Climate change and forests

Climate change, energy and biodiversity

In terms of conservation efforts, protected areas in Bolivia play a role not only in conservation but in the support of local livelihoods and social participation as well. The Bolivian government estimates that around 60,000 people live inside protected areas and some 200,000 people live in surrounding areas. Consequently, involving local communities in national park affairs and the promises of development benefits has helped increase interest in conservation.

The National Service of Protected Areas developed the framework of "Parks with People" in 2005, considering the importance and role of protected areas for sustainable livelihoods, poverty alleviation and sustainable development in rural areas, including a significant role on ecosystem services provision.⁶ As part of this process, which is currently evolving into a national policy of shared management under the new government administration, not only national areas were represented in the national system of protected areas, but municipal protected areas and neighbouring declared indigenous territories are also seen as areas for biodiversity conservation. The percentage of national territory covered

by protected areas in Bolivia has thus increased in the last decade, to approximately 19 per cent of the total surface with representation of all the country's ecosystems (see figure 1).⁷

Nevertheless, several national parks are still constrained in enforcing conservation measures and there remain conflicts regarding access to natural resources, including minerals, hydrocarbons, timber, wildlife and land resources. Therefore, the institution in charge of safeguarding biological diversity in Bolivia is in permanent conflict.

Up until the late 1980s, deforestation rates in Bolivia were among the lowest in Latin America, based on key determinants which included a weak domestic demand for agricultural products and lack of infrastructure.⁸ However, two national inventories of forest resources concluded that deforestation increased dramatically during the 1990s especially after the implementation of the structural reforms during the same decade.⁹

In this context, Camacho estimated that more than three million hectares of lowland forests in Bolivia have been

> cleared, with 1.4 million hectares (46.7 per cent) deforested in the department of Santa Cruz between 1993 and 2000. Consequently, deforestation rates have quadrupled during this time following the structural reforms and policies introduced in 1993. These estimates led to several proposals and studies suggesting that structural adjustment has contributed to increase



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More than three million hectares of lowland forests in Bolivia have been cleared.

deforestation rates for soy and timber exports, by applying economic instruments and policies that removed price controls on soybeans, devalued

the Bolivian currency, promoted investments in physical infrastructure such as roads and telecommunications, and introduced tax breaks and fiscal incentives for exporters.¹⁰ Studies argue that the increasing deforestation rates in Bolivia as a whole are indicative of the general weakness of the government in the forestry and environmental sectors. Moreover, municipal governments have been largely ineffective in preventing deforestation.¹¹ These reasons are also encapsulated in the notion that structural adjustment reduced the role and capacities of the government.

In national terms, deforestation increased from an average of 152,000 hectares per year in the period 1985-1993 to approximately 300,000 hectares per year in 2006 (see figure 2).¹²

CO₂ emissions in Bolivia: the role of deforestation and energy

The second national report on the accomplishment of the Millennium Development Goals in Bolivia estimated that national emissions of CO₂ were

62.614 Gg. for 2002. The official inventories on the emissions source of GHGs indicate that the dominant sector in the emission of CO_2 is land-use change.¹³ In this sense, the widespread practice of slash-and-burn and the conversion of land for agro-industry and cattle-stock eliminate vegetation and burn of biomass, which represent the major cause for deforestation, biodiversity loss and CO_2 emissions.

Accordingly, these emissions are distributed in three main sectors. Around 89 per cent of CO_2 emissions are based on land-use change, followed by 10.5 per cent of emissions related to the energy

sector and only 0.46 per cent to the industrial process produced by cement factories.¹⁴ It is clear the differences between the first and second

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2004-2005

Around 89 per cent of CO2emIssions are based on land-use change

sources of emissions in the country.

Available data on CO_2 emissions as a result of slash-and-burn practices shows a discrepancy between the official data provided by the National Programme of Climate change and those provided by San Andres University (UMSA). The official estimations by the NPCC were 0.044 GT of CO_2 for 1998,¹⁵ while the emissions estimated by the university

> shows 0.36 GT of CO₂.¹⁶ These scenarios were based in the vulnerability assessment of ecosystems undertaken by the National Programme of Climate Change and supported by different models accepted internationally, such as UKHI, HADCM2, GISSEQ, MAGICC, and the meteorological data available for the country.¹⁷



1985-1993

0

Figure 2. Evolution of Deforestation Rates in Bolivia 1985 - 2006

1993-2003

2006

ecosystem services sold as commodities, has however been opposed as due to its clearly neoliberal approach. Nonetheless, according to the National Development Plan (NDP), carbon sequestration and certified emissions reduction (CERs) of GHGs represent an important opportunity for income generation at a national level. The policy sees the State participating as the owner of natural resources in the generation of economic surplus through certification, international negotiation, sale and fair distribution of benefits produced by the commercialisation of carbon bonds in international markets. Three programmes have been proposed to implement this strategy:

a. CERs, carbon sequestration and conservation towards the promotion of clean development strategies and mechanisms for international markets:

Climat

Climate change

Introduction

From 14 to 16 April 2008, Mediterranean experts, scientists, NGOs, conservationists, governmental officials and international organisations met in Athens, Greece to discuss issues related to the impacts of climate change on Mediterranean forests adding to the already ongoing threats and challenges impacting these ecosystems and the people depending on them, and to search for adaptation opportunities and options to enhance their social and environmental resilience

Statement

Mediterranean forests, woodlands and

scrub, situated in a transitional zone between the European, African and Asian continents, are one of the planet's centres of biological diversity and are linked to outstanding cultural features. The Mediterranean vegetation includes 25,000 floral species, representing 10 per cent of the world's flowering plants on just over 1.6 per cent of the Earth's surface. It is also the second world leader in plant endemism, with an estimated 50 per cent (13,000) of these species found nowhere else on Earth. Species' groups with a Pan-European distribution, such as fir, beech, pine and oak have the highest species diversity in the Mediterranean region, and the Mediterranean populations are often the most variable ones in terms of genetic diversity. Furthermore, Mediterranean forests also host an amazing faunal diversity, especially when is expressed by the ratio between species richness and area.

Forests provide vital environmental services— soil, water catchment, timber, food and medicine, stabilisation of urban shortage constitute the main limiting factor and its irregular distribution can easily activate soil erosion and water run-off if forest cover is loss.

Rapid and abrupt land-use changes, mainly due to development pressures and urban sprawl, habitat fragmentation, resource overexploitation and poor management, are the main drivers of Mediterranean forests degradation. Climate change adds to these pressures, mainly through an increased incidence of heat waves, droughts and overall temperature rise, and could eventually overstretch the resilience and adaptive capacity of the Mediterranean forest ecosystems.

Recognising that:

- k climate change is occurring and that it is exacerbating the already existing pressures and drivers for forest loss and degradation;
- k forest wildfires are among the most direct and immediate consequences of climate change upon Mediterranean forests, and that

Forest wildfires are among the most direct and immediate consequences of climate change upon Mediterranean forests. rests, and that climate change impacts, such as extended periods of drought, and extreme meteorological phenomena (heat waves and strong winds), combined with unsustainable land uses changes, bad man-

agement practices, lack of awareness and lack of adequate fire management strategies encourage the alarming trend of increasing the frequency, intensity and extent of fires;

 Mediterranean countries share common conservation and socio-economic development themes despite the significant disparities that are



Picture 2. Discussion restoration issues on a WWF forest landscape restoration study tour in Spain and Portugal (*Courtesy Mark Aldrich, WWF*)

still present between the shores of the Mediterranean sea in terms of per capita gross domestic product, forest area coverage and landownership structure;

- k despite the efforts deployed, Mediterranean forest ecosystems present a level of degradation that is still alarming, threatening the natural resources and cultural heritage therein;
- k climate change compounded with "mal-adaptive" processes and inadequate land uses (*i.e.* unsustainable rapid land-use changes, rural abandonment and overexploitation of land resources) are likely to reduce the adaptability of Mediterranean forest to autonomously accommodate to climate change, and to increase the frequency and intensity of pathogens' outbreaks, dieback events, uncontrolled fires and other large-scale disturbances;
- k the Mediterranean people and economies will be chiefly affected by the diminishing of forested areas, usually replaced by fire prone shrub communities, increased landscape fragmentation, which may consequently

impede migration/dispersal opportunities for a number of species at risk of extinction, and decrease of annual increments and the subsequent income from forests;

The participants:

- k Urge all Mediterranean countries to mainstream fire risk reduction and climate change adaptation needs into all sectoral policies, regulations and rural/urban development plans linked with forest ecosystems, at national, regional, and EU levels
 - k continue to improve the cooperation among the government, scienti

on the wider landscape scale "ecosystem approach", and securing provisions for both *in situ* persistence of unique Mediterranean reservoirs of forest diversity (genotypes, species and communities), and for the facilitation of species migration needs;

- k providing recommendations to forest and land managers to increase forest resilience to climate change, such as the increase of diversity at all levels (genotypes and species composition in forest stands; habitat types and mosaic character of forest landscapes), changes in silvicultural practices (*i.e.* thinning for a wider spacing to improve resistance to drought conditions water shortages; longer rotation periods to increase carbon sequestration), and changes in soil management practices (*i.e.* low tillage and maintenance of permanent soil to reduce erosion rates and downstream flooding and increase water absorption and retention);
- k encouraging forest managers, scientists and practitioners to actively assess and promote the economic valuation and sustainable

use of forest products and services, a key step to reduce existing pressures on natural ecosystems and to increase the capacity of ecological and social systems to accommodate to climate change;

- k encouraging forest landscape restoration initiatives that contribute to maintain the basic ecological processes and biodiversity values, to build landscape patterns, habitats and species compositions more resilient to large scale disturbances like fire, and to provide a wide range of benefits for the society;
- k promoting successful results from existing projects and initiatives aimed at increasing the resilience of Mediterranean forests and people to global change impacts and fostering their replicabilenc4 replicabil-

develop and propose measures and policies;

k The scientific community should commit to make the knowledge and science easily accessible to people and decision makers, and work0t Tr/ange and forests

Protected areas

One of the most promising mechanisms with which to stop massive destruction of the Amazon forest has been the creation of large blocks of protected areas. These areas have a role not only in protecting biological or forest diversity, but also in fostering social and cultural well-being by providing economic alternatives to local populations, *e.g.* through extractive reserves, sustainable development reserves and indigenous people's lands etc.¹⁴

The role protected areas play in halting deforestation has been assessed in several regions of the world. Generally speaking, deforestation rates within protected areas are signifi Until 1997, most protected areas were strictly protected for nature conservation. However, since 1998 the govern-

ment has recognised many indigenous people's lands and created over 300,000 km² of sustainable use areas. The carbon study thus addressed protected areas in their widest sense, looking at all protected areas (for nature conservation), indigenous people's lands and military areas. According to figures published in 2004, 43 per cent of the Brazilian Amazon is currently protected, of this, 54 per

cent are indigenous people's lands and 44 per cent are strict nature protected areas.

The carbon study was undertaken by overlaying a map of these protected areas with historical deforestation maps from 1997 and 2007, apossi* (bTDat)ss007, 1894 705.3521 Tm1 scn6, Octob297, mo2t protect96.95q1 i 157 116 BT16 902T164.26 Climate change, Energy change and Conser

forest carbon stocks. The areas supported by the ARPA Programme alone can reduce potential emissions from deforestation by 2050 of nearly 1.1 billion tons of carbon. Nevertheless, the consolidation of this extensive protected area network represents a great challenge to the Brazilian nation, especially in areas located along the active deforestation front, where numerous land conflicts and other illegal activities threatens the social and natural environment. This challenge is likely to grow in the near future due to increasing demands for agricultural commodities. Thus, those areas located along the deforestation front face greater threats and present the greatest potential for carbon emissions. On the other hands, if efficiently implemented, these same areas also represent the greatest potential for the reduction of carbon emissions. For these reasons they deserve special attention from conservation investments, even though they do not fit the traditional conservation approaches that prioritise protection according to their high biological diversity and low levels of threat.



Picture 4. Aerial view of forest clearing to create grazing pasture for cattle, Juruena National Park, Brazil. (© *Zig Koch/WWF*)

In our view, the best way forward consists in encompassing both strategies. In other words, it is necessary to give priority in protecting key areas against the advance of the deforestation frontier, as well as targeting the highly representative biodiversity samples

It is necessary to give priority in protecting key areas against the advance of the deforestation frontler, as well as targeting the highly representative biodiversity samples of the Amazon as a whole.

of the Amazon as a whole. In addition to continuing to expand the Amazon protected network, a substantial allocation of resources is vital to the success of this innovative conservation strategy that aims for the creation and consolidation of protected areas along regions of extreme land use dynamics.

Quantifying reductions of deforestation and associated carbon emissions through the implementation and consolidation of protected areas is an important contribution to the international debate. In the scope of the United Nations Framework Convention on Climate Change, this work brings major contribution to the decisions made by the Conference of the Parties, held in December of 2007 in Bali. The Bali Action Plan (Decision UNFCCC 1/ COP13), which addresses measures and proposals with the objective of increasing the implementation of national and international mitigation, specifically refers to the development of policy approaches and positive incentives on issues relating to reducing emissions from deforestation in developing countries. In a specific decision concerning deforestation (Decision UNFCCC 2/CP 13),

it is noted that sustainable reductions of emissions resulting from deforestation in developing countries require

This huge effort towards conservation and reduction of deforestation emissions requires stable and predictable availability of resources.

stable and predictable resources. It is also acknowledged that reducing emissions from deforestation in developing countries can foster multiple benefits and complement the objectives of other relevant conventions.

The estimate of the reduction of emissions resulting from defor-

estation under various scenarios allow us to conclude that the strategy for the implementation and consolidation of protected areas, especially the ARPA Programme, can be classified as a demonstration activity for reducing emissions from deforestation in Brazil. As highlighted by the COP, this huge effort towards conservation and reduction of deforestation emissions requires stable and predictable availability of resources. It is imperative that the efforts made until the present moment be ensured and continued. The ARPA Programme is ready to become integrated with future formal and/or volunteer mechanism of positive incentives towards reducing emissions from deforestation.

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Notes

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- 1 Saatchi et al., 2007, Nepstad et al., 2007.
- 2 Malhi et al., 2008.
- 3 Morton et al., 2006.
- 4 Nepstad et al., 2007.
- 5 INPE, 2008.

- 6 Margulis, 2003, Alencar *et al.*, 2004.
- 7 Soares Filho *et al.*, 2006.
- 8 Sampaio *et al.*, 2007.
- 9 Nepstad et al., 1999, Nepstad et al., 2008.
- 10 Nobre et al., 1991.
- 11 IPCC, 2007.
- 12 Nepstad et al., 1999.
- 13 Nobre *et al.*, 1996; Nepstad *et al.* 2007, Nepstad *et al.*, 2008.
- 14 Naughton-Treves *et al.*, 2005; Maretti *et al.*, 2003; Maretti *et al.*, 2005; Peres, 2005; Schwartzman e Zimmerman, 2005.
- 15 Bruner *et al.*, 2001; Naughton-Treves *et al.*, 2005; Ferreira *et al.*, 2005; Soares-Filho *et al.*, 2006, Nepstad *et al.*, 2006.
- 16 Vandermeer, 1995; Cronon, 1995.
- 17 INPE, 2008.
- 18 Bonham-Carter, 1994.
- 19 Soares-Filho et al., 2006.
- 20 Vera-Diaz et al., 2008.
- 21 Merry et al., in press.
- 22 Merry et al., in press.
- 23 Soares et al., in press.
- 24 Saatchi et al., 2007.
- 25 Hougthon et al., 2005.

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