + C_{REG}$$ **Equation B-1**

At a given scale *i*, the credits can be computed as:

$$C_i = REF_i - \left(BAU_i + \Delta EMISS_i\right)$$ **Equation B-2**

where the REF_i is the crediting reference emission level at scale *i*, BAU_i is the BAU at scale *i*, and $\Delta EMISS_i$ is the change in emissions associated with actions at scale *i*. However, there will be uncertainty related both to the BAU path of emissions and the change in emissions associated with a specific action at any given scale. There will be an expectation (E[x]) of the amount of credits that could be generated by activities at each scale based on predictions of a BAU path and the impact of the actions undertaken. However, at each scale, there will be a difference between the expectation and the realized reductions.

$$e_{ref,i} = REF_i - BAU_i$$ **Equation B-3**

Where $e_{ref,i}$ is the error associated with setting the reference level. It represents the amount of credits to be received based on the reference level, even if no action to reduce emissions occurs. The error will be positive when a conservative reference level is adopted for that component. A negative reference level error indicates there will be fewer credits generated than expected based on actions undertaken. This component is equal to zero if the reference level is set at the value of the BAU; however, this may not necessarily be the case. There are two reasons for this outcome: (i) the BAU is not observable once REDD is in place; and, (ii) even if the BAU were known with certainty, the reference level could be set to a different value by policymakers as a tool to redistribute financial incentives. Therefore, this error is not a purely random error tied to uncertainty because policymakers may intentionally bias the reference level. However, we consider it an error component to the extent it generates credits or debits without any actual

change of emissions relative to the BAU. Based on the definition in Equations B-2 and B-3, the credits at scale *i* can be expressed as:

$$C_i = e_{ref,i} - \{E[\Delta EMISS_i] + e_{IMPL,i}\}$$ **Equation B-4**

Where $E[\Delta EMISS_i]$ is a component representing expected credits stemming from actions at scale *i*, and there is also an implementation error component, $e_{IMPL,i}$, reflecting that actions taken may not lead to exactly the expected emissions reduction.

As pointed out in Equation B-1, the credited emissions reductions at the different scales have to sum to the amount of credited emissions reductions at the national level.

$$C_{NAT} = e_{ref,NAT} - \{E[\Delta EMISS_{NAT}] + e_{IMPL,NAT}\} = \sum_i \{e_{ref,i} - \{E[\Delta EMISS_i] + e_{IMPL,i}\}\}$$

Equation B-5

Assuming that expectations for BAUs and for changes in emissions are consistent across scales we can state that:

$$e_{ref,NAT} = \sum_i e_{ref,i}$$ **Equation B-6**

$$e_{IMPL,NAT} = \sum_i e_{IMPL,i}$$ **Equation B-7**

C

APPENDIX C – DEVELOPMENT OF A SPATIAL SIMULATION MODEL FOR THE XINGU RIVER BASIN

***Deforestation**:* The dynamic landscape model used for this analysis was developed to simulate future landscape trajectories corresponding to a set of alternative policy proposals. The model is based on spatial-statistical analyses of land-use change, derived from a land-use and land-cover change analysis, and a Geographical Information System (GIS) consisting of data related to the location and neighborhood context of 4 focal land-cover transitions: (1) forest to agriculture (i.e., pasture or annual crops); (2) cerrado (savannah) to agriculture; (3) agriculture to regenerating forest; and (4) agriculture to regenerating cerrado. The model simulates land-cover changes over a 30 year time horizon, beginning in 2008 and ending in 2037, using land-cover conversion rates calculated from different reference periods as described below ("Scenarios"). The model integrates coupled components developed within two spatial structures: (1) sub-regions defined by hydrographic sub-basins, and (2) raster (grid) cells (2940x7434) at 0.2-km resolution.

The model uses a nested, sub-regional approach based on hydrographic basins to better represent the spatial variation in ecology (i.e., forest type) and legal realities of land-use policy in the region, as well as to facilitate model processing. The model is calibrated and run separately for nine 3rd-order sub-basins (explained in more detail below), the results of which are merged at every time step. This step decreases processing memory requirements and better simulates actual land-cover change processes by regionalizing rates, relationships to proximal drivers, and patterns.

Each of the nine sub-basins is further sub-divided into micro-watersheds representing individual stream reaches (1:1,000,000 scale), which interact such that the proximity of a deforestation front in one micro-basin influences deforestation in a neighboring micro-basin. Within a sub-basin, all microbasins are constrained by the total annual land-cover change rate for the whole basin. For the BAU scenario simulation, the sub-division into microbasins does not affect the location of the focal land-cover change events. However, the microbasin subdivision becomes important in modeling alternative land-use policy scenarios in which regulations are established for the property level. This is because we employ the micro-basins as proxies for individual properties to better simulate policy outcomes on private lands. (Maps of property perimeter boundaries are not available). The mean size and range of sizes of the 7572 micro-basins (x = 5981 ha, 4-70,766 ha) is comparable to that of private properties in the region.[109,110] Furthermore, Brazilian water law

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[110] Fearnside, P. M. 2005. Deforestation in Brazilian Amazonia: History, rates, and consequences. *Conservation Biology* 19 (3):680-688.

requires management plans at the watershed level and the Brazilian Forest Code stipulates that deforestation rights may be traded by property owners within watersheds in certain case.[111,112, 113]

The model has four basic steps (described in further detail in Stickler 2009[95] and Stickler et al. 2009[114]). First, annual deforestation rates are calculated for each 3rd-order watershed based on conversion rates calculated for the period 1996 to 2005. Next, annual deforestation probability in relation to a set of spatial variables is obtained using "weights of evidence" analysis[115] for each of the nine sub-basins. Third, for each sub-basin, a unique spatial simulation model was developed. Finally, we validated the model by comparing the simulated and observed landscapes for the year 2007. All modeling phases used the Dinamica EGO graphical interface platform (http://www.csr.ufmg.br/dinamica/) that has the capacity to process multiple large map sets and has special features for advanced spatial modeling and simulation.

Aboveground Carbon: We developed a carbon bookkeeping model that keeps track of aboveground carbon losses and gains at each time step for each modeled scenario. It is run independently (offline) of the land cover change model, using maps of annual land cover type and land cover residence time generated by the land cover change model as input. Annual carbon emissions are calculated as the total carbon content of areas cleared in each year, as represented by a map of potential biomass corrected for the average carbon content of the pastures and crop field that replace forests in the Xingu region. Annual carbon gains through sequestration by regenerating vegetation were calculated using a logistic growth curve calibrated using data from Zarin et al. (2001)[116] and Houghton et al. (2000).[117]

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[112] Chomitz, Kenneth M. 2004. Transferable Development Rights and Forest Protection: An Exploratory Analysis. International Regional Science Review 27 (3):348-373.

[113] MP 2166-67 2001.

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[116] Zarin, D. J., M. J. Ducey, J. M. Tucker, and W. A. Salas. 2001. Potential biomass accumulation in Amazonian regrowth forests. Ecosystems 4:658-668.

[117] Houghton, R. A., D. L. Skole, C. A. Nobre, J. L. Hackler, K. T. Lawrence, and W. H. Chomentowski. 2000. Annual fluxes of carbon from deforestation and regrowth in the Brazilian Amazon. Nature 403:301-304.

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