EVERYTHING IS CONNECTED

CLIMATE AND BIODIVERSITY IN A FRAGILE WORLD

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CONTENTS

FOREWORD

Healthy ecosystems and a stable climate are critical to human well-being and development. But both are chronically threatened. As forests, savannahs and grasslands were converted to cities and farms, as rivers were dammed to irrigate fields, as new technologies gave us the energy to produce and consume things previous generations could scarcely have imagined, we have improved the lives of billions. But these recent changes to natural systems have come at considerable cost to the complex life support systems of our fragile world.

Although many of us may feel distant from nature, for the majority of people on Earth, biodiversity loss is an immediate threat to their health and livelihoods. We may take biodiversity for granted, but the intricate web of life which surrounds us—and of which we are a part—is vital for our economy. Our fisheries depend on a healthy ocean. Our agriculture depends on the genetic material from which seeds and livestock are bred, the microorganisms that provide us with fertile soil and the water that irrigates our crops. And even with the invention of many synthetic materials, trees bring us wood and paper, plant and animal fibres give us the clothes we wear and countless, often unrecognised, organisms provide our medicines. Biodiversity is the foundation of our wealth and the root of our culture. It is the Earth's life support system.

It is also vital for our climate. Forests and savannahs are key to the maintenance of the stable weather patterns we are used to, locking away vast amounts of carbon and generating rain for our crops. Mangroves and wetlands make us more resilient to extreme events, reducing coastal erosion and flooding, and maintaining water flow and quality. And it is the rich variety of plant and animal life itself, both on land and in the oceans, which will help us adapt to an uncertain future climate. Conversely, further degradation of natural systems can accelerate global warming, which in turn will put at risk the natural systems we are trying to protect. Together climate change and environmental degradation are lowering the resilience of ecosystems by reducing the variety of species and their ability to adapt.

A stable climate and healthy ecosystems are also vital components for development. Unless we understand the interconnections between climate and biodiversity and develop ways to work in partnership on these issues, it may become even more difficult to achieve the Millennium Development Goals and rid the world of hunger, extreme poverty and avoidable disease—as well as to avoid sudden changes to the planet's life support systems which do not discriminate on the basis of wealth.

Protecting and improving our future well-being and development requires a reassessment of how we use, value and protect our natural capital and how we structure our economies. This in turn will involve changes in the way that we make and implement decisions and how we incentivise one choice over another. Recognising the true value of biodiversity and ecosystem services and taking it into account in our economic decisions could help to steer governments, businesses and society towards a greener global economy. The solutions will not be simple. Nor will they be easy. But we can and must seek them out and make them work.

Reducing Emissions from Deforestation and forest Degradation or REDD could be one such solution. Carefully designed, REDD has the potential to reduce emissions while safeguarding the biodiversity of our forests and savannahs and the livelihoods of the people who depend on them. *The Economics of Ecosystems and Biodiversity* (TEEB) study estimates that the loss of ecosystem services caused by global deforestation is worth between two and five trillion dollars per year.

For business, minimising water and energy use or recycling waste materials, can bring important long-term benefits for their bottom line and for society as a whole. Companies prepared to pioneer new technologies stand to pre-empt changes in public policy and seize new opportunities. Businesses that are able to demonstrate that they are more responsible and more discriminating throughout their supply and

value chains will be in a better position to capitalise on changing consumer preferences. Ultimately, all of us—government, business and civil society—have an interest in rebuilding the stock of natural capital: it is at the core of every business model.

In 2002, at the sixth Conference of the Parties to the Convention on Biological Diversity, 193 countries committed themselves to halting biodiversity loss worldwide by 2010. That target has been missed, despite significant progress in some areas (including in the Brazilian Amazon). Eight years on, we celebrate the UN's International Year of Biodiversity. This year, we reflect on how much we value the Earth's fragile life-support systems. They are under threat. And by threatening them, we are threatening our own well-being and prosperity.

We firmly believe that by identifying and acting on the links between climate and biodiversity we can safeguard our precious natural capital while adapting to and mitigating the threat from climate change. We are delighted to be able to bring together here some of the ideas and experiences which will help us do that. We hope that by sharing this experience we can help to begin an important debate.

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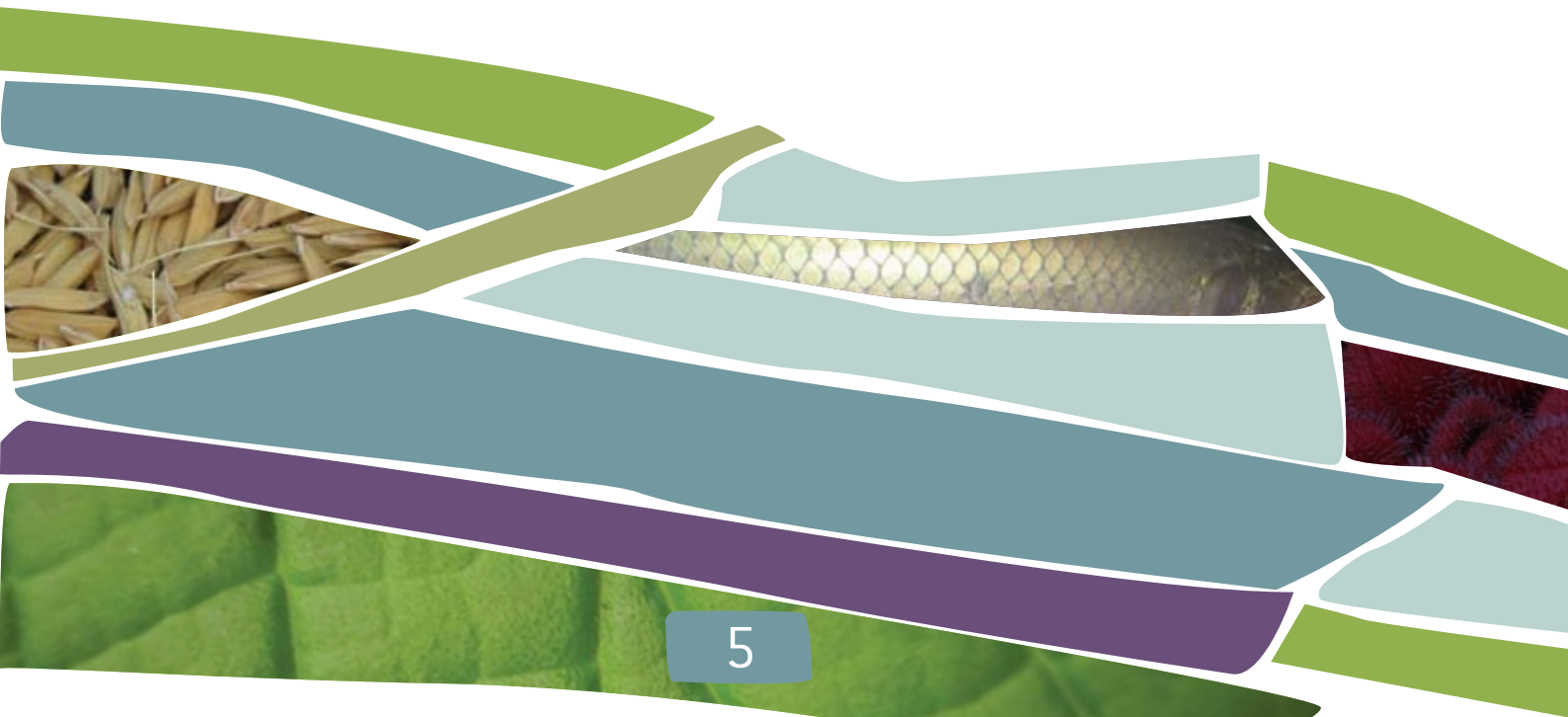

INTRODUCTION

This publication brings together eight original articles by experts to tackle head on some of the most difficult questions facing us all: How a stable climate and a productive biosphere can be secured together. Why this is an opportunity for green growth. And how a closer partnership between the multilateral environmental agreements, in particular the Convention on Biological Diversity and the Framework Convention on Climate Change, can help.

It also brings together the experience of one of the world's megadiverse countries in tackling these challenges: Brazil is home to the world's largest tract of virgin rainforest—an area roughly the same size as the EU. It is estimated that the Amazon rainforest generates up to half of the rainfall which agriculture and hydropower plants in south-eastern Brazil and in the rest of South America depend on. It helps to regulate the global climate, sequestering millions of tonnes of carbon every year. And all this while safeguarding a fifth of the world's freshwater and perhaps a third of its biodiversity.

The publication focuses on one of the most promising mechanisms for mitigating climate change: Reducing Emissions from Deforestation and forest Degradation (REDD). REDD is a set of steps designed to use market or financial incentives in order to reduce the emissions of greenhouse gases from deforestation and forest degradation. Including enhancement of existing forests and expansion of forest cover, REDD becomes REDD-plus.

Implemented carefully, REDD-plus has the potential, not only to mitigate climate change, sequestering billions of tonnes of carbon in forests, but also to conserve biodiversity and safeguard the livelihoods of forest-dependent communities. But implemented unwisely, it could risk an expansion of plantations and continued depletion of natural forests, as well as carbon investment deals that deprive forest peoples of their livelihoods.

Emily Dunning and colleagues from the United Nations Environment Programme World Conservation Monitoring Centre (UNEP WCMC) make the case for protected areas as havens for biodiversity and as bulwarks against a changing climate. Adriana Ramos and Rodrigo Junqueira from *Instituto Socioambiental* (ISA) show how the knowledge of indigenous peoples is critical to making REDD-plus a reality. Mauricio Voivodic from Imaflora and colleagues share their experience in working with forest-dependent communities to develop safeguards to maximise the cobenefits for biodiversity and society that REDD-plus can deliver.

Pavan Sukhdev, lead author of *The Economics of Ecosystems and Biodiversity* (TEEB) study and Deutsche Bank economist, tells us why ecosystem services can create new value and new opportunities for our economies. Peter May from the Federal Rural University of Rio de Janeiro (UFRRJ) explains how Brazil has begun to seize the opportunity green growth offers. Eduardo Assad and Hilton Pinto from EMBRAPA and the University of Campinas highlight the importance of biological diversity for safeguarding our food supply in a changing climate.

Eduardo Viola and Cristina Inoue from the University of Brasília argue that a closer partnership between the Convention on Biological Diversity and the UN Framework Convention on Climate Change will be important if we are to effectively make the global transition to a low-carbon, green economy. Brenda Brito and colleagues from Imazon set out how one municipality in Brazil, on the frontline in the fight against deforestation, has begun the process of reinventing itself for a greener future.

Disclaimer

The views expressed in this publication are purely those of the authors and may not in any circumstances be regarded as stating an official position of the governments involved.

THE ROLE OF PROTECTED AREAS IN MITIGATING CLIMATE CHANGE AND CONSERVING BIODIVERSITY

Emily Dunning, Matea Osti and Helena Pavese

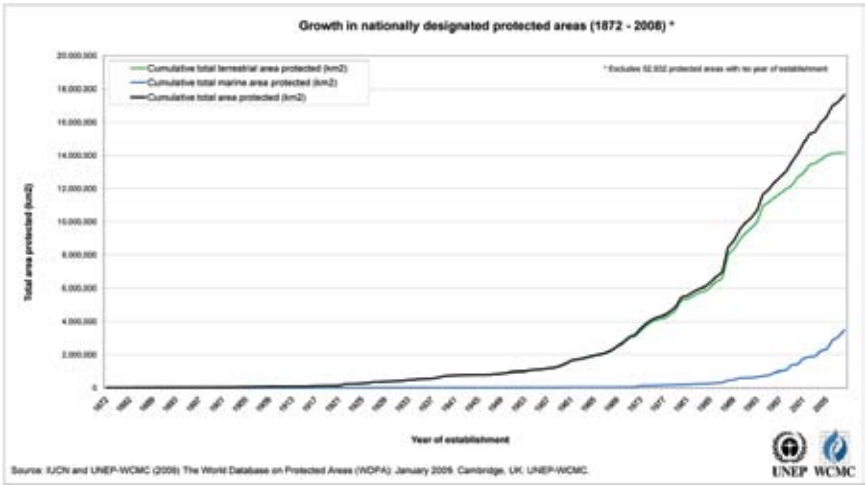

Figure 1: Growth in nationally designated protected areas (1872-2008).

Protected area networks represent the cornerstones of many national conservation plans. They have achieved a lot but have the potential to achieve even more if they were better secured, expanded and financed. If managed effectively they can bring significant benefits to society – both locally and more broadly.

The concept of protected areas has existed for millennia although their forms have changed, evolved and diversified through time. In the present day they include anything from national parks to extractive reserves and private protected areas. Behind this diversity, however, their fundamental basis remains the same: the protection and maintenance of biological diversity, and of natural and associated cultural resources, managed through legal or other effective means.

Areas under formal protection have rapidly increased throughout the twentieth and twenty-first centuries (see Figure 1). There are currently more than 120,000 terrestrial protected areas world-wide, covering around 12.2 per cent of total land area.

A National System of Conservation Units was created in Brazil in 2000 and this currently encompasses 685 protected areas (310 Federal and 375 State-designated), covering 16 per cent of the country's continental area and 1.6 per cent of the marine environment. They are distributed across the seven Brazilian biomes (the Amazon and Atlantic rainforests, savannah-like Cerrado, semi-arid Caatinga, wetland Pantanal and grassland Pampa, as well as coastal and marine areas) and organised into fifteen management categories, from strict protection to sustainable use.

Protected areas are usually declared for a specific conservation purpose, but they provide other ecosystem services besides, one of which is climate change mitigation. By reducing deforestation and protecting other ecosystems within their boundaries, they can help to reduce greenhouse gas emissions and sequester further carbon. Their potential for protecting carbon as well as biodiversity is only beginning to be recognised. Worldwide, terrestrial protected areas contain over 312 gigatonnes of carbon, equivalent to

15.2 per cent of the global terrestrial carbon stock. This means that protected areas contain a larger proportion of the global terrestrial carbon stock (15.2 per cent) than the land area they cover (12.2 per cent).

Protected areas are effective in reducing deforestation and protecting biodiversity. Deforestation in the Brazilian Amazon is about 10 to 20 times less within protected areas and indigenous lands than in adjoining areas. The expansion of the protected areas network accounted for 37 per cent of the reduction in deforestation between 2004 and 2006. Their effectiveness in preventing the displacement of deforestation to other areas (leakage) is often less clear, although one study in the Brazilian Amazon was positive. Protected areas in the Brazilian Amazon now contain 54 per cent of the region's remaining forests and 56 per cent of its forest carbon, highlighting their important role in climate change mitigation and biodiversity conservation.

Recent analyses in Brazil suggest that forests in 115 out of 206 protected areas established since 1999 have experienced less deforestation since their designation. However, this means that 48 per cent of protected areas surveyed have not been effective in reducing deforestation. Global analyses have shown that between 2000 and 2005, an estimated 1.75 million hectares of forest were lost from protected areas in six humid tropical forests, causing the emission of 0.25-0.33 gigatonnes of carbon.

Protected areas are likely to form part of at least some national strategies arising out of Reducing Emissions from Deforestation and forest Degradation (REDD-plus) mechanisms. REDD-plus is a proposed mechanism to provide financial incentives to reduce losses and enhance sequestration of forest carbon. Eligible activities currently being discussed under the UN Framework Convention on Climate Change (UNFCCC) include the sustainable management of forest, enhancement of forest carbon stocks, and conservation of forest carbon stocks. Each of these could potentially include designation of new protected areas or investment in existing ones. A major advantage of incorporating protected areas into national REDD-plus strategies is that the protected area legislation already exists in many countries, such as in Brazil, and implementation is therefore likely to be relatively fast and simple.

A country's REDD-plus strategy may include the declaration of new protected areas in areas of high carbon density. The national conservation strategy, however, will have biodiversity as its primary focus; with this priority, selecting areas of low carbon but high biodiversity could be a more valuable use of limited conservation resources. Overlapping areas of both high carbon and high biodiversity may be of greatest interest to a government wishing to use resources efficiently. Protected area designation should be based on clear priorities to most effectively achieve the desired goal.

For all the perceived benefits, the inclusion of protected areas as a component under REDD-plus does not come without certain implementation challenges. Questions have been raised about 'additionality' (i.e. the extent to which the funding for carbon stored in protected areas will provide additional climate change mitigation benefits). This is still to be worked out under the UNFCCC negotiations, but, given that many protected areas do not currently provide effective protection due to limited resources, increased funding could directly contribute to improving their climate change mitigation capacities.

Protected areas should not just be seen as 'environmental sanctuaries'. Any new land designated for protection is likely to have an effect on local livelihoods. This may be negative if designation involves human displacement and restricts access to resources. Alternatively, it may provide new income and opportunities through REDD-plus payments, livelihood diversification and ecosystem service protection. One study showed that 10 protected areas in the Brazilian Amazon provide a direct contribution of around US$ 1.76 million to the local economy and generate about 218 direct job opportunities.

History has shown that the effectiveness of protected areas relies on adequate investments, efficient management processes and support from and compliance by communities living in or near them. If protected areas are not properly planned, designated and managed, local communities can lose rights of access to resources and economic opportunities. This can result in human displacement, resentment and lack of cooperation, which undermines their long-term effectiveness. As such, the governance of

protected areas, the extent and methods of community consultation and inclusion, and the way in which communities are compensated for or benefit from their designation are important considerations.

The degree to which local people will benefit or be harmed is usually determined by the protected area's status and governance (whether local people are involved), and the previous history of use. Recent findings have shown that protected areas allowing some productive use can be as (or even more) effective than strict protected areas which limit on-site human activity. Any new protected area established or strengthened as part of a country's REDD-plus strategy should draw upon past experiences, involve local communities in careful planning and implementation, and aim to bring tangible benefits to the communities in question.

If managed carefully, protected areas can play a role in climate change mitigation, while contributing to biodiversity conservation and the sustainability and enhancement of local livelihoods. The extent of protected area effectiveness as a climate mitigation measure will be determined by a number of factors, both human and environmental. However, it is likely to be most influenced by the implementation and management approaches adopted, and the extent to which these approaches are harmonised with local community interests and values. As negotiations on REDD-plus move forward, the inclusion of protected areas under the mechanism is looking increasingly likely. The advantages are clear; nevertheless, time will need to be devoted to addressing issues such as non-additionality, human impacts of land designation and governance, all of which have the capacity to weaken the success of protected areas' contribution to REDD-plus.

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THE CONTRIBUTION OF INDIGENOUS PEOPLE TO FOREST CONSERVATION AND RECOVERY

Adriana Ramos and Rodrigo Junqueira

Halting deforestation and ensuring Amazon conservation is fundamental to the maintenance of climate balance. Worldwide deforestation is estimated to have been responsible for the equivalent of 10 per cent to 35 per cent of global CO_2 emissions during the 1990s. In the Brazilian Amazon alone, deforestation released 200 million tonnes of carbon per year over the past decade, something close to three per cent of the global total. Carbon emissions from deforestation and forest fires in the Brazilian Amazon could negate more than half of the reductions achieved by developed countries under the Kyoto Protocol.

A recent study commissioned by the secretariat to the United Nations Convention on Biological Diversity (CBD), the third *Global Biodiversity Outlook*, states that a number of ecosystems may be close to suffering irreversible changes. It also warns of the potential impact that the deforestation of the Amazon could have on rainfall and, consequently, on agricultural production, in parts of South America. The National Institute for Amazon Research (*Instituto Nacional de Pesquisas da Amazônia* – INPA) estimates that the Amazon evaporates 30 billion tonnes of water on a single day. The forest emits organic aerosols to the atmosphere, which work as cloud seeds. But the fumes of forest fires introduce too many particles in the atmosphere, drying the clouds and blocking the rain. It is a very sensitive balance.

Land-grabbing, unauthorized occupation, the expansion of extensive monoculture models and non-compliance with environmental legislation have led to a significant fragmentation of Brazil's national forests, threatening the protection of springs and water courses and jeopardizing their ecological functions. It is estimated that almost six million hectares of native vegetation were deforested in the Xingu basin, including about 300 thousand hectares of private lands which, by law, must be maintained as forests. These areas would have helped to ensure the maintenance of environmental services such as genetic flow – the ability of animals and plants to mix within green corridors in order to reproduce – and water filtering. Along with 'forest recovery', these areas can play a vital role in both conservation and reducing forest degradation.

The fight of Acre-state rubber tappers in the mid-1980s highlighted the direct relation between defending their traditional way of life and the preservation of the Amazon forest. This triggered the creation of the 'Forest Peoples' Alliance', which included several traditional communities and indigenous peoples.

Since then, the debate on the conservation of the Amazon has gained a new urgency. At its heart is a recognition that protected areas are not just environmental sanctuaries, but home to countless indigenous peoples and forest-dependent communities. These communities have an important role to play in conserving biodiversity and restoring degraded ecosystems. International initiatives, such as REDD-plus have the potential to strengthen conservation efforts and safeguard these people's livelihoods.

In 1992 the CBD recognized indigenous peoples and traditional communities as the main actors of conservation. The existence of natural resource management systems based on respect for natural cycles and the recovery capacity of ecosystems, which derive from tradition-based knowledge, represent the basis of this sustainable use of forests.

Indigenous lands should be considered a fundamental component of a national conservation strategy. These currently comprise 12 per cent of Brazil's total national

territory and 21 per cent of what is legally defined as the Brazilian Amazon. They also contain uniquely diverse ecosystems, which must be conserved as a natural resource. Indigenous people consider that securing their territories is fundamental to the continuity, conservation, sustainable use and management of biodiversity.

This is the challenge that the *'Y Ikatu Xingu'* campaign plans to address. Created in 2004 to protect the springs and headwaters of the Xingu river, in the state of Mato Grosso, it involves indigenous peoples, farmers, family agriculture producers, researchers and civil society organizations in a uniquely innovative collective effort. The campaign seeks to promote a forest and agro-forestry culture by training socio-environmental agents in networks ranging from city halls to indigenous community villages. The methodology used is 'learning by doing'. The campaign focuses on the development and improvement of techniques for forest recovery that are simultaneously effective from an ecological point of view and economically feasible for the reality of the Xingu basin. The planning and territorial management of the Xingu river basin region is also on the agenda.

The experience of mechanized forest planting is one of the big innovations developed by the campaign. Agricultural machinery is being used to plant seeds of native species over large areas, where recovery through seedlings would be prohibitively slow and expensive. The initiative has generated a growing demand for native seeds which has led to the development of the Xingu Seeds Network.

The network is composed of 300 collectors, 11 collection groups, 12 collection sub-groups, 10 settlements, six indigenous communities and 25 civil society organizations from 16 municipalities (See figure 1). Its main activities are the training of seed collectors and the creation of a seed exchange market. It aims to generate income for family rural producers and indigenous communities; and to act as a communications and exchange channel amongst seeds collectors, plant nurseries, NGOs, rural property owners and other stakeholders.

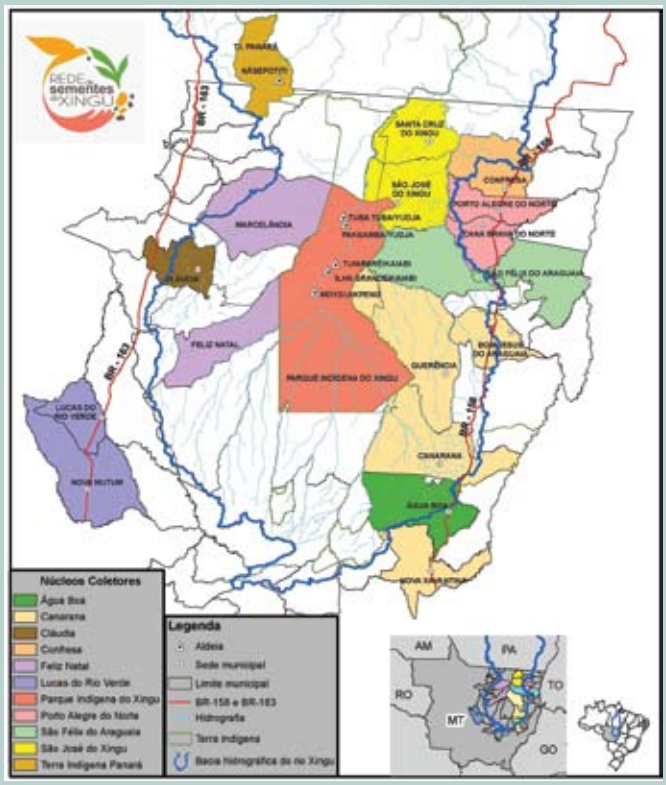


Figure 1: Map of the municipalities and collection groups that participate in the Xingu Seeds Network.

The network is structured in a participative way, through the continued training of seed collectors; experience sharing; and bring together the knowledge of rural producers, indigenous peoples, technicians and researchers. It also provides stakeholders with a means by which they can articulate their experiences. The discussions include finding and tending to species; improving seed collection techniques, storage, germination and harvesting of seeds; and developing plantations.

The collective decisions of the network, related to the construction of price tables and the definition of priority species, are taken at regular meetings, which provide an opportunity to exchange experiences and techniques and discuss the organization of work and other issues related to the network. These are attended by representatives of all the major groups of seed collectors. For the construction of price tables, for example, the criteria used include the size of the seed, the scarcity of the specimen, the difficulty and time used in the collection and/or improvement, the seed germination rate and the demand, function or usefulness of species.

The network has a list of 230 species with the estimated number that can be collected by each group. The storage of seeds takes place in three seed houses. Between 2007 and 2009, 25 tonnes of seeds were commercialized, generating 250,000 Brazilian Reais in income for collectors and therefore supplying the increasing demand for seeds for the recovery of degraded protected areas in the region.

The experience in the Xingu Basin is an example of how a combination of different stakeholders and multiple strategies can work together to address socio-environmental challenges in places like the Amazon. The involvement of indigenous peoples and other traditional communities must be prioritized in the fight against deforestation. Mechanisms like REDD-plus can become an effective instrument in support of this challenge, leveraging social benefits and economic sustainability, as long as the rights of these peoples are taken into account seriously.

DEVELOPING SAFEGUARDS FOR REDD-PLUS: THE IMPORTANCE OF A COLLABORATIVE APPROACH

Mauricio Voivodic, Rubens Gomes, Paula Franco Moreira, Luis Meneses, Andre Nahur and Talia Bonfante

Local farmers in Rondônia state, in the eastern Brazilian Amazon, discuss REDD-plus safeguards.
photo: Andre Costa Nahur

The Intergovernmental Panel on Climate Change (IPCC) recognized, in 2007, that reducing deforestation and degradation of tropical forests would have a massive effect, in the short and medium terms, on the reduction of global carbon emissions and its harmful effects on global climate change.

In this context, the REDD-plus mechanism has created a unique opportunity for concentrating political and financial resources to reduce the alarming rates of tropical forest loss. The original Reducing Emissions from Deforestation and forest Degradation (REDD) mechanism is a set of steps designed to use financial incentives in order to reduce the emissions of greenhouse gases from deforestation and forest degradation. However, REDD-plus covers issues that go beyond simply emissions reductions, such as:

• maintenance of biodiversity and other environmental services;

• a shift from an exploitative development model to a sustainable economy associated with forest conservation; and

• the preservation and valuation of the cultural and religious diversity and the livelihoods of about 350 million indigenous peoples and local communities that live in and depend on forests.

During the Copenhagen climate talks in December 2009, safeguards for REDD-plus activities were discussed by the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA). There was a consensus that certain safeguards should be respected when implementing REDD-plus activities. Among these are:

• protection and conservation of natural forests, ecosystem services and biological diversity;

• non-conversion of natural forests; and

• respect for the rights and knowledge of indigenous peoples and local communities, including consideration of the United Nations Declaration on the Rights of Indigenous Peoples.

The text produced by the group emphasizes the importance of engaging multiple actors in the debate on REDD-plus, highlighting that it needs to be discussed not only in the international arena, but also at regional and local levels, involving governments, the private sector, civil society and, in particular, indigenous peoples and local communities.

The apparent agreement on these safeguards amongst the representatives of the 200 or so countries that are part of the United Nations Framework Convention on Climate Change (UNFCCC) represents a huge achievement and a signal that socio-environmental issues cannot be forgotten or dealt with in a trite or authoritarian manner.

Despite these recent advancements in the international debate, however, the local situation is often still challenging. Pilot programmes and projects for REDD-plus are being implemented in many countries under different methodologies promoted by national or local governments, companies or civil society organizations. These remain largely unregulated and there has been little discussion about how to involve stakeholders and respect the rights of indigenous peoples. This situation has even resulted in the rejection of REDD-plus mechanisms from some indigenous peoples organizations, symbolically represented by the motto: 'no rights, no REDD!'

Uncertainty over the social and environmental conditions of pilot REDD-plus projects in Brazil was widely manifested by social movement organizations during a seminar, held in April 2009. This resulted in a decision by a group composed of environmental organizations, representatives of indigenous peoples and local communities, rural producers and research institutes to start a broad and inclusive process that could become a reference to help to guide REDD-plus programmes and projects everywhere.

The first stage was the creation of a multi-stakeholder committee to represent the different sectors involved or affected by REDD-plus mechanisms. This has revised several background documents that dealt with environmental or social issues of REDD and, from there, a draft was composed with a set of socio-environmental safeguards, organized into themes.

This document was then submitted to a broad public consultation process and disseminated over the internet for 150 days. Altogether, 559 responses were received from about 200 people and organizations. The consultation included important civil society groups such as the Amazon Working Group (*Grupo de Trabalho Amazônico* – GTA), the Confederation of Indigenous Organizations of the Brazilian Amazon (*Coordenação das Organizações Indígenas da Amazônia Brasileira* – COIAB), the National Council of Extractive Communities (*Conselho Nacional das Populações Extrativistas* – CNS) and the National Confederation of Agricultural Workers (*Confederação Nacional dos Trabalhadores na Agricultura* – CONTAG). These networks have organized meetings with representatives of indigenous peoples, local communities and family farmers from all of the Amazon states. About 150 community leaders, representing different regions of the Amazon, have participated in these meetings. Meetings were also held in São Paulo, with the private sector, and with family farmers from the south of the Amazon.

All the responses were registered and presented for discussion to the committee members, who composed the final version of the REDD-plus socio-environmental safeguards based on them. These are organized around eight principles and 27 criteria. Committee decisions were taken by consensus, which makes the document a major multi-stakeholder agreement on the criteria to be adopted in REDD-plus activities to minimize socio-environmental risks.

The criteria include critical aspects for the effectiveness of REDD-plus activities related to transparency, participation, guarantee of traditional rights, benefit-

sharing and biodiversity conservation. One of them states that the beneficiaries of REDD-plus activities should be those that hold the usage rights of the land and/or natural resources, and that promote conservation activities, sustainable use and forest recovery. Another guarantees beneficiaries the right to free, previous and informed consent, and participation in all stages of the REDD-plus activities, including in the decision making processes related to the definition, negotiation and benefit sharing. The document also states that all high biodiversity conservation value attributes shall be previously identified, protected and monitored and that forest restoration shall use only native species.

Taken together, these criteria contribute to a broad ranging discussion related to land use in Brazil, strengthening the links between biodiversity conservation, social rights, climate change and agriculture. As a result, the document can be considered a manifesto agreed by many different sectors of Brazilian civil society, and has become an important reference at the state and federal level.

This initiative also contains relevant lessons for the international debate on REDD-plus and will be shared with other countries in order to encourage similar processes in other regions. One major point was the recognition of how important it is to have a broad discussion process on REDD-plus safeguards involving the effective participation of all stakeholders, especially indigenous peoples and local communities. Such actors were not simply consulted during the process, but were mainly responsible for the construction of the document, which has strengthened its legitimacy and their sense of ownership of it.

Finally, as this issue deals with a complex theme that involves many different – and sometimes opposing – interests of society, the discussion on REDD-plus cannot follow the conventional top-down path. This initiative has shown that the development of safeguards through a collective effort and collaborative approach, and at a regional scale, is not only possible but crucial for the effectiveness of REDD-plus. Social and environmental aspects are peculiar to each region, and it is at this level where the main risks associated with REDD-plus are found. The definition of safeguards by the UNFCCC is important, but it does not substitute in any way for the importance of local debate.

ECONOMIC APPROACHES TO BIODIVERSITY & ECOSYSTEM SERVICES

Pavan Sukhdev

Why mix economics with biodiversity? Isn't one about prices and markets, while the other concerns the priceless living fabric of this planet, for which there are no markets? These are good questions. Their answers lie in an understanding of ecosystem services, their importance for human well-being, their economic value and at the same time their economic invisibility.

Ecosystem Services

Most of the goods and services that flow to humanity from nature are public. In other words, they are available to all, enough for all, and nobody can prevent another from receiving them. Furthermore, they are usually received directly from nature, not through markets, and are mostly free. At an ecosystem level, they include water regulation, prevention of soil erosion, carbon storage and sequestration. At a species level, we benefit from nature's provision of food, fibre, fuel-wood, crop pollination, and so on. Even at the genetic level, we receive free services – since bio-prospected discoveries provide the molecules for new medicines, and crop genetic diversity improves their disease resistance.

Private wealth is well recognized and recorded, so can be priced and traded, managed for well-being, and even taxed. But the public wealth that is in Nature is less easy to identify, which leads to its devaluation, dissipation and loss. Our first point is, therefore, that all these goods and services are too important to ignore for any form of decision-making in the public interest, especially in the interest of poorer sections of society. Rather than continuing to ignore the value and importance of such public wealth, *The Economics of Ecosystems and Biodiversity* (TEEB) emphasizes its economic worth to our economies and our wellbeing, our livelihoods and our health.

The TEEB approach is to press these values into serious consideration by policy-makers, administrators, businesses and individuals. Sometimes, just *recognizing* their value can lead to policy change – for example, a comprehensive stakeholder workshop to examine the problem of Coral Reef losses, in Tubbataha, Philippines, in 1998 led to a successful 'no-take' zone being established in 2006, followed by the 'Tubbataha Reefs National Park Act' in 2010. At other times, *demonstrating* their economic worth can lead to effective policy change – for example, the Nakivubo swamp near Kampala was conserved as a natural waste management facility instead of being converted into farmland as the economic value of the former use was higher than the latter. Finally, in certain cases, *capturing* value may be required, through mechanisms to reward stakeholders, local communities, and others who can help solve the problem of loss of natural capital. For example, Costa Rica's Payments for Environmental Services (PES) scheme, and indeed, another fifty PES schemes which are detailed in our TEEB report for local and regional policy-makers.

Natural Capital: Development's Biggest Asset

Another good question, frequently asked: 'is nature conservation at odds with human development?'

In Burkina Faso, management strategies in the Sourou Valley wetland had, for decades, focussed on promoting agriculture. The International Union for Conservation of Nature (IUCN) conducted an economic valuation of the products obtained, which revealed that only three per cent of the value related to agriculture, while other products generated by the wetland (forest products, fodder, and fisheries) accounted for more

than 80 per cent, and this did not include all wetland benefits. Local decision makers are now starting to integrate the valuation of ecosystem services into development plans.

This anecdotal example illustrates a well-supported observation: that the value of ecosystem services is a significant component of the livelihoods of rural and forest-dwelling people in developing countries, and conserving them and providing equitable access to them is very much a 'development' strategy. At TEEB, we calculated what these values would be for such communities in Brazil, India and Indonesia, for respective populations of forest-dependent and tribal societies, and subsistence farmers. The answers were poignant: these ecosystem services (whilst not a surprisingly large unrecorded percentage of National Income, or per cent of GDP) were estimated to be a seriously large 45-90 per cent of the 'GDP of the Rural Poor'. We find that Natural Capital, or the nation's ecosystems and biodiversity, is probably the biggest development asset of them all.

TEEB and Brazil

If one country can show the potential for all the TEEB study has revealed, it is Brazil, a 'global capital of natural capital'. Biological diversity plays a key role in the country's economy. It allows for products derived from genetic resources – ranging from pharmaceutical goods, cosmetics and perfumes to agricultural, mineral and other products to be developed. It also plays a major role in stabilizing the weather, in purifying the air and the water, in preserving soil fertility and maintaining its nutrient cycle. Brazil has the largest bio-capacity on Earth and its cultural and aesthetic benefits are enormous.

The Brazilian Amazon rainforest covers a surface area of 4.1million sq km, of which around 3.4 million sq km are presently forested. We already have an understanding of the Amazon's role in the battle against climate change, its massive carbon capture and storage potential, but from a TEEB perspective we look at much more than that. We see its value also lies in the genetic diversity that provides medicines, food, fibre and habitats. We see how it acts as a continental water pump, a rainmaker for the region, and reaching well beyond the borders of Brazil. These factors have a fundamental bearing on economic output and human wellbeing. They contribute to the global pharmaceutical industry, the primary industries of Brazil and its neighbours: the vineyards, the farms and even the fresh water that supports the cities that lie within the shadow of this magnificent tropical forest. When you consider how many aspects of the economy and wellbeing of not just Brazil, or its neighbours, but the world at large, depend on this huge source of biodiversity and ecosystem services, one has to question how we could justify the current rate of conversion to other forms of land use.

TEEB looks at this a little closer. The current economic paradigm encourages individuals, communities and companies to fell the rainforest for livestock farming, or crops such as soy. It is built around short-term gain and a system that does not recognise, demonstrate or capture the value of Nature. Yes, these short-term gains are significant for those using the land, but only for a limited period. Studies and experience have shown time and time again that after forests are felled and the land is converted to other uses, it is quickly rendered unproductive.

Managing Natural Capital

Globally, it is estimated that since 1960, one-third of the world's arable land has been lost through erosion and other degradation. The problem persists, with a reported rate of loss of over 10 million hectares per year. Globally, the land used and abandoned in the last 50 years may be equal to the amount of land used today.

REDD-plus has enormous potential to modify the 'business as usual' approach, which is seriously eroding Brazil's natural capital. The potential benefit of restoring the forests because of the benefits they provide is enormous. And what if agriculture did not rely on a ground zero approach for short-term gain, but incorporated better biodiversity management to ensure these benefits were maintained? And what if people were rewarded for their maintenance of this biodiversity and its ecosystem services alongside their agricultural production? The human welfare benefits of this approach are what the TEEB studies illustrate. Land management can adjust to incorporate this approach, and business and economic frameworks also can and should adjust to support this.

Brazil is acting to address this problem. For example, the National Confederation of Industry has underlined the importance of public private collaboration in addressing these issues, with its members calling for greater participation in drawing up and monitoring public policies designed to stimulate the sustainable use of Brazilian biodiversity. Brazil is also taking strong leadership in crafting a solution for REDD-plus, a proposed scheme for reducing deforestation and forest degradation, as well as increasing afforestation and sustainable management of forests. This UNFCCC-supported scheme already has some 'first-movers' in the form of the REDD-plus Partnership, a group of countries both developing and developed who are working together to pioneer ways of making REDD-plus work. It is hoped that REDD-plus will be self-financing over the longer term, even though it may begin as a public-financed initiative. At the heart of these schemes is the ethical dimension of addressing rural poverty and ensuring communities are rewarded for their positive land management actions.

There are some early signs of traction and success. Norway has committed US$ 1 billion to Brazil to help sustain significant recent reductions in its rate of deforestation. As successes multiply, with leadership from key participating countries such as Brazil, we hope there will be momentum towards an agreement amongst first-mover countries to mitigate an estimated seven billion tonnes of CO_2 over five years. As the details are worked out through actual experience, they could set precedents, be adopted more widely, and eventually integrated into a global REDD-plus agreement, as part of a new climate deal. Furthermore, once this 'carbon' PES scheme is set up and proved to function effectively, it could even become the legal and infrastructural anchor upon which to attach other PES - including for freshwater provision and species conservation. Clearly, the business opportunity that goes with such progress will be very significant, and this has no doubt crossed very many senior business minds.

Business Awareness and Opportunity

The PricewaterhouseCoopers 13th Annual Global chief executive officers (CEOs) survey revealed that Latin American CEOs are the most concerned of their peer group in the world about biodiversity loss as a threat to their business growth prospects. The Brazilian Business Council of Sustainable Development has been working with the World Business Council of Sustainable Development for a number of years in order to promote the business opportunities inherent within combining forest and agricultural activities with biodiversity. Examples of changing practice can be found. Companies such as tyre producer Michelin and wood pulp producer Veracel are combining sustainable plantations of eucalyptus, rubber and cocoa trees with ecological corridors to preserve and expand the last remnants of the Atlantic Forest, a rainforest that once covered most of eastern Brazil.

Given its extraordinary bio-capacity, Brazil's companies are ideally placed to capitalise on the boom in eco-certified products and services. One such example is the Brazilian natural cosmetics company, Natura, which has adopted the sustainable use of biodiversity as the main driver of innovation. Natura developed vegetable renewable alternatives to petrochemical raw materials, reducing the company's carbon footprint, and created an entire product line (Ekos) based on the sustainable use of biodiversity.

These signs are encouraging. The Brazilian Government recognizes the need to adjust its economic compass and sees the potential in a number of the recommendations made by TEEB. The articles in this publication clearly show that Brazil is addressing the issues it faces with regards to biodiversity loss, the livelihoods of local communities, and the need to improve agricultural practices. We are at a point at which we need to learn from each other, to share best practice and the innovation necessary to improve our economic compass and use it well. Not only does Brazil have a lot to gain from mainstreaming biodiversity into its policies and practice, but the rest of the world too has a lot we can learn from seeing how Brazil takes these initiatives forward.

At the end of the day, however, the international talks on climate and biodiversity are not just about one country. They are about one planet, many countries and one major opportunity to make an unprecedented commitment to recognising and rewarding the value of biodiversity in order to create a better future for us all.

OPPORTUNITIES FOR A GREEN ECONOMY

Peter H. May

The global recession has prompted renewed thinking about what can be done to avert further crises, while promoting social and environmental sustainability. Capitalizing on societal concerns about the impact of repetitive speculative bubbles and conspicuous consumption, the UN Environment Programme (UNEP) has called for a refocusing of the economy under the banner of a 'Global Green New Deal' so that the next growth cycle is less damaging to humans and to nature.

This is the time to take bold steps to respond to the risk of peak oil and future energy and food insecurity. The narrative of a 'clean energy race' is well established. Now is the time to launch a race towards a green economy, with green jobs and a more sustainable model of development.

Some countries have already begun this transition by stimulating the green economy. With cleaner technologies, there are new opportunities for growth and employment in productive sectors as well as among consumers and homeowners. Other initiatives are looking for new ways of measuring welfare that include the value of biodiversity and social equity.

The transition to a green economy represents an opportunity. It is a creative and necessary response to the financial crisis and its reflections in employment and household income.

Brazil's carbon and biodiversity footprint

More than 45 per cent of Brazil's energy matrix comes from renewable sources, including hydro power, ethanol, biodiesel, fuel wood, charcoal, solar and wind energy, in comparison with the average global level of 12 per cent. This high reliance on hydroelectricity and biofuels means that it is widely considered one of the 'cleanest' of the global economies. The Brazilian economy's energy intensity (energy use per unit of GDP) is also continuing to diminish as more efficient ways are found to generate, distribute and make use of primary energy supplies.

Successive innovations in Brazil's liquid fuel flexibility since the 1970s have been accomplished by stimulating use of sugarcane ethanol, mainly in order to build energy independence. This process culminated with the adoption of flex-fuel cars in 2003, which now make up over 90 per cent of the automotive fleet; ethanol is today responsible for 40 per cent of transport fuel use. Brazil is also determined to achieve greater self-reliance in diesel, and has managed to reach the B5 target (5 per cent biodiesel blend) in only a few years. Such decisions have helped to make Brazil one of the lowest global per-capita emitters of CO_2 from transport fuels.

On the other hand, Brazil remains one of the world's largest greenhouse gas (GHG) emitters when land-use and forests are included in the calculation. From 2000-2005, Brazil was responsible for nearly 50 per cent of all deforestation in the humid tropics worldwide. Historically, the principal drivers of this deforestation have been extensive ranching and its expansion into the Amazon and the Cerrado (a savannah-like mosaic of forest and grassland), which is responsible for as much as half of all Brazilian GHG emissions. Deforestation and methane from enteric digestion by cattle are major sources of global GHG emissions.

Yet since 2005, deforestation in the Brazilian Amazon has declined dramatically, in response to a mixture of tougher enforcement measures and market forces. Nevertheless, much remains to be done to consolidate reduced deforestation rates. The improvement of existing cattle ranching practices is the highest priority of all for REDD-plus as these are still the principal source of GHG emissions. All actors in the beef supply chain have a role to play: the producer – by adopting low cost techniques to intensify pasture use and avoid further

deforestation; the slaughterhouse – by restricting cattle purchases to farms which observe the most fundamental standards for environmental protection and fully respect labour laws; the supermarket – by protecting and informing the consumer of the origin of the meat they buy; and the consumer – by refusing beef obtained from questionable sources.

Secure and dramatically improved returns to the producer can be obtained by investing in improved pastures, rotational fencing and other simple techniques. However, there are a number of challenges to their uptake that need to be overcome, such as the eradication of perverse subsidies. The current structure of public financial support to the cattle industry has promoted the expansion of herds primarily in the Amazon region, without commensurate investment in recuperation of degraded pastures and efforts by ranchers to observe the Forest Code. The National Development Bank has adopted a series of measures to promote sustainable ranching and an industry Working Group on Sustainable Ranching has been formed to develop certification criteria. Meanwhile, the Public Prosecutor's office in Amazon states has exacted stiff punishments on slaughterhouses that do not comply with the law; supermarkets have placed moratoria on beef sourced from deforested areas; and civil society organizations have taken on the role of watchdogs, helping to ensure compliance by other actors in the chain. This is one critical area where concerted action can yield a response for both climate and biodiversity.

The high nitrogen use in large-scale intensive cropping systems and the disposal of animal residues from confined production is also a major cause of emissions. Soya cultivation has grown at a rapid pace. It is now the source of 90 per cent of the vegetable oil used in biodiesel in Brazil. Despite the relative dependence on large-scale soy production, the industry-adopted moratorium against its cultivation in areas of recent deforestation has paid off. The establishment of the 'Social Energy' programme which provides incentives to biodiesel refiners who purchase at least 10 per cent of their feedstock through contracts with small farm associations is also welcome. Soybean producers have increasingly adopted conservation tillage practices which retain a good share of carbon in the soil, while improving net incomes. However, the increased use of herbicides proprietary to seed producers still provokes controversy. Although genetic modification has enhanced crop resistance to weed control, the long-term health and environmental risks associated with such large scale manipulation remain contentious.

Biofuel feedstock alternatives such as castor bean, jatropha and oil palm have so far received short shrift although they may be more appropriate for production by family farmers and more suited for integration into regional agro-ecosystems. Further research, technical and financial support toward these alternatives is warranted. Brazil's adoption of zoning restrictions for the expansion of sugarcane plantations in fragile areas such as the Pantanal and the Amazon, also show responsiveness to the concerns of civil society over the impacts of large-scale biofuel expansion on biodiversity and traditional communities. Monitoring and verification by local and regional watchdog organizations will be crucial in assuring that such safeguards are observed in practice.

What more can be done?

Another response is to seek solutions through the market, by first establishing a ceiling on, for example, emissions, and then creating trading schemes. This is the theory behind 'cap and trade', a system that is already being applied in the carbon emissions compliance market and which may put a price on resources like biodiversity protection that were previously thought of as 'free goods'. In Brazil, serious consideration is already being given to the implementation of flexible markets for both carbon emissions and conservation areas on private lands. In the latter instance, private properties are required by Brazil's Forest Code to protect a certain area of their land for conservation. If, as is often the case with commercial producers, they have exceeded these limits, one option would be to purchase development rights from landowners who have not exceeded them, thus creating a market for trade.

Adoption of any of the more innovative economic instruments would require that society adopt strict limits on emissions and on the extent of ecosystem modification. Within such limits, firms

and producers could negotiate opportunities for payments or compensation for environmental goods and services that can enhance the viability of more environmentally appropriate production systems. Such an approach would be less costly overall than applying a uniform restriction over an entire industry. Important pilot efforts in this direction are already being pursued in various parts of Brazil associated with forest conservation, water resource management and biodiversity protection. Needless to say, Brazil's experiences with these alternatives will be useful for other countries that opt for a green development path.

Although conflicts exist between global and local objectives, it is clear that alternatives are being avidly pursued by Brazil in the quest for a greener economy. Recognizing the true value of biodiversity and ecosystem services and internalizing the costs associated with their destruction can set Brazil and the world on the path towards a greener global economy, using new technologies in smarter ways, promoting low carbon and resource efficient production and consumption, and encouraging trade in green goods and services. There is a need to redirect incentives and fortify consumer awareness so the economy as a whole can better reflect the nation's unparalleled opportunities for development without further resource degradation.

CLIMATE CHANGE AND BRAZILIAN AGRICULTURE: VULNERABILITIES, MITIGATION AND ADAPTATION, THE ROLE OF BIODIVERSITY

Eduardo Delgado Assad and Hilton Silveira Pinto

The rise in temperature due to global warming may provoke drastic changes to the agricultural production map of Brazil. Areas which are currently the biggest producers of grains may no longer be suitable for plantation well before the end of the century.

Coffee, sugar cane, beans, cassava, maize and soybeans currently represent 86 percent of the total area planted in Brazil. But the pattern of crops could change considerably as a result of climate change. Cassava may vanish from the semi-arid region of the northeast and coffee will have a slim chance of survival in the southeast. On the other hand, Brazil's southern region could become suitable for planting both crops as the risk of frost diminishes. Sugarcane could spread throughout the country to the point of doubling its area, but water shortages could threaten the cultivation of soya in more parts of the country.

In addition to this, increasing global demand for meat, for socio-economic reasons, is leading to an expansion of livestock farming, which will add to the replacement of natural vegetation by pastures. This is likely to cause further loss of biodiversity, which further increases greenhouse gas (GHG) emissions and reduces the possibility of finding plants more adapted to the high temperatures. According to recent scientific studies, plants are capable of handling the problem up to a temperature rise of 2°C, but begin to have difficulties in photosynthesizing above that mark.

The vulnerability of Brazilian agriculture has been assessed by 'Climate Risk Zoning' – a public policy programme of the Brazilian Ministry of Agriculture, covering around 40 crops. This programme was first established in 1996, in partnership with The Brazilian Agricultural Research Corporation *Empressa Brasileira de Pesquisa Agropecuaria* – EMBRAPA), the University of Campinas (UNICAMP) and other scientific institutions, to disclose the risk levels facing over 5,000 Brazilian towns for the country's most common crops. With this tool it is possible to know what to plant, and where and when to plant it.

The programme has also created, in effect, a map of the country's entire agricultural economy, which can be used to analyse the effects the various global warming scenarios presented by the IPCC in its latest report could have on Brazilian agriculture. The principal impacts in the next 40 years are predicted to be:

• Global warming could jeopardise food production, leading to losses of up to US$3.2 billion in 2020 and reaching up to US$7.0 billion in 2070.

• Soya could be the most affected crop. In the worst case scenario, up to 40 per cent of the crop could be lost by 2070, leading to financial losses of up to US$3.8 billion.

• Almost 33 per cent of the arabica coffee currently being cultivated at low risk in São Paulo and Minas Gerais, could be lost, although this may be compensated for by an increase in production in the south of Brazil.

• Maize, rice, beans, cotton and sunflower could suffer extreme reductions in their low risk areas in the north with a significant fall in production.

• Cassava could actually gain in its low risk areas, but will suffer serious losses in the northeast.

• Sugarcane production could double over the coming decades.

• Under the current model of agricultural production, the agriculture and livestock sector will emit about 480 megatonnes of CO_2 equivalent per year.

The simulations indicate a bleak future, but there is time to avoid significant losses, if we understand the links between agriculture, biodiversity and climate change. On the one hand, agriculture is partly responsible for global warming: greenhouse gas emissions produced by agriculture, excluding those from deforestation and conversion of land for agriculture, account from 22 per cent to 25 per cent of all emissions in Brazil. On the other, the effects of global warming can damage agricultural production.

In Copenhagen, the Brazilian Government committed to reduce emissions by 36.1 per cent to 38.9 per cent by 2020, avoiding the emission of around 1 gigatonne of CO_2 equivalent. It announced a programme of voluntary actions, which include:

• An 80 per cent reduction in the rate of deforestation in the Amazon and 40 per cent in the Cerrado (a savannah-like mosaic of forest and grassland), which corresponds to around 669 megatonnes of CO_2 equivalent.

• Promotion of actions in the agricultural area for the recovery of degraded pastures for crop-livestock integration, designed to expand no-tillage systems and nitrogen fixation, thereby reducing emissions from 133 to 166 megatonnes of CO_2 equivalent by 2020.

• Improved energy efficiency through the use of biofuels; expanding the network of hydro and alternative energy sources, such as biomass, wind turbines and small hydro; and promoting the production of charcoal from planted forests for the steel industry. The aim is to reduce emissions by 174 to 217 megatonnes of CO_2 equivalent.

The agricultural sector started to implement medium and long-term solutions to mitigate the climate change problem in 2010. The Government invested about US$1 billion in a programme to reduce deforestation, increase agricultural production and preserve biodiversity.

The main solution for Brazil is the adoption of practices to prevent the advance of deforestation by preventing the opening of new plantation areas. Degraded pastures cover approximately 100 million hectares in Brazil today. The recovery of these, if properly worked, could allow agricultural growth without the need for any further deforestation. At the same time, systems could be adopted to capture and store CO_2 from the atmosphere. Organic enrichment of pastures may also reduce their contribution to global emissions.

It is important to highlight the role of the biodiversity in securing agriculture in the future. With the changes in temperature, many crops may become unsuitable for a specific region. However, if we have a great variety of species available, we may find a way to adapt agriculture to climate change.

Without a rich reservoir of biodiversity to draw on, it will be impossible to select traits from non-commercial species, such as those in arid environments, and breed these traits into commercial species, such as wheat or maize. For instance in the Brazilian Amazon and Cerrado there are thousands of plants, including natural pastures, with high heat tolerance, but the future of these could be threatened by further temperature rises.

The semi-arid hinterland in the Brazilian northeast is likely to be the most affected region by climate change. With the risk of accelerated desertification, it could become unsuitable for the majority of the crops presently farmed there, especially cassava and maize. Many believe that the solution to this problem lies within the crops of the Caatinga (semi-arid bush land) themselves as resistance to drought is the main feature of plants in this region.

The idea is to use a better understanding of more drought-resistant plants to stimulate a wider range of crops. Various characteristic species of the biome are much more efficient as forage plants, for example, than the exotic grasses that were implanted in the region.

The problem is that producers keep insisting on planting some crops that are not suited to the region. Rather than planting maize, rice, beans and soya, it is possible to cultivate natural plants like xique-xique, a cactus used by farmers as an alternative to animal feed during periods of prolonged drought, or some leguminous plants like catingueira, jurema and angico. Fruits like umbu – which is is used in the manufacture of pulp, juice, ice cream and candy – cajá – a type of plum – and wild passion fruit can also be produced at large scale. Rural, drought-resistant, species of natural colour cotton, very similar to commercial cotton, could even compete in the market. Researchers from EMBRAPA are also investigating more drought-resistant varieties of cassava that could be planted in the place of the standard commercial crop.

Some of these alternatives have been known for years, but according to EMBRAPA researchers, there are a lack of incentives to domesticate these plants and to produce them at large-scale.

Scientists are also developing genetic variants of soybean, maize, beans, coffee, cassava and some fruits which are more tolerant to high temperatures and droughts. The studies are at an advanced stage, but even if they result in more resistant plants, as discussed above, there is a limit about how far genetic improvement can go.

One potential avenue of research is on 'second generation' genetically-modified (GM) crops, which, instead of just being herbicide-tolerant or pest-resistant, would be more suited to severe environmental conditions. This proposal aims to find plants which are naturally more tolerant of high temperatures and water shortages, and use their genes to produce more resistant farm crops. EMBRAPA is analyzing native species of the Cerrado which are more adapted to the characteristic variations in temperature and rainfall in the region. The researchers have already identified five plants (broadleaf pau-terra, small-leaf pau-terra, pacari, faveiro and sucupira preta) which occur in over 80 per cent of the biome, suggesting a high adaptive capacity. The next step is to isolate the genes which give them these characteristics.

Similar studies are also being planned for the Caatinga region. The value of the biodiversity of the two biomes is an important argument for the prevention of deforestation. In the future perhaps we will say that biodiversity is the salvation of agriculture.

THE GLOBAL TRANSITION TO A LOW-CARBON ECONOMY AND THE PROTECTION OF BIODIVERSITY: DEADLOCKS AND PERSPECTIVES

Eduardo Viola and Cristina Inoue

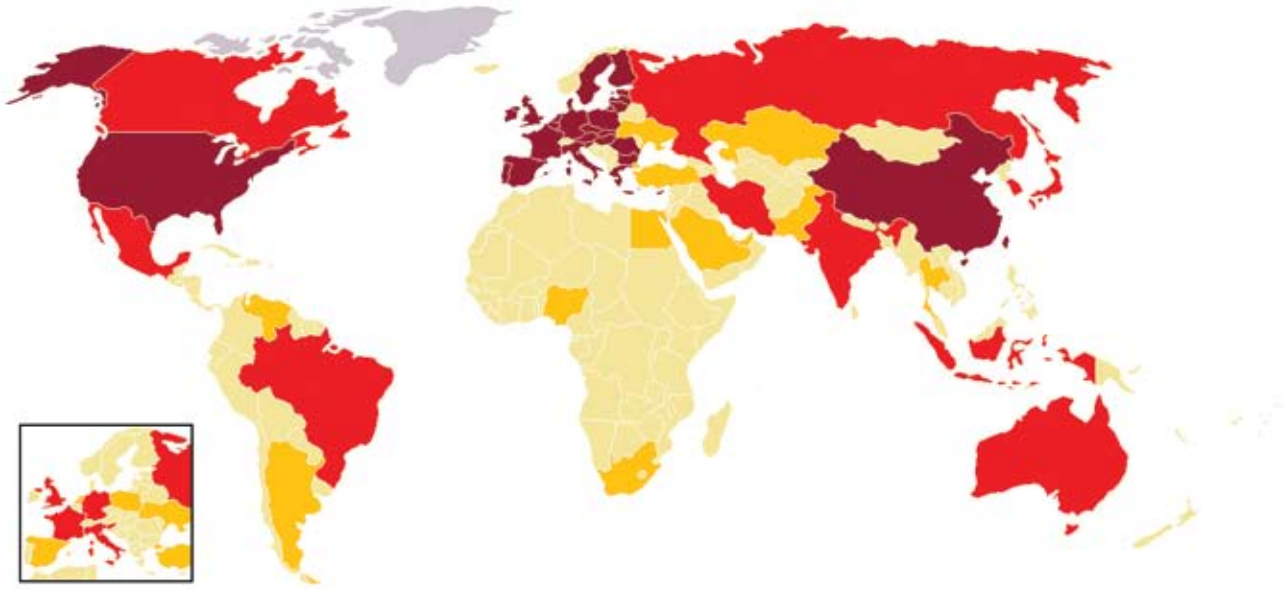


Figure 1: Countries by total national greenhouse gas emissions. Darker colours represent higher emissions. The EU is coloured as a block. EU emissions by country can be seen in the insert at bottom-left. Based on data from the World Resources Institute.

The governance architectures on global climate change and biodiversity protection have a number of potential synergies and conflicts. Despite this, the two issues are dealt with almost separately.

Eleven countries and the European Union (EU) are responsible for more than 80 per cent of global greenhouse gas emissions (See figure 1). Within this group, three major emitters — the USA, China and the EU — make up almost 60 per cent of global carbon emissions. No agreement on climate change will be possible without their full engagement, as they effectively have the power to fully or partially veto a deal by withholding their cooperation. This is the main structural reason why progress towards a global deal to mitigate climate change is currently paralyzed. The other 20 percent of global emissions are contributed by nine smaller — but still significant — emitters: Brazil, Canada, India, Indonesia, Japan, Mexico, Russia, South Africa and South Korea. None of them effectively wield, individually, a veto over a deal. But this group of countries is fundamentally important.

The main divide in the climate debate is no longer between developed and developing countries. In 2010, there are 'progressive' and 'conservative' countries in both groups. These groups are widely seen as being formed by the USA, along with many of the emerging economies on one side and the EU (especially the 'older' members), Japan, South Korea and Mexico on the other. While Brazil has a 'progressive' national emissions reduction target, its position in the international negotiations is more 'conservative', in line with those of the other countries of the "BASIC group" as well as the G77.

The 'Group of Like-Minded Mega-diverse Countries' (LMMC), created under the Convention on Biological Diversity (CBD), straddles the geographical division of the UN by continent and established political blocks. It consists of 17 developing countries, which together contain more than 70 per cent of the world's biodiversity (See figure 2). These are: Bolivia, Brazil, China, Colombia, Costa Rica, Democratic Republic of Congo, Ecuador, Kenya, India, Indonesia, Madagascar, Malaysia, Mexico, Philippines, South Africa and Venezuela. Australia is also a mega-diverse country, but it does not take part in LMMC.

There is a marked difference between the list of countries which significantly contribute to global biodiversity and that of the major emitters. Only China is both a major emitter and a mega-diverse country. However, of the nine average emitters, five of them are mega-diverse countries: Brazil, India, Indonesia, Mexico and South Africa. This creates some opportunity for synergies between mitigating climate change and conserving biodiversity, considering that land-use and the destruction of habitats are significant forces in both problems.

The main divide in biodiversity is still between those countries with high incomes and those with low and medium incomes. For example, this divide can be seen in the CBD negotiations on the establishment of an international regime designed to regulate access to and sharing of the benefits from genetic resources (Access and Benefit Sharing or ABS). This issue and the implementation of a Strategic Plan for the 2011-2020 period are on the agenda of the 10th Conference of the Parties to the CBD. The relation between biodiversity and climate change is only one of many issues that compose this Strategic Plan.

The CDB has been under less of a spotlight than the United Nations Framework Convention on Climate Change (UNFCCC). First, this is because the UNFCCC deals with a theme that is currently a fundamental for the global economy: energy. It is also widely viewed — rightly or wrongly — as producing potential winners and losers to changes from the status quo. Second, even though climate change has become a central issue in the international system, the attention given to biodiversity by policymakers and opinion formers has been far behind that given to climate change. Current

Figure 2: Like-Minded Mega-diverse Countries plus Australia.

knowledge on the relationship between biodiversity and the global economy is insufficient and there is a lack of rigorous estimates for the economic and social impacts of the loss or conservation of biological diversity for most countries.

However, although it is more complex and there is less understanding of its potential costs and benefits, the protection of biodiversity also raises issues of fundamental importance. It similarly involves an intrinsic conflict between sovereign interests in biological resources and their protection as a common concern for humanity, thus making it difficult for this issue to be dealt with as a global theme and to relate it to politics and the economy.

There are also potential synergies between biodiversity and climate change. In the first place, the interdependence of climate and biodiversity issues is very intense: global warming exacerbates the ongoing loss of biological diversity, thus increasing the planet's vulnerability to extreme climate phenomena. Climate change may become the main cause of biodiversity loss by the end of the century and it already results in a series of changes to habitats, the life cycles of the animals and plants that live within them and ultimately in the evolution of new adaptations. Biodiversity changes will also affect the ecosystem services human beings depend on, including water and air quality, pollination, food production, decomposition and nutrient cycling, carbon sequestration, and many other aspects. Secondly, biodiversity can help reduce the impacts of climate change. Habitat conservation, for example, through the conservation of mangroves, can be related to reductions in carbon emissions and reducing the risk of extreme climate events such as floods and storms. Thirdly, mitigation actions, such as reducing deforestation and forest degradation, have positive impacts on biodiversity conservation. For example, land-based carbon projects or initiatives for Reducing Emissions from Deforestation and forest Degradation (REDD-plus) could sequester carbon while safeguarding biodiversity.

The challenges, on the other side, include: First of all, the construction of governance architectures to promote these synergies. Currently, the interaction between both problems is dealt with in way which is clearly inadequate. The structure of the UN system promotes compartmentalization, hindering negotiations across and between different Conventions. This limits interaction in both arenas, which results in a superficial approach to the issue.

Secondly, the choice of alternatives for the construction of a low-carbon economy, as well as the choice of projects for the Clean Development Mechanism, could conflict with biodiversity protection. Potential conflicts need to be identified and, where possible, lessened or eliminated. For example, biofuel production or the construction of major dams have the potential to affect local or global biological diversity. However, the decisions of governments on this issue within the CBD have only had limited impact to date. Another challenge is the need to make intellectual property rights more flexible in the field of low-carbon technologies and biodiversity/biotechnology. There is also some resistance within the negotiations on the regime of ABS and in the reform of the World Trade Organization's trade-related intellectual property rights (TRIPS).

Many observers believe that the international politics of climate change and biodiversity changed deeply in 2009. The Kyoto Protocol, in which the USA and major emerging economies did not participate, has now been joined by the Copenhagen Accord. While this is widely viewed as being legally ambiguous, it was at least almost universally agreed to by the major carbon emitters. However, the prospects of a broad, legally-binding new deal will largely depend on broader developments in international relations and political dynamics in individual countries, in particular the USA. Discussions in Congress on comprehensive energy and climate legislation are currently stalled. Given the current dynamic, new legislation seems unlikely before 2013, assuming President Obama is re-elected in 2012.

Two future scenarios can be imagined. On one side, the continuation of progress on global economic governance carried out in 2009 with a multiplication of agreement areas amongst countries on security issues (reduction of nuclear arsenals, the fight against nuclear proliferation and terrorism) would favor a trend for cooperation and continuing depolarization in the coming years. This would make it possible that, the major emitters of the EU, US and China, alongside the world's smaller emitters could find a way to establish

emission caps and different stabilization years. These might be as soon as possible for the developed economies, before 2020 for relatively more developed emerging economies like those of Brazil and China, and between 2025 and 2030 for India, considering the difference in per capita emissions between these countries. A shift in the positions of the emerging economies could persuade the US Congress to make it possible for the USA to broaden its targets and bring it closer to the commitments of Europe and Japan. All this would strengthen the path for a new international climate architecture, which should be broad and consistent enough to include biodiversity protection at its center.

On the other side, persistent tensions between surplus and deficit countries in international trade, could limit or even halt the economic governance improvements made by the G20 in 2009. In this scenario, the international arena would be a more challenging place, with potential for a partial reversion of the depolarization dynamic achieved in 2008 and 2009. With the possibility of no change in this dynamic over the next two or three years, there could be no progress in international climate negotiations and the global transition to a sustainable low-carbon economy would be very slow. This could see the establishment of trade barriers for high-carbon products which would have a serious and negative impact on world trade and on many emerging economies as well as the least developed. Some emerging economies could rapidly increase the proportion of low-carbon products in their exports by making major advances in wind and solar energy. Brazil could be in a comfortable position if it manages to sustain recent reductions in deforestation and move towards reductions in carbon emissions from its agriculture sector. In addition, unlike other developing countries, Brazil could use this to attract resources from compensation mechanisms for REDD-plus, or payments for environmental services, which would be in synergy with biodiversity protection.

A fundamental question for 2010 is whether the current paralysis in the climate change negotiations will have a direct negative impact on efforts to advance discussions on biodiversity. The most acceptable answer is no. In the short term, improvements in the biodiversity regime are less dependent on changes in the global governance architecture. Governmental and non-governmental stakeholders can concentrate efforts in areas that do not conflict with the main deals that are necessary to advance the transition towards a low-carbon economy.

Even so, the biodiversity regime faces challenges such as a binding ABS Protocol, which has been gaining lots of attention within the CBD. This could delay the systematic recognition and understanding of the interactions between biodiversity and climate change.

In the long term, if we are to stabilize the climate and ensure ecosystems remain productive, we will need to establish governance mechanisms which recognize the synergies between climate and biodiversity. And without a deal to effectively tackle climate change, it will not be possible to deal with biodiversity conservation. It is necessary to deepen our understanding of the interactions between climate and biodiversity. Furthermore, we need to move towards broad and multi-scale governance architectures that go beyond the compartmentalization of these themes into specific regimes, restrained by counter-productive negotiation dynamics, exploring the synergies among both themes and overcoming challenges. We therefore need to look beyond the current disconnected approach to take a broader view of the potential deadlocks and perspectives in order to achieve a global transition to a low-carbon economy associated with biodiversity protection.

REDUCING EMISSIONS FROM DEFORESTATION AT MUNICIPAL LEVEL: A CASE STUDY OF PARAGOMINAS, EASTERN BRAZILIAN AMAZON

Brenda Brito, Carlos Souza Jr and Paulo Amaral

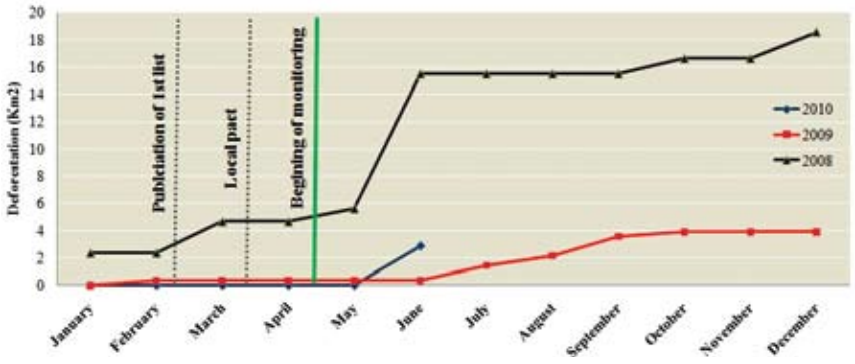
Brazil is among the top three countries that most contributed to deforestation in the last decade. Deforestation in the Brazilian Amazon has decreased from 27,400 km^2 in 2003-2004 to 7,400 km^2 in 2008-2009, but this figure is still alarming. The major causes of deforestation in the Brazilian Amazon are the expansion of cattle ranching and agriculture, in addition to land speculation. These drivers usually persist due to failures in forest governance, such as poor enforcement of environmental laws, lack of coordination among the agencies in charge of environmental control and lack of clarity over forest tenure.

In 2008 the Ministry of Environment published a list of the 36 municipalities with the highest deforestation rates in the Amazon. This was part of a new policy to reduce deforestation, by 'naming and shaming' municipalities. These municipalities lost access to credit for forestry and agriculture activities and became a priority for measures to control deforestation. To get their names removed from the list, municipalities were required to reduce deforestation rates below 40 km^2 and include 80 per cent of their area (excluding publicly-owned protected areas) into a geo-referenced rural environmental register (*Cadastro Ambiental Rural* or CAR) managed by the state environmental agencies.

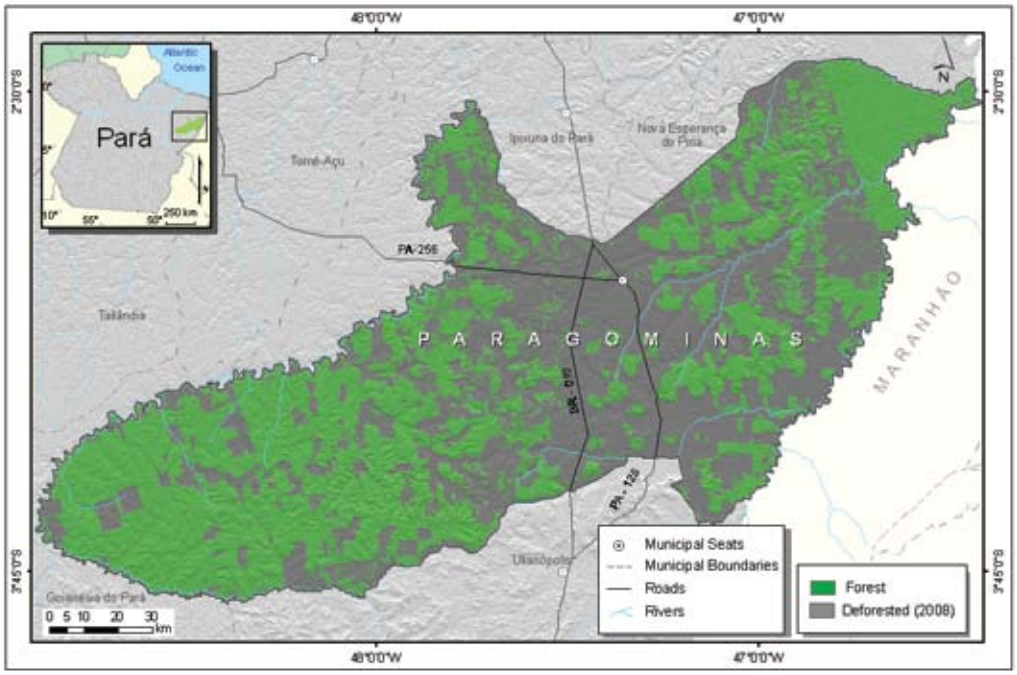
The second edition of the list, published the following year, included the original 36, plus another seven additions, bringing the total to 43 municipalities. However, by the time of the third edition, published in 2010, Paragominas, a municipality in Pará State in the eastern Amazon, became the first to be removed from the list as a result of a two year process that focused on improving local governance to prevent and control deforestation.

Paragominas' Strategy to Reduce Deforestation

Paragominas is part of the old frontier of occupation in the Brazilian Amazon. Since its foundation in 1965, the region has experienced intense and unsustainable cycles of logging, cattle ranching and agricultural expansion that resulted in it losing 45 per cent of its forested area. However, about a month after the publication of the first list of municipalities with high deforestation, Paragominas started a local process under the leadership of its mayor to decrease deforestation rates.



Deforestation and Forest cover in Paragominas as of 2008 (Source: Prodes/INPE)



Map of Paragominas municipality

Local civil society groups, producers associations and the mayor's office signed a pact for zero deforestation, an extremely challenging target at which to aim. The pact received the support of the state environmental agency and two nongovernmental organizations (Imazon and The Nature Conservancy - TNC). Two main strategies were developed to achieve Paragominas' target: monitoring and control of deforestation and registering property boundaries in the rural environmental register or CAR.

For the first strategy, the mayor's office, through its municipal environmental secretariat, started receiving monthly reports of deforestation as detected by Imazon's Deforestation Alert System (*Sistema de Alerta de Desmatamento*, or SAD). The forest clearings detected by SAD were verified and confirmed in the field by local environmental agents, who also identified the specific causes of deforestation. This was then used to demand enforcement actions from state and federal environmental agencies, since municipal agents do not have such a mandate. In 80 per cent of the cases detected by SAD, deforestation in Paragominas was caused by charcoal production.

For the second strategy, local producers associations, in partnership with Imazon and TNC started actions to encourage landowners to register their property boundaries on the rural environmental register. Several seminars and meetings took place to help in this task, with the presence of the head of the state environmental agency and prosecutors in charge of environmental enforcement.

All these actions were developed over two years and, as result, deforestation in Paragominas decreased. In the first year of the local pact, deforestation declined by 43 per cent (from 107 km^2 in 2007 to 61 km^2 in 2008) and in the second year, 2009, it reduced to 21 km^2, surpassing the 40 km^2 target set by the Ministry of the Environment. In relation to the other requirement, almost 83 per cent (15,219 km^2) of Paragominas' territory was included in the rural environmental register as of March 2010. That percentage does not consider the area of publicly-owned protected areas, since they are not subjected to the rural environmental register.

Becoming a Green Municipality

The experience of Paragominas demonstrates at municipal level the importance of properly addressing forest governance failures to reduce emissions from tropical deforestation. The key actions for achieving this result were: firstly, the local pact that created an

environment of cooperation and the following seminars that raised awareness of the problem; secondly, the monthly monitoring of deforestation; and thirdly, the training of local agents to monitor the specific causes of the detected deforestation. These measures can be replicated in the remaining municipalities in the critical deforestation list as the beginning of a strategy of readiness for Reducing Emissions from Deforestation and forest Degradation (REDD-plus).

Even though Paragominas is out of the Ministry of Environment's list, challenges remain for it to make the transition to a green municipality. For instance, it is necessary for 100 per cent of the municipality's territory to be included in the rural environmental register to consolidate a new local model of land management and use at a property scale. The consolidation of the register also requires the recovery of degraded lands to conserve local biodiversity and to comply with environmental legislation, an area that has had few advances in Paragominas.

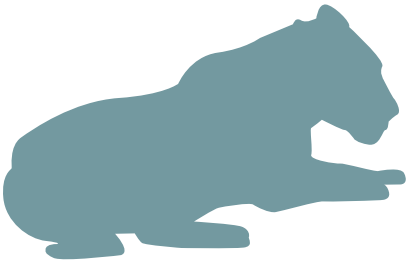
Another critical problem to be addressed is a lack of clarity over land tenure. For example, most of the deforestation detected in Paragominas in the last two years took place in areas without clear property rights. Without this clarity, local producers will continue to face difficulties in accessing credit for forestry and agricultural activities, due to restrictions imposed by the new financing rules introduced in 2008.

The measures implemented in Paragominas so far have focused on command and control. Nevertheless, to make the transition to a sustainable economy, the local production will need new incentive mechanisms and more sustainable practices. One of the key components will be the development and implementation of certification mechanisms for sustainable products that integrate four different assessments: of different productive systems inside the same property; of good practices for production; of traceability and of compliance with environmental standards, including maintenance of biodiversity. For instance, current certification schemes for logging do not assess other forms of land use in the same property where logging is taking place, so they cannot certify sustainability at a property scale.

In a transition to a green economy, governments also need to invest in adequate infrastructure for environmental control and land tenure regularization, as well as investing in research to develop more efficient models of production in the agribusiness sector, allowing increases in production expansion into forest areas. Moreover, civil society has to continue to improve its capacity to monitor the impacts and benefits of rural production. Finally, the market needs to use certification to reward those producers who can demonstrate sustainable practices. Thus, the process of turning into a green municipality will require commitments from different sectors.

In Paragominas, a first step in that direction was the signature of a new local agreement in 2010 in favor of legal and sustainable production, which involved the forest, cattle ranching and agriculture sectors. However, the readiness measures implemented in Paragominas need to be extended to other municipalities with high rates of deforestation and the incentives for a green economy have to be implemented. In this way, we can defeat illegal and unsustainable rural production and create a competitive advantage for more sustainable methods of production.

ABOUT THE AUTHORS



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