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Adapting to Change

The State of Conservation of World Heritage Forests in 2011

International Year of Forests • 2011

United Nations Educational, Scientific and Cultural Organization

World Heritage Convention

Adapting to Change

The State of Conservation of World Heritage Forests in 2011

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"Enchanted forest" © Gayle Gerson

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Joint Foreword

Around the planet, forests provide a source of subsistence and livelihoods for some 1.6 billion people, many of whom are mired in poverty. Forests contribute directly to poverty reduction by generating jobs, incomes, and vital goods for communities – from timber and firewood to food and medicine. If managed in a sustainable manner, forests can help to curb disease and to regulate hydrological, carbon and nutrient cycles that contribute to healthy lifestyles.

2011 and 2012 are pivotal years for the world's forests and for sustainable development. The United Nations General Assembly declared 2011 as the *International Year of Forests*. In June 2012, the international community will convene in Rio de Janeiro for the *United Nations Conference on Sustainable Development*, also known as Rio+20. At this much-awaited conference, countries will renew their commitment to sustainable development and focus on accelerating the implementation of measures agreed upon since the first Earth Summit in 1992.

This is why UNESCO is devoting this edition of the *World Heritage Papers* series to forest conservation and the green future of our planet. This publication highlights all forest areas inscribed on the UNESCO World Heritage List. To date, the List contains 104 forests, covering a total area of over 75 million hectares (750,000 sq km). Each is a unique ecosystem that provides space for cooperation in science, education, and culture and that is invaluable for the benefit of all.

Launched in 2001, UNESCO's *World Heritage Forest Programme* celebrates the social and cultural value of forests for local communities and conveys the extraordinary natural beauty and biological diversity of these sites. The three Rio Conventions devoted to climate change, biological diversity and combating desertification, along with the United Nations Forum on Forests, all emphasize the pressing need to manage natural resources sustainably. UNESCO works to strengthen the importance of sustainable forest management, and especially conservation, as green economy activities that contribute to the eradication of poverty.

Experts warn us that the planet's natural resources continue to be depleted at an alarming rate. Forests are especially vulnerable, facing serious threats ranging from unsustainable practices to climate change. In a context of environmental crisis, the UNESCO World Heritage Convention can help rally international attention and cooperation for the ambitious task of preserving these unique natural areas. Future generations have a right to enjoy forests as much we do today.

We are convinced this publication will help to mobilize greater public support worldwide for heritage forests and for all types of forests. ■

Irina Bokova
Director-General of UNESCO

Sha Zukang
United Nations Under-Secretary-General for Economic and Social Affairs and Secretary-General of the UN Conference on Sustainable Development

Introductory Remarks

Kishore Rao
Director
UNESCO World Heritage Centre

This second *State of Conservation of World Heritage Forests report* was timed for release during the United Nations International Year of Forests, the motto of which *Celebrating Forests for People* is very appropriate to the World Heritage Convention – a widely recognized United Nations convention created in large part to ensure that people, both current and future generations, could continue to celebrate and benefit from the outstanding cultural and natural diversity of our world.

The first World Heritage forests were inscribed on the World Heritage List in 1978 (Nahanni National Park in Canada, Yellowstone National Park in the USA). As of the 35th session of the Intergovernmental World Heritage Committee in 2011, 104 World Heritage sites covering over 77 million hectares across all biogeographic realms are recognized as World Heritage forest sites – by any standard this is a huge success story for forest conservation. But recognition is only one part of the World Heritage Convention. The complementary part focuses on conservation – a more difficult task.

The World Heritage Committee monitors the state of conservation of World Heritage sites, and over the years – as demonstrated in this publication – it has become apparent that World Heritage forests are a particularly vulnerable group of World Heritage sites. As human populations grow, and as previously forested lands are converted into agriculture, or degraded by logging or by various industrial or public utilities infrastructure, more and more people are forced to look for increasingly scarce forest resources in places where they still exist in relative abundance, which is most often within forest protected areas such as World Heritage forest sites.

The FAO's Global Forest Resource Assessment for 2010 indicates that the trend for including forests in protected areas has accelerated in the last ten years, but that non-protected primary forests – those least disturbed by intensive human activity – continue to be lost at a rate of 4.2 million hectares a year. Extrapolating these trends leads us to conclude that as access to non-protected primary forests becomes ever more difficult, pressure to facilitate access to the remaining protected forests will increase. A brief review of the annual *State of Conservation* reports produced by the World Heritage Centre and IUCN for the World Heritage Committee reflects this reality in the wide range of threats to listed World Heritage forests. For example, illegal logging and the bushmeat trade pose grave threats to several World Heritage forests because the lands surrounding these sites have often already been depleted of such resources.

Beyond the threats that we have grown accustomed to dealing with, climate change is expected to significantly increase the complexities of protected area management in the coming years. Managers will need to redouble their efforts, not only to reduce existing threats but also to look beyond the boundaries of their protected areas so that suitable adaptation strategies may be implemented. These managers will need to develop the capacity and be given the responsibility to engage with agents of wider land use changes in order to achieve this.

There is an urgent need to find ways in which the World Heritage Convention will, on the one hand, ensure the long term conservation of World Heritage forests, and on the other, encourage the replenishment and sustainable management of accessible forest resources for local communities whose access to resources have been considerably reduced. Recognizing the need to encourage synergies between conservation and development, the World Heritage Committee requested at its 34th session in 2010 that sustainable development measures be integrated into the work of the World Heritage Convention, which has resulted in the approval of an action plan to further this objective. Interesting opportunities are emerging in the case of World Heritage forests. For instance, the emerging global recognition of the role of forests in capturing and storing carbon has led to the development of mechanisms designed to encourage forest conservation, sustainable forest management, and the enhancement of forest carbon stocks through the programme, *Reducing Emissions from Deforestation and Forest Degradation* (REDD+).

In the early stages of development, REDD+ has the potential to compensate communities involved in activities that will result in increased forest cover and better forest management. The link with the conservation of World Heritage forests in the long term is obvious, and worth exploring.

Beyond providing an overview of the state of conservation of World Heritage forests in general, this publication attempts to provide some welcome thoughts on the relationship between World Heritage forests and their surrounding landscapes, and on mechanisms that could be applied to ensure that this relationship is mutually beneficial alongside social, economic and environmental criteria. I am convinced that the World Heritage Convention can be effectively leveraged to bring about such positive contributions, and I look forward to seeing tangible results on the ground. ■

While many forests predate human existence on earth, forest history is – at its core – about the changing relationships between people and forests, and was the reason behind the choice of the International Year of Forests to celebrate 'Forests for People'.

Furthermore, changes in forest-human relationships have been occurring rapidly over the past two decades, posing a challenge for the future. Every year, around 13 million hectares of forests are lost, mainly due to the conversion of forested land for other uses.

Yet the message of the International Year of Forests is not about doom or the impending extinction of forests, it is a celebration of the many wonders forests give to us all. There are great success stories over the world of people sustainably using forests for shelter, food, income, medicine and clean water. Forests provide income, trade, sustenance, and a way of life. These stories exist, and are plentiful.

UNESCO World Heritage sites provide a perfect example of how forest conservation can help improve our planet for future generations. With the recent World Heritage designations, sites such as the Ogasawara Islands (Japan) have brought the number of World Heritage Forest sites to 104, putting UNESCO in a unique position to protect some of the world's most precious forests.

A World Heritage designation alone, however, does not guarantee a forest's survival. It is the work of the people on the ground, both UNESCO and local populations, matching World Heritage guidelines with local needs. These stories of dedicated relationships between forests and people are at the heart of the International Year of Forests, and are a significant step towards ensuring that future generations continue to enjoy the many benefits that forests have to offer for years to come. ■

Jan McAlpine
Director
United Nations Forum on Forests

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Contents

Joint Foreword . . . 3
Irma Bokova
Sha Zukang

Introductory Remarks
Kishore Rao . . . 5
Jan McAlpine . . . 7

1 State of Conservation of World Heritage Forests in 2011 . . . 11
New Challenges for World Heritage Forests – *Jeffrey A. McNeely* . . . 12
A Selection of World Heritage Forest Indicators – *Marc Patry and Romy Horn* . . . 17

2 Adapting to changes . . . 23
Climate Change and World Heritage Forests – *Jim Perry* . . . 24
Assessing the Connectivity of World Heritage Forests – *Robert M. Ewers and Valerie Kapos* . . . 29
REDD+ as a Contribution to Conservation and Connectivity of World Heritage Forest Sites – *Steffen Entenmann and Christine B. Schmitt* . . . 32
Integrating World Heritage Forests into a Future REDD+ Mechanism – *Jacob Phelps and Edward L. Webb* . . . 39
What World Heritage Can Offer REDD+ Policy Development – *Jacob Phelps and Edward L. Webb* . . . 42
The Contribution of Rainforest Alliance/FSC Certification to the Conservation of World Heritage Sites – *Deanna Newsom and David Hughell* . . . 46
Enhancing Community Management of World Heritage Forests Through Landscape Labelling – *Jaboury Ghazoul* . . . 54

3 Global Governance – What is the relationship between World Heritage Forests and Global Governance processes? . . . 59
Forests and Protected Areas: Outcomes of the Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity – *Johannes Stahl , Tim Christophersen and Jason Spensley* . . . 60
World Heritage Forests for People – *Benjamin Singer* . . . 65
Biosphere Reserves, World Heritage Sites and People: Enhancing Synergies for Sustainable Forests – *Ana Persic and Melody Ocloo* . . . 68

4 Case Studies – On Connectivity . . . 73
Belovezhskaya Pushcha/Białowieża Forest World Heritage Site – *Renata Krzyciak-Kosiska* . . . 74
World Heritage Sites, Biosphere Reserves and Model Forests: Connecting Mesoamerica – *Eduard Muller and Marc Patry* . . . 80
Multi-actor Partnership and Sustainability Management of Biodiversity: The Case of the World Heritage Site of the Dja Faunal Reserve (DFR) – *Gustave Ossie Ompene, Patrice André PA'AH, Théophile Bouki, Jean-Claude S. Njomkap, Julie Gagoe Tchoko and Mariteuw Chimère Diaw* . . . 86
Ecological Integrity and Sustainable Development in the Chiquitano Dry Forest of Bolivia – *Roberto Vides-Almonacid and Hermes Justiniano* . . . 91

Annexes . . . 97
I. World Heritage Forest Indicator Database . . . 98
II. World Heritage Forests - Inscription and Geographical Characteristics . . . 102
III. Reporting Trend for World Heritage Forests, 2001-2011 . . . 107
IV. Forests Previously Identified for Potential Inclusion onto the World Heritage List – *Romy Horn* . . . 111
V. World Heritage Forest Sites Coinciding with Ramsar Sites and/or Biosphere Reserves . . . 112
VI. Cultural World Heritage Sites with Significant Forest Cover – *Nicholas Flack* . . . 114

1

State of Conservation of World Heritage Forests in 2011

Cloud forests of the Talamanca Range – La Amistad Reserves / La Amistad National Park (Costa Rica, Panama) © UNESCO/Patry

New Challenges for World Heritage Forests

by Jeffrey A. McNeely

Senior Science Advisor, IUCN

Introduction

It sometimes seems that forests are stuck in an Alice in Wonderland world, running faster and faster just to stay in the same place. But it is actually worse than that, because some of the world's most important forests are seriously threatened by overharvesting, road-building, habitat loss and so forth. The authoritative Global Forest Assessment (2010) reported an annual net loss of 5.2 million hectares of forest over the past decade, a somewhat lower rate than the previous decade but this annual loss still totaled almost as much as the total forest area protected as World Heritage forests.

While the rate of destruction may have slowed, and the growth of plantations increased, the latest word from the Brazilian Amazon is that the rate of loss there was about six times worse in 2010 than it was in 2009 - after 2009 had been celebrated because the rate of forest loss in the Amazon had been significantly reduced.

But think about it: slowing the global rate of loss simply means that it will take somewhat longer for the world's forests to be converted to other uses, perhaps leaving only the World Heritage forests to remind us of the past glories of the world's richest terrestrial ecosystems.

Even the boreal forests, long thought to be secure because of their vast expanses and remoteness, are facing more threats than ever. Infestations of various species of beetles are killing off forests, even in iconic World Heritage sites such as Yellowstone National Park where the whitebark pines, whose cones help grizzly bears fatten up for the winter, are dying the death of a thousand bites from mountain pine beetles, made worse by an invasive species of fungus that causes white pine blister rust. Native to Eurasia, this fungus invaded Canada around 1900 and has now spread throughout the western USA (including at least four World Heritage sites other than Yellowstone: Mesa Verde, Olympic, Redwoods, and Yosemite). Other insect species are happily munching away on species like lodge pole pines, spruces, and firs; some forest entomologists call the infested ones 'zombie trees' – the living dead.

The northern forests covering millions of hectares are now being reduced to kindling, awaiting the devastation of forest fires such as those that ravaged Russia in 2010 with damage Pravda (2010) estimated at US$ 15 billion from some 7,000 fires spread over an area greater than one million hectares; and in May 2011, wildfires destroyed some 297,000 hectares of Russian forest, almost twice the rate of loss in 2010. As discussed in the chapter by Perry (this volume), climate change is adding a profound new threat to the usual litany of threats to forests, and is highly likely to have negative impacts on the outstanding universal value of many forested sites now listed on the World Heritage List. Small wonder that a disproportionate number of World Heritage forest sites are listed as World Heritage in Danger (Patry and Horn, this volume). Or perhaps the real wonder is that more World Heritage forests are not listed as 'in danger', because they almost certainly are living on borrowed time.

World Heritage forests need help, and they need it quickly. With 2011 proclaimed as the International Year of Forests, it provides a strong incentive for concerted action on the world's forests that have formally been designated of possessing 'outstanding universal value' (OUV) under the World Heritage Convention. This brief introductory chapter will highlight some of the responses to the increasing challenges, examine the benefits and costs of these, and suggest some new approaches to managing World Heritage properties that have been listed, at least partly, because of the OUV of their forests.

The dynamic history of forests

Forests often seem eternal, stable representations of mature and stately ecosystems. But the venerable concept of relatively stable 'climax' forest ecosystems that are hundreds, or even thousands, of years old has now been replaced by the recognition that forests are in a constant state of change, requiring more adaptive forms of management (Hollings, 1978). Resource managers now need to consider the dynamic forces of fires, storms, droughts, climate change, and other natural factors with the usual human impacts such as logging, introduction of non-native species, building of roads, planting of vast plantations of genetically identical trees, and so forth. World Heritage forests are not immune to these inexorable forces of change, posing a constant challenge to those seeking to maintain the rigidly defined OUV for which these forests were added to the World Heritage List, while simultaneously incorporating the management flexibility required by changing conditions.

Perhaps the most worrying change for many foresters is climate, which will lead to fundamental changes in forest ecosystems as different species respond in different ways (Perry, this volume). Breeding seasons will change, warmer winters will lead to subsequent outbreaks of pests, new species will arrive, and many of the species found in World Heritage forests may move to new habitats or, worse, become extinct (Schneider and Root, 2002; Settele *et al*., 2008).

The changes to forests are far greater than simply an aesthetic issue of interest, primarily to conservationists. In fact, every person in the world is affected by what is happening to forests, even though many remain blissfully unaware of their dependence. For example, the forests of the Amazon basin are often considered 'the lungs of the planet' because of the oxygen they produce through photosynthesis. But in two of the past five years, drought conditions have converted the Amazon into a net *consumer* of oxygen and *producer* of carbon dioxide (Lewis *et al.*, 2011). When droughts or fires hit forests, even World Heritage status cannot prevent them from producing more of the greenhouse gases that can accelerate further climate change.

Connectivity and fragmentation

A healthy, resilient forest cannot be isolated from the broader healthy ecosystem to which it belongs. In ecological terms, forests are intimately tied to the flow of nutrients, water, pollinators, predators, and many other forces of nature from the surrounding lands (Ewers and Kapos, this volume). As just one example, the snows of Kilimanjaro are melting, at least partly, because the forests on the lower slopes, outside the World Heritage boundary, are being cleared, thereby reducing the moisture that is carried up the volcano's slopes to be deposited as snow. Isolating a forest by excessive land use changes around it will have significant repercussions on its ability to maintain its composite biodiversity and to provide ecosystem services, rendering it more susceptible to disturbance. In this regard, no forest is an island. Ironically, in strictly legal terms, World Heritage forests tend to be managed as if there were islands. They must be designated with boundaries that indicate which government agency has responsibility for maintaining its World Heritage values. As a result, though a forest is extensively connected to the lands around it, management is often designed as though they were closed systems and it is often forced to function with little interaction or mandate to engage with landscape level stakeholders who may have an influence on systems, which in turn may affect World Heritage forests. The long-term well being of World Heritage forests is therefore at risk from both ecological and institutional isolation.

This isolation is one of the major threats to World Heritage forests, with once contiguous forests reduced to a patchwork of smaller forests, each with fewer species than the larger forest had held - though some fragments may retain surprisingly rich species diversity (Innes and Er, 2002). While World Heritage forests may have been designed and managed to be less vulnerable to fragmentation caused by humans, this protection is not always permanent. For example, in 2009 New Zealand's Mount Aspiring National Park (part of the South West New Zealand World Heritage Area) was threatened with losing 20 per cent of its area to open up mining opportunities (Haggart, 2009). The irony is that a group of sites including five national parks, which together met the criteria for OUV, were combined with State forest land to establish this 2.6 million hectare area precisely to provide greater connectivity, a design feature that was not lost on the opponents to the mining proposals. But this example demonstrates that even countries with resources and capacity may benefit from the added vigilance provided by the World Heritage Convention to resist the powerful economic interests that may have other ideas on how a World Heritage forest might be used.

Still, one of the most promising approaches to protecting forests is to expand the forested World Heritage properties so that more of them are like the South West New Zealand World Heritage Area that exists today (Ghazoul, this volume). The advantage of such expansion is to provide space for plant and animal species to adapt to climate change, and to extend the available habitat for such wide-ranging species as jaguars, tigers, wolves, grizzly bears, gorillas, bison, and elk.

Examples of similar approaches on the World Heritage forests list include the Gondwana Rainforests of Australia, the Wet Tropics of Queensland, Brazil's Southeast Atlantic Forest Reserves and Central Amazon Conservation Complex, among others. But much more could be done, perhaps beginning with linking the World Heritage forests of Central America (Panama's Darien National Park, the Panama/Costa Rica transboundary Talamanca Range-La Amistad Reserves, Guatemala's Tikal National Park, and Río Plátano Biosphere Reserve in Honduras) with other forested areas that do not meet World Heritage criteria by themselves, but can contribute to the OUV of an entire landscape. World Heritage could then be seen as the centrepiece of the Mesoamerican Biological Corridor (Muller and Patry, this volume). The Yellowstone to Yukon corridor could find ways to link Yellowstone to Kluane/Wrangell St. Elias/Glacier Bay/Tatsheshin-Alsek, using World Heritage properties – like beads in a natural necklace: Glacier, Waterton, Nahanni, the Canadian Rocky Mountain Parks, and Wood Buffalo would be substantial jewels in such a necklace. Given that such connectivity plays a role in assuring the OUV of these sites, the World Heritage Committee might be interested in playing a more active role in helping bring such systems about.

But connectivity also carries some hazards. A process that can help grizzly bears to move more widely can also be used by various pest species to move more extensively, freed from their dispersal barrier of inappropriate habitats. The evolutionary forces of isolation may be disrupted, fires may find it easier to spread, and disease may no longer be impeded by buffer zones. These risks will need to be incorporated, as connectivity becomes a more central concern in forest management (Ewers and Kapos, this volume).

Another form of connectivity is also worth exploring: the vertical movement on mountains. Already, many World Heritage forests are cloaking mountains, and the idea is that species responding to climate change will have relatively short geographic distances to move, so plants and animals can more easily change their elevational distribution in order to remain in a sort of equilibrium with the climate (Bush *et al.*, 2004); lower elevation areas could be added as a sort of buffer zone for possible future expansion. World Heritage Mountain Forests that could form the basis of such an approach include the Greater Blue Mountains (Australia), Three Parallel Rivers of Yunnan (China), Los Katios (Colombia), Sangay (Ecuador), Nanda Devi and Valley of Flowers (India), Lorentz (Indonesia), Mount Kenya (Kenya), and Kinabalu (Malaysia). A research and monitoring programme based on World Heritage Mountain Forests could be highly productive, with useful comparisons among different geographical variables.

Forests and conflict

Forests have several characteristics that often seem to attract conflict (Price, 2003; Richards, 1996). They provide shelter to insurgent groups (think back to Robin Hood or more recent rebels in Colombia and Peru), can help to finance these groups, contain valuable subsistence resources, and often are remote from the corridors of power. World Heritage forests are not immune to these problems, and four of the five World Heritage sites in the Democratic Republic of the Congo (DRC) are on the World Heritage in Danger list, in large part because of armed conflict and associated problems (Virunga, Kahuzi-Biega, Okapi, and Salonga). Manas (India), Comoe (Ivory Coast), and Rwenzori (Uganda) have all suffered from such problems. Moreover, many forests that are not on the World Heritage List also suffer from such conflicts, including those in Afghanistan (Conniff, 2010), Burma/Myanmar, and much of West Africa.

On the other hand, World Heritage can also help to address this problem, especially when neighbouring countries are also involved in the conservation of adjacent sites. For example, National Parks in Canada and in the US were jointly nominated in 1995 to form the Waterton-Glacier International Peace Park, and while that border has been a relatively easy one to manage for many decades, other transboundary forests have been established where the borders are in remote wilderness locations, or where transboundary cooperation may have been limited for historical reasons. Examples include Iguazu (Argentina) and Iguaçu (Brazil), the Primeval Beech Forests of the Carpathians (Slovakia and Ukraine), and the Belovezhskaya Pushcha/ Białowieża Forest (Belarus/Poland) (Krzysciak-Kosinska, this volume). The potential for additional such areas shows considerable promise, for example linking Virunga National Park (DRC) with Bwindi Impenetrable Forest (Uganda). Such transboundary sites can help inspire international cooperation that replaces conflict (Brunner, 1999; Sandwith *et al.*, 2001).

The human dimension

Forests have been providing benefits to people for as long as people have existed, and all World Heritage forests have been substantially influenced by people (Singer, this volume). Over half of World Heritage forests currently support resident human communities, often indigenous peoples whose traditional knowledge can offer important insights into how forests can be managed (Beltran, 2000). The benefits that forests provide are well known and include timber, firewood, habitat for harvested species (both plants and animals), shelter, and so forth. No wonder that many forests and even individual trees have been granted sacred status in many parts of the world (Barrow, 2010), including some on the World Heritage List (such as Japan's Yakushima cedar forests and various sacred sites in the Kii mountain range).

But perhaps more relevant to modern decision-makers, these benefits, also known as 'ecosystem services', provide substantial values in economic terms. A recent study, *The Economics of Ecosystems and Biodiversity* (TEEB) found that tropical forests are worth between US$ 6,120 and US$ 16,362 per hectare, depending on location, species with touristic value and other variables (TEEB, 2010). Conserving forests can also be a matter of life or death. One study of over 160 extreme events found that a 10 per cent loss of native forest cover increased flood frequency by 2.9–25.3 per cent, the number of people killed by 1.0–6.9 per cent, and people displaced by 0.7–5.1 per cent (Bradshaw *et al.*, 2009). The ecosystem service of protecting people against extreme climatic or geological events may in a sense lie beyond economic value, as it requires putting a price on human life.

Much of this volume is rightfully devoted to the impacts of human induced climate change on forests, and the economic response to those impacts, especially the approach that has come to be known as REDD, or more recently, REDD+. The acronym stands for Reducing Emissions from Deforestation and Forest Degradation, but the original idea implied that carbon sequestration was the only objective, opening the possibility of replacing old-growth forests with non-native fast-growing species like eucalyptus. It soon became apparent that REDD could be applied far more broadly and include many other forest values, as well as providing strong support to old-growth forests with high biodiversity values (Phelps and Webb; Entenmann and Schmitt, this volume). These additional values form the '+', and World Heritage forests offer an ideal opportunity for demonstrating how funds linked to climate change can be used to conserve old-growth forests through REDD+. Indonesia's Tropical Rainforest Heritage of Sumatra is already benefiting from this process, and could be a useful pilot project for testing some of the complexities involved in REDD+, especially ensuring that forest dwelling people receive their fair share of the benefits (Hirsch *et al.*, 2010; Phelps *et al.*, 2011).

Reducing external impacts on World Heritage forests

Global demand for forest products continues to expand, though the rate of increase is surprisingly modest, increasing by only 0.4 per cent per year since 1980. But over the same time, paper consumption increased at an annual rate of 3.2 per cent, and sawn timber and wood panels increased by 0.8 per cent per year (Ajani, 2011). This apparent anomaly is explained by a significant increase in the use of recycled paper, high-yielding pulp technologies, and replacing sawn timber with reconstituted wood panels. Further, widespread expansion of tree plantations (usually monospecific) is reducing some of the demand on the remaining natural forests. China, a major global consumer of wood resources, is a global leader in decoupling forest consumption from economic growth that is dependent on wood products (FAO, 2009).

Conclusion: How World Heritage forests can be the catalyst for forest conservation

The International Year of Forests has been established with the objective of drawing the world's attention to these critically important ecosystems and their multiple values for humanity. The hope is that this attention will in turn lead to greater protection for the remaining forested areas of our planet. World Heritage forests can play a critical role in this global initiative, as the papers in this publication demonstrate. As forests recognized by governments to be of outstanding universal value, they can open the minds of governments, corporations, and the public to the magnificence of what remains of our green planet. As the conversion of forests continues, World Heritage forests may be the last reminders, or at least the best examples, of nature's wealth.

Some key actions, building on each other, could include:

- Build World Heritage forests into other international programmes to conserve forests and to use forests sustainably, including the UN Framework Convention on Climate Change, the International Tropical Timber Organization, the World Trade Organization, the Convention on Biological Diversity, and many others.

- Manage World Heritage forests in conjunction with the surrounding lands, thereby expanding their influence and expanding their effective size. Such links could also help World Heritage to be seen more clearly as an important contribution to development in rural areas, thereby opening potential new sources of funding.

- Continue and expand research on World Heritage forests, thereby helping to understand how these systems adapt to changing conditions and provide goods and services to people, and the rest of nature. Such research would also provide the basis for long-term monitoring of World Heritage forests, thereby providing a baseline against which research in other kinds of forests could be compared. Such research should also include economic dimensions that build on the work of TEEB, and incorporate traditional knowledge where this is relevant.

- Use World Heritage forests as pioneers in developing effective approaches to REDD+, recognizing that these forests are both the richest terrestrial stores of carbon (Lewis *et al.*, 2009) and provide the best capacity for adapting to changing conditions. The World Heritage Committee could play a key role in advocating such an approach (Phelps and Webb, this volume).

- Continue to encourage the general public to visit World Heritage forests so they can experience for themselves the inspiration that such sites have to offer. After all, public support is essential to maintaining the world's forests in the face of increasing demands.

- Make best use of the management tools available to World Heritage forests at all levels, from the most humble forest guard up to the World Heritage Committee. Through the long-term monitoring of World Heritage forests, management responses can be calibrated to respond to emerging needs, which might even include changing some boundaries, linking World Heritage forests through corridors of suitable habitat, and managing natural forces such as fires, disease outbreaks, and senescence. Perhaps more importantly, management techniques developed in World Heritage forests could be applied to other forests to deal with increasing human pressures, using techniques such as the certification of sustainable harvesting (Newsom, this volume), the use of new technologies to maintain genetic diversity, controlling the spread of invasive alien species, and dealing with the anthropogenic spread of pathogens.

The bottom line: eternal vigilance, powerful partnerships, adaptive management, and strong public support will provide the best chance for a healthy future for World Heritage forests.

References

Ajani, J. 2011. The global wood market, wood resource productivity and price trends: an examination with special attention to China. *Environmental Conservation*, Vol. 38, No. 1, pp. 53–63.

Barrow, E. G.C. 2010. Falling between the 'cracks' of conservation and religion: the role of stewardship for sacred trees and groves. In: Verschuuren, B., R. Wild, J. McNeely, and G. Oviedo (eds). *Sacred Natural Sites: Conserving Nature and Culture*. Earthscan, London, pp. 42–52.

Beltran, J. 2000. *Indigenous and Traditional Peoples and Protected Areas: Principles, Guidelines, and Case Studies*. IUCN, Gland, Swizterland

Bradshaw, C., B. Brook, K. Peh, and N. Sodhi. 2009. Flooding policy makers with evidence to save forests. *Ambio*, Vol. 38, No. 2, pp. 125–126.

Brunner, R. 1999. *Parks for Life: Transboundary Protected Areas in Europe*. IUCN, Ljubljana, Slovenia.

Bush, M.B., Silman, M.R. and Urrego, D.H. 2004. 48,000 years of climate and forest change in a biodiversity hot spot. *Science*, Vol. 303, No.5659, pp. 827–829.

Conniff, R. 2010. Forestry on the front lines. *Environment Yale*, Fall: 12-15.

FAO. 2009. FAOSTAT. http://faostat.fao.org/site/626/default.aspx#ancor

Global Forest Resources Assessment. 2010. Food and Agricultural Organization of the United Nations. Rome, Italy. http://www.fao.org/docrep/013/i1757e/i1757e00.htm

Haggart, M. 2009. Proposal to mine Aspiring. Otago Daily Times, December 1. http://www.odt.co.nz/news/national/84055/proposal-mine-aspiring

Hirsch, P.D, W. M. Adams, J.P. Brosius, A. Zia, M. Baariola, and J. Dammert. 2010. Acknowledging conservation tradeoffs and embracing complexity. *Conservation Biology*, Vol. 25, No. 2, pp. 259–264.

Holling, C.S. (ed.). 1978. *Adaptive Environmental Assessment and Management*. John Wiley and Sons, London.

Innes, John L. and Kenneth Er. 2002. Questionable utility of the frontier forest concept. *BioScience*, Vol. 52, No. 12, pp. 1095–1109.

Lewis, S. *et al.*. 2009. Increasing carbon storage in intact African tropical forests. *Nature* vol. 457, pp. 1003-1006.

Lewis, S.L., P.M. Brando, O.L. Phillips, G.M.F. van de Heijden, and D. Nepstad. 2011. The 2010 Amazon Drought. *Science*, Vol. 331. No. 6017, pp. 554.

Phelps, J., E. Webb, and L. Koh. 2011. Risky business: an uncertain future for biodiversity conservation through REDD+. *Conservation Letters*, Vol. 4, No. 2, pp. 88–94.

Porteus, A. 1996. *The Love of the Forest: Myths and Legends*. Senate, London.

Pravda. 2010. Russian forest fires cause over $15 billion in damages. http://www.MarketOracle.co.uk/article21904.html

Price, S.V. (ed.). 2003. *War and Tropical Forests: Conservation in Areas of Armed Conflict*. Food Products Press, Binghampton, NY.

Richards, P. 1996. *Fighting for the Rain Forest: War, Youth and Resources in Sierra Leone*. Heinemann, Oxford, UK.

Sandwith, T., C. Shine, L. Hamilton, and D. Sheppard. 2001. *Transboundary Protected Areas for Peace and Cooperation*. IUCN, Gland, Switzerland.

Schneider, S. and Root, T. (eds). 2002. *Wildlife Responses to Climate Change: North American Case Studies*. Island Press, Washington DC.

Settele, Josef, et al.. 2008. Climatic Risk Atlas of European Butterflies. Pensoft, Sofia and Moscow.

TEEB. 2010. Pushpam Kumar (ed.) *The Economics of Ecosystems and Biodiversity*. Earthscan, London. http://www.teebweb.org

A Selection of World Heritage Forest Indicators

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Formally adopted by the World Heritage Committee in 2001, the World Heritage Forest Programme is committed to the identification and conservation of the world's most outstanding forests. Since its adoption, nineteen new World Heritage forests have been inscribed, including the inscription at the 35th session of the World Heritage Committee in 2011, bringing the total to 104 sites. These forests come in various shapes and sizes and have different conservation histories. Factors affecting their conservation vary widely, complicating any effort to provide standardized indicators of their state of conservation. However, by relying on a variety of indicators, both specific to the World Heritage processes and to the nature of the sites themselves, a general impression can be obtained. The following indicators serve to update and complement a series of indicators originally developed and presented in 2007 (UNESCO, 2007).

1. Are World Heritage forests able to withstand and bounce back from catastrophes?

The surface area of World Heritage forests as an indicator of resilience

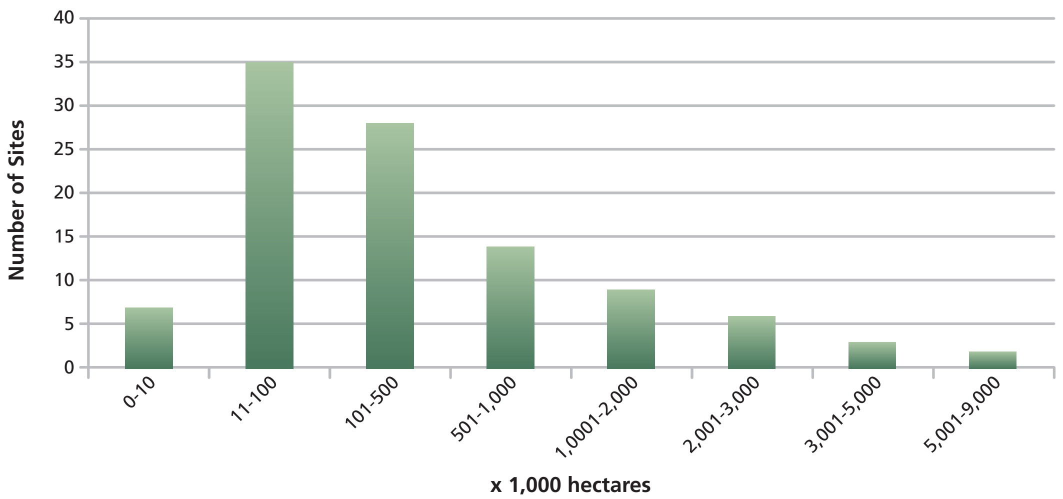
One component of a World Heritage site's Outstanding Universal Value (OUV) relates to its overall integrity, which refers to its capacity to maintain the attributes that contribute to its inscription criteria over time. Though many factors will affect the integrity of a site, a crucial factor is its capacity to recover from occasional catastrophes – known as its 'resilience'.

It is generally understood that resilience, and thus integrity, increases with the size of a site. Larger sites are better able to recuperate and return to their original condition from such disturbances as forest fires, hurricanes, disease outbreaks, or even temporary anthropogenic disturbances such as illegal logging or hunting.

Box 1. Extensions of World Heritage forests

Manú National Park was originally inscribed in 1987 with a total surface area of 1,532,806 ha. The government of Peru enlarged the national park in 2002. In 2009, the World Heritage Committee approved Peru's request to have the World Heritage site officially increased to a total of 1,716,295 ha. Similarly, Australia had originally nominated Kakadu National Park with a size of 614,400 ha, which the Committee inscribed in 1981. Over the years, this property had been expanded on three occasions and now covers an area totaling 1,980,994 ha. At its 35th session, the Committee recently decided to extend the Primeval Beech Forests of the Carpathians, originally inscribed in 2007, with a surface area of 29,279 ha. The site now includes the Ancient Beech Forests of Germany, resulting in a total coverage of 33,670 ha in three countries.

Figure 1. Number of World Heritage forests by surface area



Forty per cent of World Heritage forests are less than 100,000 hectares in size. Seven are even less than 10,000 hectares. Generally speaking, the smaller the size, the greater the need to ensure effective management in order that the capacity to respond to threats is in place. States Parties should constantly be encouraged to nominate larger forests, or to increase the size of existing World Heritage forests wherever possible. Alternatively, the management of smaller World Heritage sites should receive adequate support and attention in order to ensure that their OUV is fully conserved over time.

2. Are World Heritage forests representative of the diversity of forest life on Earth?

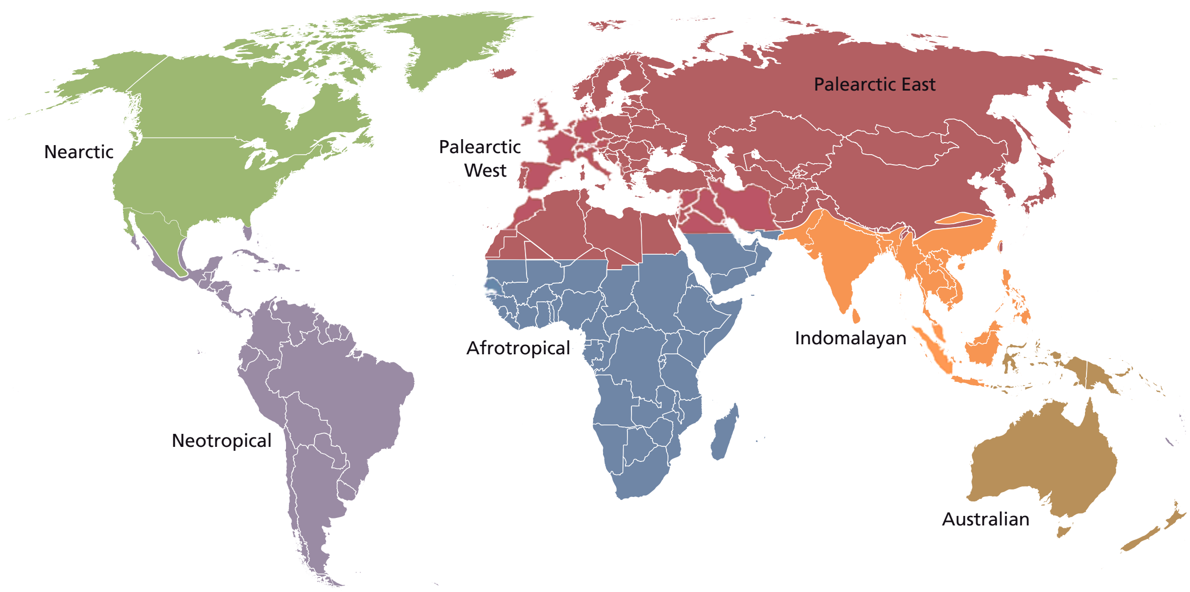
Distribution by biogeographic realm

The world can be divided into biogeographic realms – the largest scale biogeographic division of the Earth's land surface based on historic and evolutionary distribution patterns of terrestrial plants and animals. These realms represent those areas of the Earth where life evolved over long periods of time in relative isolation, separated by geographic features such as oceans, mountain ranges or deserts, forming natural barriers to the movement of animals and plants.

In carrying out a comparative analysis of nominated World Heritage forests, one argument for Outstanding Universal Value is to demonstrate that a particular site encompasses a rich array of life forms not yet well represented on the World Heritage List. Over the years, this approach has contributed to an effective representation of different biogeographic realms within the network of World Heritage forests.

World Heritage forest sites comprise a good representation of most biogeographic realms, with the exception of the Palearctic West (Europe, west of the Ural Mountains, including the Middle East and North Africa). This may be explained by the relative absence of large and/or intact forest tracts in this relatively industrialized and populated region, and by the wide expanses of grasslands and very dry climates. The large tropical forest areas of the world (Neotropical, Indomalayan and Afrotropical realm), containing the greatest density of biological diversity, together represent 53 per cent of World Heritage forest sites. Although the Palaearctic East realm is vast, almost all of the World Heritage forest cover in this area can be attributed to just four sites in the Russian Federation. The Oceanic realm, covering mainly smaller Pacific islands and New Zealand, is not shown on the map (Figure 2).

Figure 2. Biogeographic realms



Source: http://en.wikipedia.org/wiki/File:Ecozones.svg; Map modified

3. Are most potential World Heritage forests already inscribed?

Rate of inscription

An analysis of the rate of inscription of World Heritage forests over the years reveals three distinct phases. From 1978 to 1987, when the Convention was in its infancy, an average of four World Heritage forest sites per year was inscribed. Between 1988 and 1998, this rate dropped to an average of 2.6 sites per year. Notwithstanding a sudden surge in inscriptions during 1999 and 2000 when fifteen sites were inscribed (following the Berastagi expert meeting on tropical World Heritage forests that encouraged new nominations), the average for the period 2001–2011 slowed to 1.7 sites per year.

This progressive reduction in the rate of inscriptions can in part be seen as an indication that most of the outstanding forests of the world may have been recognized under the Convention already. In fact, except for some potential omissions, IUCN has concluded that most large, intact protected forests meeting inscription criteria have been identified and are today inscribed. In its 2004 study, IUCN found that forests in general were already well represented on the World Heritage List (IUCN, 2004). It should therefore not come as a surprise to conclude that one day there will be little scope for new inscriptions.

Figure 3. Distribution of World Heritage forest cover by realm (ha, % total)

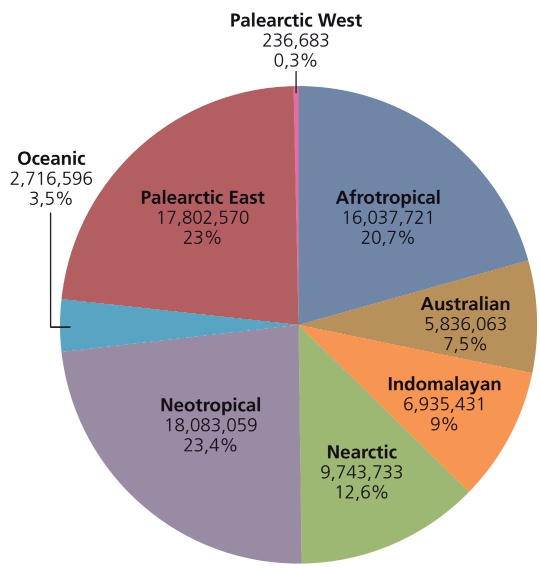
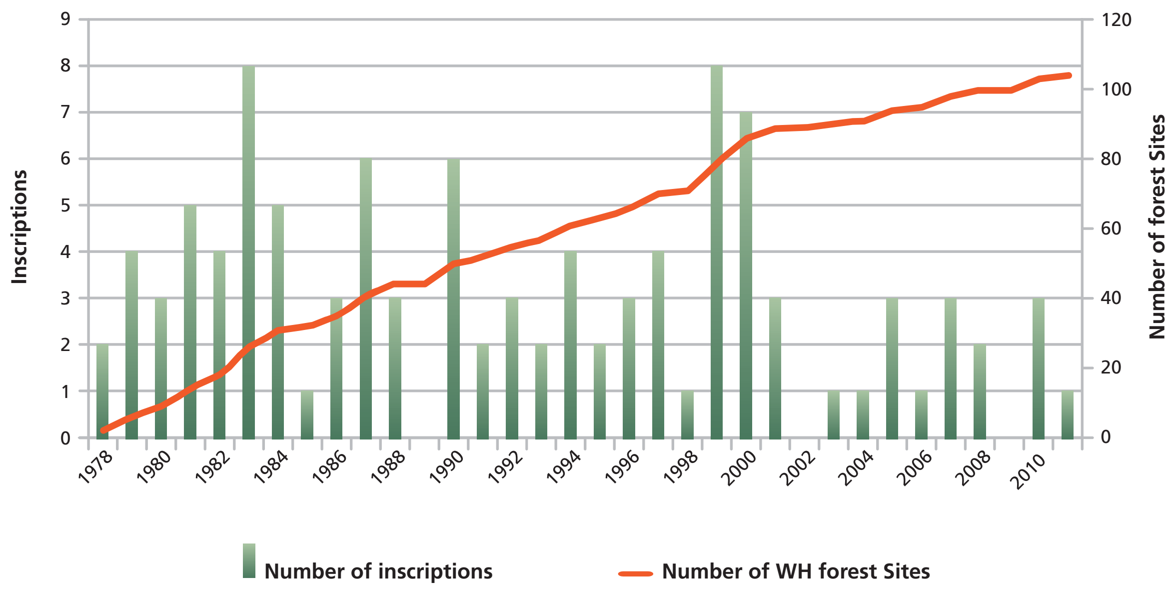


Figure 4. Annual Inscriptions of World Heritage forest sites



4. Are World Heritage forests a particularly vulnerable class of World Heritage site? Relative proportion of 'Danger List' sites that are World Heritage forests

When conditions are such that a World Heritage site is faced with threats that may irreparably harm its OUV, the World Heritage Committee may inscribe the site on the List of World Heritage in Danger as a way to draw national and international attention to the site's conservation needs. A site is removed from the list once the Committee is satisfied that its OUV is no longer under threat. Measuring the proportion of World Heritage forests that are on the Danger List over time provides an indication of the overall trend in the state of conservation – and therefore vulnerability – of World Heritage forests.

Since World Heritage sites were first inscribed in 1978 to the present day, between 11 per cent and 17 per cent of all World Heritage sites have been recognized in part for their forest related values (Figure 5, see orange line). Though somewhat variable in the first six to eight years of the Convention, since 1984 the trend has been towards a very gradual decline in the number of World Heritage forests as a percentage of the total number of World Heritage sites. Today, 11 per cent of World Heritage sites are forest sites.

In contrast, when analyzing the proportion of World Heritage forests among all of those sites inscribed on the List of World Heritage sites in Danger (Figure 5, red line), this figure ranges from 0 per cent (from 1978 to 1991, no World Heritage forest had ever been on the Danger List) to as high as 52 per cent in 1999.

Figure 5 clearly illustrates that since 1992, World Heritage forests have been disproportionately present on the 'Danger List', always at least twice, and up to four times as present on the list than could be expected from their relative numbers. These figures could be a clear indication that the OUV of World Heritage forests may be systematically more vulnerable than that of other World Heritage sites.

5. Is the State of Conservation of World Heritage forests an increasing concern for the World Heritage Committee? Reporting Trend

The Reporting Trend (formerly called the 'Threat Intensity Coefficient') is a function of the number of times the World Heritage Committee reviews the state of conservation of a particular site in the preceding fifteen years, together with the relative distance in time the review has taken place. Thus, if the World Heritage Committee reviewed a site for a few years running, but 10–15 years ago, the trend value will be very low and dropping, this would indicate that the issue in question occurred in the past but was no longer raising concerns. However, a review of a site over the past three to four years will reveal a steep increase in the Reporting Trend value, indicating a current concern that remains an issue. A value of 0 indicates the World Heritage Committee had not reviewed the site in the past fifteen years, and a value of 100 indicates that the Committee had studied the state of conservation of the site for each of the past fifteen years. The Reporting Trend values for individual World Heritage forests can be found in Annex III of this publication.

Figure 6 illustrates the average reporting trend value of all World Heritage forest sites on an aggregate basis.[1] This

1. For a full discussion on the methodology behind this indicator, please refer to: http://whc.unesco.org/uploads/activities/documents/activity-43-2.pdf

Figure 5. Relative number of forest sites on the List of World Heritage in Danger (1978–2011)

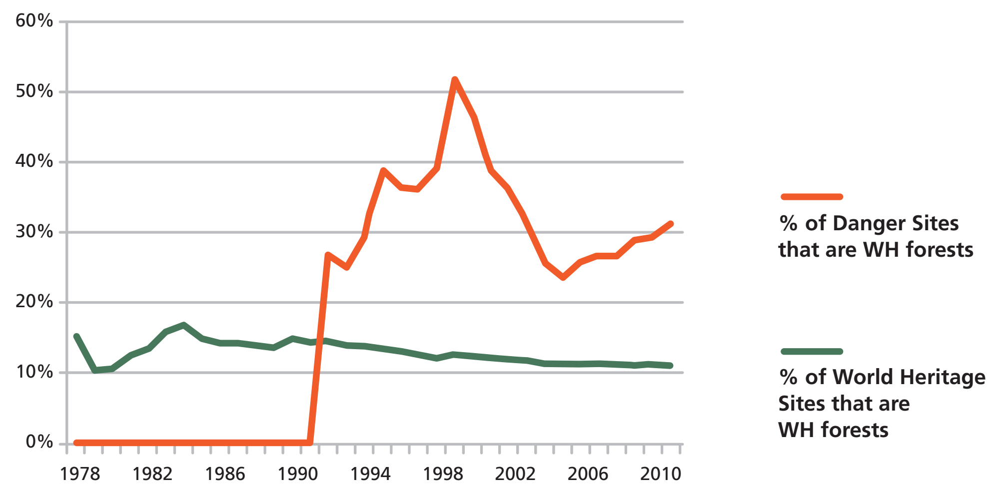


Figure 6. Reporting trend for World Heritage forest sites

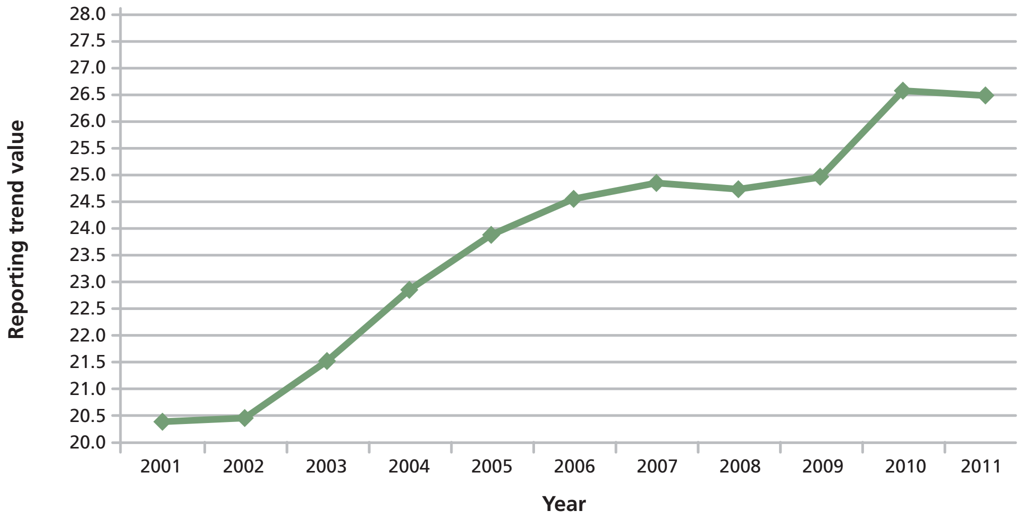


chart illustrates a trend to a more frequent review of World Heritage forest sites by the World Heritage Committee at its annual meetings, pointing to a systematic increase in conservation concerns for these World Heritage sites.

World Heritage sites in danger are annually reviewed by the World Heritage Committee. While figure 5 provides an indication of the relative proportion of World Heritage forest sites in danger, figure 6 provides a broader reading of the state of conservation reviewing trends by the World Heritage Committee for all World Heritage forest sites, regardless of whether or not they are on the List of World Heritage sites in Danger. As a result, in contrast to figure 5, which indicates a decline in the proportion of World Heritage forest sites on the Danger List between 1999 and 2005, figure 6 indicates a near constant increase in the level of attention granted by the World Heritage Committee on the state of conservation of World Heritage forest sites.

With regard to figure 6, it is clear that World Heritage forest sites have almost consistently drawn increasing attention from the World Heritage Committee in its annual deliberations on the State of Conservation of World Heritage forest sites since 2002. This trend, if not reversed, would indicate increasing conservation concerns for World Heritage forest sites as a whole.

Conclusion

The indicators noted here, combined with those presented in the 2007 World Heritage Centre report, help improve the understanding of the World Heritage Convention with regard to forest conservation worldwide, as well as providing forest conservation stakeholders a good first quantitative impression on the state of conservation trends for these forests.

Collectively, World Heritage forests make a very significant contribution to forest conservation at the global level; as of 2006, 13.3 per cent of all IUCN category I-IV protected forests were recognized under the World Heritage Convention (UNESCO, 2007). These forests are found to be relatively well distributed among the major biogeographic realms of the planet, with 60 per cent over 100,000 ha in size, indicating that the network of World Heritage forests largely consists of what should be fairly resilient forests that are representative of the diversity of the world's forest ecosystems.

However, the indicators do point to some concerns regarding the trends in their state of conservation. For example, World Heritage forests are proportionately over-represented on the List of World Heritage in Danger, and they are also steadily attracting more attention over time from the World Heritage Committee in their deliberations over the state of conservation of World Heritage sites. Both these indicators suggest that the conservation of World Heritage forests is increasingly difficult. Further research would be required to investigate the nature of the threats being considered by the World Heritage Committee so as to better define the factors contributing to these trends.

References

IUCN. 2004. *The World Heritage List: Future priorities for a credible and complete list of natural and mixed site*. IUCN, Gland. Available online: http://whc.unesco.org/uploads/activities/documents/ activity-590-3.pdf

UNESCO. 2007. *World Heritage Forests – Leveraging Conservation at the Landscape Level*. World Heritage Report 21. UNESCO, Paris. Available online: http://whc.unesco.org/uploads/activities/documents/ activity-43-8.pdf

2

Adapting to changes

Boreal forests of Gros Morne National Park, Canada © Lisa Liscoumb

Climate Change and World Heritage Forests

by Jim Perry
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Overview

Managers of World Heritage forests are facing a poorly recognized crisis. Climates are changing all over the world and we are seeing increased frequencies of floods, droughts, and severe storms. As climates change, ecosystem constituents react differently, some species expanding their ranges, some contracting them. As climates change, a World Heritage forest may also become more vulnerable to human induced impacts, compounding stresses. Taken together, these stresses and changes may lead to the loss of those values for which a site was originally recognized under the World Heritage Convention.

The Sundarbans in Bangladesh, as well as Sundarbans National Park in India, consist almost entirely of near sea level mangrove forests, harbouring the largest remaining populations of Bengal tigers. They are surrounded by densely populated and intensively farmed agricultural lands, and even minor sea level rises, coupled with increasing typhoon frequencies, may result in a radical reduction of forest cover.

There are two central themes that describe the principal opportunities for action: i) assess and ii) adapt.

Assessing climate change
It is critical today that site managers, national governments, and UNESCO refine existing monitoring and assessment (M&A) programmes to include the detection of climate change related impacts in World Heritage forests. M&A should include climate variables, plant and animal community indicators, and measures of the activities and services associated with a human valuation of these unique systems (i.e. tourism, fishing). Though routine climatic monitoring is common near and within World Heritage forests, ecological monitoring, as well as monitoring of human activities, is infrequent and often expensive. There is great need and opportunity for a network of World Heritage forest managers, an interactive group that shares ideas, data, analyses and interpretations.

Adapting to climate change
Once monitoring has provided information on changes taking place, the next and more complex challenge lies in implementing effective adaptation measures. All ecosystems change through time. The challenge facing us today is to understand where changes will threaten the Outstanding Universal Values that qualify a site as World Heritage, and understand if and how we can do something about it, and when we cannot, then act on that information. Adaptive strategies include land management (i.e. establishing ecological corridors to allow the migration of plants and animals, and buffers to increase the resilience of sites), on-site management (i.e. encouraging or discouraging vegetative patterns), and management of human impacts (i.e. fire risk). It is likely that a systematic and full response to climate change for all World Heritage forest sites will be restricted by financial capacity. To prioritize action, the sites that are at highest risk, the drivers of that risk, and those with potential for greatest adaptive opportunities, all need to be identified.

Introduction

Forested ecosystems exist because landscape patterns (i.e. soils, precipitation, temperature) encourage the growth of trees over other land ecosystems, such as grass and shrublands. All forested ecosystems have a spatial pattern of plant and animal communities, and that spatial pattern has a temporal component (i.e. it changes with time). The principal driving force that has resulted in the forest ecosystems we see today is climate, and climate varies regionally as a function of atmospheric composition and large-scale surface properties like oceans and mountains. It varies at a finer scale as a function of topography, vegetation, land cover, and many other variables. Notwithstanding human activity over the last several hundred years, that local- and regional-scale pattern dictates if lands are covered by forests, grasslands, or deserts.

There is strong evidence that local and regional climatic patterns are changing at rates higher than in the past several thousand years. For example, the flood frequency of rivers draining into the Great Barrier Reef have increased significantly as upstream land use practices have changed (Devlin *et al.*, 2001, Greiner *et al.* 2005). Changes are seen in average temperature and precipitation within a region, and at a single location. However, climate has a large natural variability. It is difficult to demonstrate, with confidence, that average temperature or precipitation varies significantly within a region or within a few decades. In contrast, we have strong evidence that the variance around average conditions is changing rapidly. Many if not all World Heritage forests would be able to demonstrate increased floods, droughts and other extreme events over the last 50–100 years, were sufficient data available. Some of the climate related change in plant and animal communities are now apparent (i.e. along the edge of a forest-grassland transition) and others are yet too subtle for us to detect. The changes will become more apparent in the future, and the rate of climate change suggests that landscape changes will accelerate. The most likely places to detect changes will be those that are climatically marginal (i.e. transitional areas between forest types or areas where a forest's character is unusual for the region – perhaps having tree cover that is characteristic of a wetter or drier region).

Evidence for climate change – a summary

Climate patterns and their changes are understood through the use of complex computer generated General Circulation Models (GCMs). There are more than twenty GCMs currently in use by the world community[1]. A GCM uses observed data and atmospheric physics to model the flows of energy and water in the atmosphere. Modelers use observed data from historical records to calibrate the GCM, and as a reference against which to understand predicted future conditions. By their nature, GCMs are very data and computer intensive, and are rather coarse in scale. GCMs have a cell size (i.e. smallest spatial unit) of >10,000 km^2 or 1 million hectares. Such cell sizes are appropriate when modeling global patterns; they are less so when asking about predicted future conditions for a given location (i.e. a specific landscape). Most World Heritage forests would fall within a relatively few GCM cells[2]. Though finer scale circulation models (RCMs or Regional Circulation Models) do exist, they require very large empirical data sets for the region under consideration, and are subject to significant limitations (Jones *et al.*, 1997, Elliott and Bell, 2011). Typically, they have been developed and tested only in specific regions, usually in countries with strong economies and a long tradition of climatic monitoring. Such models will be unavailable for most areas that contain a World Heritage forest.

Given the distinct limitations and specifications pertaining to GCMs in use today, the commonly accepted practice for understanding possible futures is to use several GCMs and to combine the result. Averaging predictions among models is straightforward, and is the most common approach to combing multiple predictions for a location and time frame. However, model predictions vary among GCMs, the correct model choice is unknown, and many atmospheric processes are stochastic (i.e. occur randomly). Therefore, there will always be uncertainty about a predicted future. That uncertainty requires adaptive management (i.e. taking action on the ground, measuring effects, and changing management as necessary). It also requires being routinely aware of the growth in model effectiveness, so that management is based on reasonable climate scenarios.

Some modeling efforts accept the average prediction among models as the best answer available, and use that in planning future management. An alternative is to examine variance among models (i.e. standard deviation among models, over the mean of model predictions) as an estimate of uncertainty. If most models predict similar conditions, that ratio will be low and one can be relatively confident in predicted conditions. If that ratio is large, there is less agreement among models and one should have less confidence in the predictions. Uncertainty plays a relatively small role at a given site. However, society has a relatively fixed amount to invest in adaptive management of World Heritage forests. Uncertainty around predicted future conditions should influence where those resources are invested. For example, sites whose climate change predictions are more certain should receive higher priority.

Modeling global and regional climates is a complex task, requiring massive computers and the involvement of highly skilled atmospheric scientists. Few World Heritage forest site managers will have access to detailed model predictions for their site. However, there are resources that would guide managers in developing a broad understanding of predicted future climates and in designing adaptive monitoring and assessment, as well as management pro-grammes. For example, recent developments in free, global climate models[3] would allow a site manager to begin to collect site-specific information.

Vulnerability of a World Heritage forest

The science of vulnerability assessment is growing rapidly as scientists learn more about the ways ecosystems respond to changing climates. In general, some of the influences known today that influence vulnerability include size, landscape complexity (i.e. fragmentation, connectivity), aggressive land use (i.e. intensive agriculture, urbanization), elevation gradient, and the distribution of water.

Defining Vulnerability

Overall vulnerability of a site is expressed by combining a range of variables and comparing many sites to each other. Variables that are thought to influence the vulnerability of a World Heritage forest to climate change include size, susceptibility to sea level rise, fragmentation, patch size and distribution, mountainous landscape, insular nature, aggressive land use and elevation and distance away from the coast (Perry, 2011). There is no threshold for these variables. Vulnerability in this context suggests that the probability of a negative impact due to climate change is relatively high, among World Heritage forests.

1. http://www.ipcc.ch/
2. http://whc.unesco.org/documents/publi_wh_papers_21_en.pdf
3. http://www.worldclim.org/

Figure 1. Satellite images of two World Heritage forests

Volcanoes of Kamchatka, Russian Federation, a site perceived to have low vulnerability to climate change.

Sunderbans National Park, India and The Sundarbans, Bangladesh, a site perceived to have high vulnerability to climate change.

Source: Google Earth

Global models can help prioritize among World Heritage forests, but cannot give site-specific adaptation recommendations. It is important to note that broad global or regional assessments are prioritization exercises that should not be confused with a site-specific climate change adaptation plan. There is a wide range of tools available on a global basis to support large-scale vulnerability assessments (i.e. Nkem *et al.*, 2007). Managers may access many of those free of charge. For example, remote sensing tools such as Google Earth and its associated satellite images are accessible and invaluable.

Fortunately, other tools exist to help site managers get a better idea of the climate changes that might occur at their site, offering directions for adaptation initiatives. Understanding the vulnerability of an individual site requires knowledge and data describing local conditions. The information required for a given site will always be contextual; a review of the variables that drive vulnerability will allow a site manager to identify the variables most appropriate for his/her site. Many of those data can be collected at coarse spatial scales (i.e. for assessing a site in its surrounding landscape) from remote sensing data such as Google Earth. Geographic Information System (GIS) files of the site will be an invaluable way to identify finer scale spatial pattern, to track and express observed changes in pattern, and to plan management actions (i.e. collaborative management with an adjacent land unit). Data availability for GIS applications will vary widely among sites. Where available, Digital Elevation Maps (DEMs), soil and vegetation maps, and the distribution of major wildlife habitat units, along with a good understanding of the reasons behind a site's recognition under the World Heritage Convention, will be informative in understanding climate change vulnerability.

The influence of nearby human population centres

Human activity adjacent to, and in some cases within a World Heritage forest will have significant impacts on that ecosystem and will influence its vulnerability to climate change. Human influence on a World Heritage forest is influenced by a range of variables, such as proximity to transportation corridors, population centres, and the nature of surrounding land use. The Human Influence Index (HII[4], Sanderson *et al.*, 2002) developed by CEISIN at Columbia University uses the most recent data available to combine eight major variables into one index. The HII is a useful tool for comparing sites in a region or for tracking changes through time (Leroux *et al.*, 2010). The HII ranges from 0 to 64 globally; it ranges from 0 to 33, and averages 15.1 in World Heritage forests.

The HII is calculated for a designated area (i.e. a site itself or a site in its surrounding landscape). The HII can express current and anticipated anthropogenic influences on a site and can guide a site manager in developing proactive management strategies. For example, a site in a landscape with a high HII might anticipate that climate changes will cause increased incursion on the site. Proactive strategies might include developing co-management strategies for adjacent lands, or investing resources in assessment and education to ensure that people in adjacent communities understand the value of the site, as well as the probability and significance of a potential, climate change related impact.

4. http://sedac.ciesin.org/wildareas/downloads/maps/Human_Influence_Index/North_America.pdf

The argument for proactive adaptive action

There are 211 World Heritage sites recognized for natural heritage criteria. Nearly half of those (about 100) are World Heritage forest sites. Those sites represent unique ecosystems of very high value to humankind. They sequester and store carbon, buffer regional and climatic changes and are often centres of reproduction and dispersal of important plant and animal species into the wider landscape. It is clear that the species composition, ecosystem function and health of those forests are strongly influenced by climate, and that local, regional and global scale climates are changing. There is a very high probability that World Heritage forest ecosystems are changing more rapidly now than for the last several hundred years. However, the rate and magnitude of those changes is not readily discernible. Certainly, the more sensitive forest sites and their components (i.e. sea level forests, forest-grassland transitions) are noticeably changing. However, many World Heritage forests are large, relatively uniform tracts. Such systems may be strongly resistant to climate change and may deserve increased levels of attention and protection for just that reason.

Monitoring

An innovative monitoring programme will return great dividends. For example, ecological monitoring at especially sensitive or indicative locations within a site (i.e. at a forest-grassland border, along an elevation gradient, or along a glacier's leading edge) may serve as early warning of climate related changes. Aquatic communities within forest ecosystems integrate many landscape characteristics and can serve as highly sensitive indicators. The most effective ecological monitoring programmes will be integrative among ecosystem components, and will target landscape characteristics such as edges and transitional zones, where climate change effects are likely to be first noted.

The most significant decision to be made regarding climate change adaptation and ecological monitoring is the audience for the results, and the actions one wishes that audience to take. A proactive climate-change response plan for a World Heritage forest should include stakeholder definition (i.e. who are the people who care about and have the ability to act upon impacts of climate change at the site?). A monitoring programme, including both climatic and ecological variables will inform those stakeholders and guide their actions. An actively engaged site manager will be able to provide data and information about his/her site, and the ways climate-related changes are affecting that site, or might affect it in the future. A stakeholder group will be able to develop and assess large scale adaptive strategies such as the purchase or management of adjacent lands, the formulation of land use policies designed to encourage certain behaviours among land owners, or management of human impacts (i.e. better fire control capacity).

A serious constraint faced by all World Heritage forest site managers is resource limitation. Each site has a relatively limited budget that can be invested in management, M&A, and all the other demands placed on the site's budget. Investing in climatic and/or ecological monitoring represents one more demand on limited resources; setting priorities among those competing demands is a central function of management. There are at least two resources that would help an individual site manager evaluate climate change related risks compared to competing priorities:

- Global models that evaluate relative climate change risk at World Heritage sites (i.e. Perry, 2011, Epple *et al.*, 2010) identify sites perceived to be most at risk, and identify perceived causal factors (i.e. what makes one site more at risk than another). Sites generally perceived to be at higher risk will find monitoring an important investment. Variables perceived to drive vulnerability at a given site will often be useful components of a monitoring programme.

- A professional network of or conversation among World Heritage forest site managers will provide guidance about stakeholder definition, monitoring approaches, analytical approaches, findings and interpretations of monitoring programmes, and adaptive actions taken as a result of monitoring. One strategy that has proven effective in similar settings is twinning. In such a programme, a site manager in a location that has a relatively strong resource base is paired with a manager where resources are more limited. The two share ideas, data, analytical strategies and results, strengthening each.

Summary

Some World Heritage forest sites are at much higher risk of climate related changes than others. Recent attempts to assess relative climate change risk among World Heritage sites assist individual site managers in understanding the magnitude of the risks they face, as well as the specific on-site variables most strongly driving such risk and therefore, most likely to change. Carefully designed and implemented ecological and climatic monitoring programmes that actively engage a strong stakeholder base will be most effective in detecting and responding to climate induced changes. A proactive strategy will ensure the best decisions. Elements of such a strategy should include: 1) developing a World Heritage forest adaptation toolkit, 2) engaging the World Heritage forest community (i.e. managers and staff of the 104 designated forest sites) in an active discussion of anticipated, climate induced changes, and 3) pairing sites to share analytical ideas and approaches. Actions such as those will increase the probability that climate change impacts are detected early and that proactive, adaptive strategies are identified and considered in a timely way.

References

Devlin, M., J. Waterhouse, J. Taylor, J. Brodie. 2001. Flood plumes in the Great Barrier Reef: Spatial and temporal patterns in composition and distribution. *Great Barrier Reef Research Publication* 68. Great Barrier Reef Marine Park Authority, Townville Australia
http://www.gbrmpa.gov.au/corp_site/info_services/publications/research_publications/rp068/index.html

Elliott, J.A. and V.A. Bell. 2011. Predicting the potential long term influence of climate change on vendace (*Coregonus albula*) habitat in Bassenthwaite Lake, UK. *Freshwater Biology*, Vol. 56, pp. 395– 405.

Greiner, R., A. Herr, J. Brodie, D. Haynes. 2005. A multi-criteria approach to Great Barrier Reef catchment (Queensland, Australia) diffuse-sourced pollution problem. *Marine Pollution Bulletin*, Vol. 51, pp. 128–137.

Jones, R.G., J.M. Murphy and M. Noguer. 1997. Simulation of climate change over Europe using a nested regional model 2 Comparison of driving and regional model response to a doubling of Carbon Dioxide. *Quarterly Journal of the Royal Meteorological Society*, Vol. 123, pp. 265–292.

Leroux, S.J, M.A. Krawchuck, F. Schmiegelow, S.G. Cumming, S. Lisgo, L.G. Anderson, M. Petkova. 2010. Global protected areas and IUCN designations: Do the categories match the conditions? *Biological conservation*, Vol. 143, pp. 609–616.

Nkem, J., C. Perez, H. Santoso, M. Idinoba. 2007. Methodological framework for vulnerability assessment of climate change impacts on forest based development sectors. CIFOR CATIE.
http://www.cifor.cgiar.org/trofcca/attachment/03%20TroFCCA%20Annual%20Report%20-%20%20Year%202%20-%20web.pdf

Perry, J.A. 2011. A global model identifies the 16 natural heritage World Heritage sites most at risk from climate change. *International Journal of Heritage Studies*. In Press.

Sanderson, E.W., J. Malanding, M.A. Levy, K.H. Redford, A.V. Wannebo, G. Woolmer. 2002. The human footprint and the last of the wild. *BioScience*, Vol. 52, No. 10, pp. 891–904.

Assessing the Connectivity of World Heritage Forests

by Robert M. Ewers [1] and Valerie Kapos [2,3]

Connectivity and the maintenance of biodiversity in World Heritage forests

Many different properties of forest reserves, including their size, continuity or fragmentation, and the degree to which they are connected to other forest areas, affect their usefulness for preserving biodiversity. Connectivity and its inverse – isolation – measure the extent to which a landscape facilitates or impedes the movement of organisms between habitat patches. It is an important determinant of biodiversity within forests because it strongly influences the rates and patterns of species survival and dispersal, affecting many ecological processes. The ability to move across a region, exploiting resources that vary in space and time, is a fundamental requirement for survival in many species; connectivity between habitat patches facilitates such movement and is often an important contributor to the long-term persistence of such species, and others that depend on them.

The degree to which connectivity affects the ability of a forest to support species is largely a function of the size of the forest. Most species require a minimum habitat area to support a successfully reproducing population; forests that are larger than the minimum area required for a particular species have a strong chance of retaining viable populations of those species over the long term. However, minimum area requirements vary greatly among species. While some invertebrates need less than one square metre, large carnivores may require many thousands of square kilometres. Connectivity with other areas of forest can increase the total amount of forest available to wide-ranging species, and may be an important determinant of the ability of a reserve to support large, mobile animals. By contrast, the persistence of small or sedentary species inside reserves is likely to be less affected by connectivity.

World Heritage sites that contain forest tend to be large; nearly all are greater than 10,000 hectares in size, and half of them are 100,000 hectares or more (Thorsell and Sigaty, 1997), though some are not completely forested (the 1997 analysis included World Heritage sites with 20 per cent or more forest cover). This suggests that World Heritage forests are generally much larger than average forest fragments within modified landscapes, which are mostly smaller than 100 hectares (Cochrane and Laurance 2002; Ribeiro *et al.*, 2009). World Heritage forests are therefore likely to act as reservoirs of biodiversity in wider fragmented landscapes, harbouring populations of forest species that serve as a source of colonizers, transients, dispersers and pollinators for forest fragments outside the World Heritage site itself.

How does connectivity change?

Connectivity can be altered at two spatial scales. At the finest, within-site scale, something as simple as a road can effectively divide the forest into 'isolated' fragments. Research has shown that some Amazonian understory birds are unable to cross dirt roads (Laurance, 2004), and many large mammals in the Congo avoid roads (Laurance *et al.*, 2006), suggesting that the presence of even small roads can impair the connectivity of the forest. Within-site connectivity of World Heritage forests is an important factor in maintaining their biodiversity.

At a larger spatial scale, land use change in the region surrounding a World Heritage forest can cause it to become an increasingly isolated forest 'island' in a matrix of other land uses. In this respect, connectivity is not a binary variable, with a forest being either connected or not connected. Rather, as forest is lost from a landscape, the forested links between remnants are progressively lost, leading to a gradual decline in connectivity. In the ideal scenario with maximum connectivity, a World Heritage forest would be embedded in a much larger, fully forested region. At the opposite extreme would be a World Heritage forest that is completely surrounded by a large expanse of non-forest habitat that prohibits the dispersal of many forest species, effectively separating the World Heritage forest from all other forests in the region. In most situations, however, connectivity is likely to be somewhere between these two extremes; it is important to be able to quantify connectivity and monitor changes in it.

Principles for measuring the connectivity of World Heritage forests

There are many landscape metrics designed to measure connectivity, ranging from simple measurements, such as distance to nearest patch of the same habitat type, to more complicated ones that weight distance between patches by the size of those patches, and measurements that assess the spatial distribution and shape of patches in the landscape. However, because different species respond to the same pattern of forest in different ways, there is no single measure of connectivity that will reflect all the biological implications of changing connectivity. Despite this complexity, there are some guiding principles that can help to assess connectivity in and around World Heritage forests.

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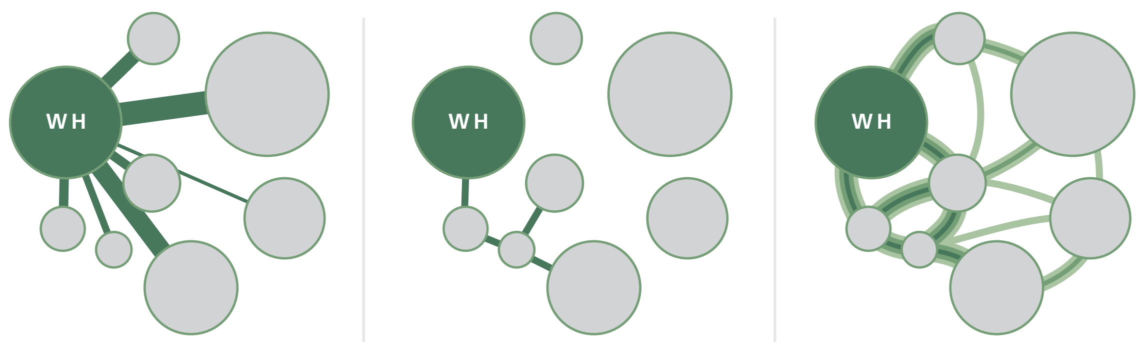
One set of these relates to corridors of forest, such as riparian forests that are often preserved along river margins, and may connect a World Heritage forest to other forest areas. Corridors are known to promote the dispersal of species between habitat patches, thereby reducing biodiversity loss within them (Damschen *et al.*, 2006). The likely efficacy of a corridor can be assessed using four criteria: (a) wide corridors are preferable to narrow corridors, as many species avoid forest edges and are therefore unlikely to move through a narrow strip of forest (Ewers and Didham, 2007); (b) shorter corridors are more likely to allow successful dispersal between patches than long corridors; (c) similarly, a corridor should ideally be continuously forested with no breaks, such as might be created by roads crossing the corridor (this is not to say that a 'broken' corridor will not function; as long as a species will cross small gaps then the individual patches of forest along that corridor can act as 'stepping stones', facilitating the movement of a species from one location to another); (d) finally, the size of the forest patch at the other end of the corridor is a strong determinant of the size of populations inhabiting that patch and therefore the likelihood of individuals leaving the patch to disperse along the corridor (Hanski, 1998). Corridors that connect a World Heritage forest to a large forest patch are likely to have a larger beneficial effect for the World Heritage forest than those connecting to a small forest patch.

Another important principle concerns the nature of the habitat 'matrix' that surrounds a World Heritage forest. Many forest species are more likely to disperse through habitats that are similar to the forest they originate in, so a World Heritage forest that is surrounded by a plantation forest might be more connected than one that is surrounded by a rice paddy. For example, Renjifo (2001) showed that bird populations inhabiting forest patches in the Andes were more connected when forest patches were separated by a matrix of exotic tree plantation than when separated by pasture. A matrix that is 'permeable' to the dispersal of individuals increases the 'functional connectivity' of a patch, effectively a combination of both the spatial pattern of habitat and the ability of a species to cross the matrix.

New developments in assessing connectivity

Connectivity measures are being developed that better represent the impact of spatial patterns of forest on the dispersal of organisms, but this improvement comes at the expense of simplicity; measures are gradually increasing in complexity. The current approaches fall broadly into three groups based on metapopulation biology, graph theory and circuit theory respectively (Figure1). Perhaps the largest step forward in assessing connectivity has been to consider how a target patch is connected to all the forest patches in the landscape, rather than focusing on connectivity between individual pairs of fragments. Hanski (1998) presents a simplistic method for doing this that is widely used in metapopulation biology, based on three parameters: (a) the distance between the target patch and all other patches, with that distance weighted by, (b) the size of patches, and (c) the permeability of the matrix. Applying this index to World Heritage forests has the advantage that all forest patches in the landscape count towards the connectivity of the World Heritage forest, but it ignores that fact that some patches will simply be too far away to be within the dispersal range of some species. An alternative approach is to determine the maximum distance that one or more selected species can disperse

Figure 1. Three methods of assessing the connectivity of a World Heritage forest



(a) Metapopulation
Metapopulation biology links the World Heritage forest to all other forest patches, with the magnitude of that link determined by a combination of the size of the forest patch and how far away it is.

(b) Graph theory
Graph theory assesses connectivity by identifying a network of linked patches that are separated by a maximum distance.

(c) Circuit theory
Circuit theory assesses all the possible paths an individual could take when moving among fragments. High frequency movement paths are shown with thicker and darker connections than low frequency movement paths.

World Heritage forest — Other forest patches in the surrounding region across the matrix habitat that surrounds a World Heritage forest, and to then use graph theory to define clusters of patches that are separated by less than that distance (Keitt *et al.*, 1997). Connectivity can then be measured as the total amount of forest area that is connected in the patch cluster to which the World Heritage forest belongs. Graph theory approaches retain the advantages of the metapopulation approach, without the disadvantage of incorporating forest patches that are too far away to be relevant to the World Heritage forest.

Most recently, 'circuit theory' has been advanced as a method for quantifying connectivity over large spatial scales (McRae and Beier, 2007). The central assumption behind circuit theory is that not all individuals that disperse from one patch to another do so using the same route across the intervening matrix. Circuit theory integrates all possible pathways that could connect pairs of forest fragments, incorporating features of the landscape such as corridors, small habitat patches, or barriers to dispersal that can make sections of the pathway more or less permeable than other sections.

Simple methods for monitoring changes in the connectivity of World Heritage forests

Although it would always be best to use a quantitative metric of connectivity, these metrics require relatively detailed knowledge of how particular species will disperse through a given matrix habitat, and that information is often not available. Moreover, because the same spatial configuration and matrix habitat will affect different species differently, the metric obtained for one species will not be a valid representation of connectivity for all species. In the absence of such detailed knowledge, there remain some relatively simple rules that can be used to gauge the connectedness of a World Heritage forest and how that might be changing through time. First and foremost however, we stress that assessing the connectivity of a World Heritage forest requires that attention be paid to what is happening to the forest outside of the World Heritage site itself. After all it is the spatial relatedness of the World Heritage forest to other forests in the region that defines its connectivity.

We suggest three complementary methods for detecting changes in the connectivity of a World Heritage forest. First, a simple quantification of how much forest exists in the surrounding region and whether that amount is increasing or decreasing will give a lot of valuable information. Deforestation in the surrounding region will inevitably leave the World Heritage forest more isolated and therefore less connected. Second, the width of forest corridors should be routinely checked to ensure that they are retaining their width and not becoming constricted along their length. Any constriction to a forest corridor is likely to reduce its effectiveness and thereby decrease the connectivity of the World Heritage forest. Finally, quantifying changes to the matrix land use along the borders of World Heritage forests will help determine changes to the functional connectivity of forest patches. Land use intensification around forests is likely to reduce their connectivity, as is changing the matrix from tree cover to more open land covers. In combination, these three simple measures will give a rapid assessment of whether the connectivity of a particular World Heritage forest is increasing or decreasing through time.

The wider context of World Heritage forest connectivity

It is important to recognize the central role that World Heritage forests will play in maintaining regional connectivity of forests beyond the borders of the World Heritage sites themselves. Because they are generally large, World Heritage forests will contribute significant amounts of the standing forest area in many regions, and are more likely to be the source than the recipient of individuals that disperse to and from surrounding, smaller forest patches. World Heritage forests have internationally recognized importance, and viewing them as integral and connected parts of the wider landscape will further increase that importance.

References

Cochrane, M. A. and W. F. Laurance. 2002. Fire as a large-scale edge effect in Amazonian forests. *Journal of Tropical Ecology*, Vol. 18, pp. 311–325.

Damschen, E. I., N. M. Haddad, J. L. Orrock, J. J. Tewksbury, and D. J. Levey. 2006. Corridors increase plant species richness at large scales. *Science*, Vol. 313, No. 5791, pp. 1284–1286.

Ewers, R. M. and R. K. Didham. 2007. The effect of fragment shape and species' sensitivity to habitat edges on animal population size. *Conservation Biology*, Vol. 21, No. 4, pp. 926–936.

Hanski, I. 1998. Metapopulation dynamics. *Nature*, Vol. 396, pp. 41–49.

Keitt, T. H., D. Urban, and B. T. Milne. 1997. Detecting critical scales in fragmented landscapes. *Conservation Ecology*, Vol. 1, No. 1, p. 4.

Laurance, S. G. 2004. Responses of understory rain forest birds to road edges in central Amazonia. *Ecological Applications*, Vol. 14, No. 5, pp. 1344–1357.

Laurance, W. F., B. M. Croes, L. Tchignoumba, S. A. Lahm, A. Alonso, M. E. Lee, P. Campbell, and C. Ondzeano. 2006. Impacts of roads and hunting on Central African rainforest mammals. *Conservation Biology*, Vol. 20, No. 4, pp. 1251–1261.

McRae, B. H. and P. Beier. 2007. Circuit theory predicts gene flow in plant and animal populations. In: *Proceedings of the National Academy of Sciences*, Vol. 104, pp. 19885–890.

Renjifo, L. M. 2001. Effect of natural and anthropogenic landscape matrices on the abundance of subandean bird species. *Ecological Applications*, Vol. 11, pp. 14–31.

Ribeiro, M. C., J. P. Metzger, A. C. Martensen, F. J. Ponzoni, and M. M. Hirota. 2009. The Brazilian Atlantic Forest: how much is left, and how is the remaining forest distributed? Implications for conservation. *Biological Conservation*, Vol. 142, No. 6, pp. 1141–1153.

Thorsell, J. and T. Sigaty. 1997. *A global overview of forest protected areas on the World Heritage List*. Natural Heritage Programme and UNEP World Conservation Monitoring Centre, Gland, Switzerland. http://cmsdata.iucn.org/downloads/forests_1.pdf

REDD+ as a Contribution to Conservation and Connectivity of World Heritage Forest Sites

by Steffen Entenmann and Christine B. Schmitt

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Introduction

A shift from the traditional exclusionary conservation paradigm towards a more integrative landscape approach can be seen in the management philosophies of protected areas (PAs) (Phillips, 2003). This derives partly from a better scientific understanding of how humans have been shaping ecosystems and landscapes, increasing recognition of local and indigenous communities as well as uncertainties regarding the potential impacts of global climate change (Sayer and Maginnis, 2005). In addition, the frequent shortcomings in funding for PA management is an incentive for exploring new possibilities to monetize ecosystem services that are delivered by PAs (de la Harpe *et al.*, 2004). In this regard, payment schemes for carbon sequestration services in the context of Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+), as currently negotiated under the United Nations Framework Convention on Climate Change (UNFCCC), might play a considerable role as an additional source of long-term funding for forest PAs in the future (Dudley, 2008; Harris *et al.*, 2008).

Whereas the primary focus of the REDD+ mechanism is the creation of incentives for reducing CO2 emissions and enhancing forest carbon stocks in developing countries, it bears great potential to promote actions that contribute to the conservation targets of the Convention on Biological Diversity (CBD) and of the World Heritage Convention (WHC) (SCBD, 2009; von Scheliha *et al.*, 2009; Pistorius *et al.* 2010).

The present paper discusses general risks and benefits of REDD+ for biodiversity, and highlights recent developments and preliminary experiences regarding synergies between REDD+ and PAs, including World Heritage forest sites. In particular, it will discuss how REDD+ can help to protect biodiversity in World Heritage forest sites and how it can contribute to the long-term integrity of World Heritage forest sites, focusing on the aspect of connectivity.

Benefits and risks of REDD+ for biodiversity

Additional benefits for biodiversity that can be derived from REDD+ include the conservation of forest biodiversity beyond the mere protection of forest cover, the establishment of corridors between PAs (see Chapter 4 on connectivity) (Wendland *et al.*, 2009), the reduction of forest fire incidents (Stickler *et al.*, 2009) and securing the sustainable delivery of forest ecosystem services (UN-REDD, 2009). Furthermore, there are opportunities for enhancing biodiversity monitoring in and outside PAs.

However, these potential additional benefits will not automatically be achieved because REDD+ is designed with a quantitative focus on carbon (Brown *et al.*, 2009; Long, 2009; Pistorius *et al.*, 2010). Although the latest REDD+ negotiation text calls for a safeguard to prevent the conversion of natural forests [2], the UNFCCC forest definition in itself does not distinguish between natural forest and forest plantations [3] and thus is a loophole for management activities that are harmful to forest biodiversity. The same holds true for the sustainable management of forests (SMF), which is promoted by the UNFCCC [4] but lacks an adequate definition (Pistorius *et al.*, 2010). Activities aimed at enhancing forest carbon stocks also bear such risks as they may encourage the establishment of monoculture plantations with low habitat and biodiversity value (Koh andWilcove, 2008; Danielsen *et al.*, 2009). Furthermore, there is the risk of inter-ecosystem leakage since forest conservation under REDD+ can trigger a shift of land use conversion pressures to non-forest ecosystems with high biodiversity, such as peatlands or grasslands (Klink and Machado, 2005; Miles and Kapos, 2008; Paoli *et al.*, 2010). PAs may also be threatened by leakage if REDD+ activities outside the PAs lead to an increase in deforestation pressure within the PAs.

Notwithstanding these potential risks, REDD+ activities – if properly designed – can contribute to the long-term funding of PAs and to the conservation of biodiversity and ecosystem services in PAs within a landscape scale approach. World Heritage forest sites have Outstanding Universal Value (OUV) in terms of forest biodiversity and delivery of important ecosystem services (Ripley, 2007) and are therefore sites with high potential for achieving synergies between climate and biodiversity objectives under REDD+. The synergies between REDD+ and the long-term conservation of World Heritage forest sites are starting to be widely recognized, as demonstrated by the increasing

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2. Refer to Annex I, paragraph 2(e): http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf
3. Refer to Annex A, paragraph 1(a): http://unfccc.int/files/meetings/workshops/other_meetings/application/pdf/11cp7.pdf
4. Refer to Section III B, paragraph 70: http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf

number of REDD+ related activities and pilot projects in and adjacent to World Heritage forest sites (Box 1). This development begs the question of how the impacts of REDD+ on World Heritage forest sites can be monitored (Phelps and Webb, this volume) and if REDD+ can contribute to the ecological connectivity of these sites.

Valuing and monitoring biodiversity benefits in REDD+ pilot activities

A growing number of REDD+ pilot projects worldwide have generated a wealth of experience in monitoring the impacts of REDD+ on forest biodiversity. Selling carbon certificates on the voluntary market is an important source of funding for these projects, and higher revenues can be expected if the project is certified for its positive biodiversity impacts by a third party based on recognized certification schemes (EcoSecurities, 2010). For instance, besides pure carbon certification, the CCBA Standard[5] or the Plan Vivo Standard[6] also evaluate socioeconomic and ecological impacts of carbon projects, and are valuable sources on how to assess and monitor forest biodiversity.

In compliance with the mentioned standards, the state of biodiversity in REDD+ pilot projects is often described by the presence or abundance of particular (i.e. endemic or threatened) plant and animal species, and the number, extent and uniqueness of different forest habitats, forest structure, area, proportion of forest cover in the project area and degree of forest fragmentation. An assessment of the pre-project condition of biodiversity is thus the basis for subsequent monitoring activities, and for evaluating if the project generates any positive impacts on biodiversity.

An important conceptual framework applied by many certification schemes for assessing forest biodiversity is the High Conservation Value (HCV) concept developed by the Forest Stewardship Council (FSC). This concept recognizes six types of HCV forests and provides guidelines for monitoring the ecological conditions and changes in forests. It also recognizes whether the project area provides habitats to species listed on the IUCN Red List of Threatened Species, as well as important ecosystem services such as the provision and storage of water and the protection of soil against erosion.

Although the biodiversity indicators used to account for positive net-benefits of the projects –as required by the standards – certainly have some shortcomings as their choice is not necessarily based on sound biologically and ecologically considerations (Entenmann, 2010), they exemplify a practical compromise between ecological requirements and financial and time constraints. Furthermore, the monitoring activities carried out in REDD+ projects, in

5. Standard of the Carbon, Community and Biodiversity Association (CCBA): http://www.climate-standards.org/

6. For more information: http://planvivo.org

Box 1: REDD+ activities in or adjacent to World Heritage forest sites

The tropical biome comprises the biggest part of World Heritage forest sites, both in terms of numbers and area, and the total area of World Heritage forest sites increased strongly in the tropics from 1997 to 2006 (Patry *et al.* 2007). At the same time, there has also been a growing number of conservation activities that apply REDD+ components in tropical forests in or adjacent to World Heritage forest sites.

For example, the Noel Kempff Mercado Climate Action Project was created in 1997 and became one of the first certified forest emissions reduction projects. It is located in the World Heritage forest site ***Noel Kempff Mercado National Park*** in Bolivia and significantly increased the habitat for species with a large home range (TNC 2009).

In Bangladesh, a forest carbon investment programs is developed for the World Heritage forest site ***Sundarbans***, the world's largest mangrove forests (Lockwood & Kothari 2006; Bangladesh Forest Department 2010).

An example for REDD+ activities emerging adjacent to World Heritage forest sites is a forest carbon programme in the ***Maya Biosphere Reserve*** in Guatemala, which is a mosaic landscape of PAs including community managed forest concessions and the World Heritage forest site ***Tikal National Park***. It is intended to reduce deforestation by using Conservation Agreements and strengthening of community management (Harvey *et al.* 2010).

Another carbon project, the ***Chocó-Darién Ecological Corridor***, is being developed adjacent to the World Heritage forest site ***Los Katíos Natural National Park*** in Colombia and ***Daríen National Park*** in Panama. The Chocó-Darién Ecological Corridor involves Afro-Colombian and indigenous communities in the Darién region of northwest Colombia near the Panama border. This region has an extraordinary high level of biodiversity, i.e., as it is inhabited by more than 400 bird species and many endangered mammals. (CEPF 2005; Butler 2009).

There is also a project idea for the Sian Ka'an region in Mexico, which includes the integration of REDD+ activities in the zone. Three PAs lie within the project's area: the Bala'an K'aax area of flora and fauna protection, World Heritage forest site ***Sian Ka'an Biosphere Reserve***, and the Calakmul Biosphere Reserve. It is expected that REDD+ is going to contribute to sustaining critical ecosystem services, biodiversity and local livelihoods (U'yool'che A.C. 2010).

compliance with the standards, can facilitate the general biodiversity monitoring and reporting that needs to be carried out in World Heritage forest sites.

Connectivity

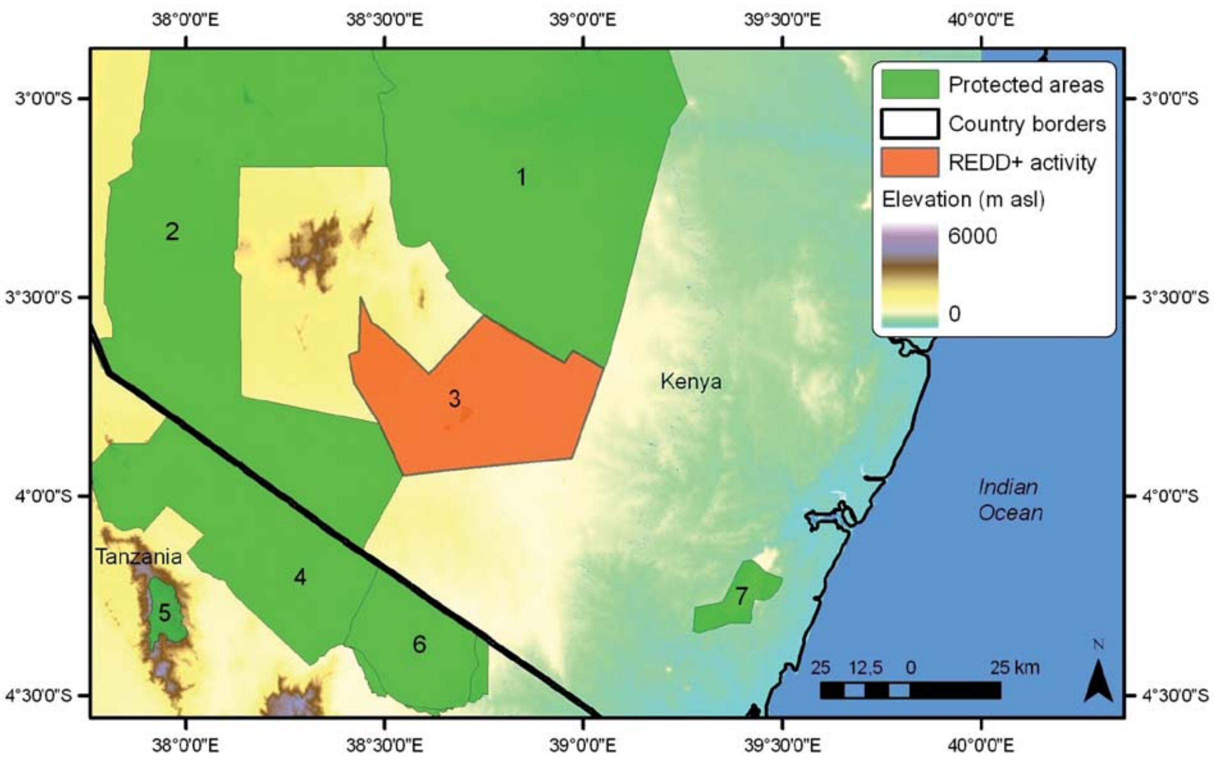
Increasing isolation of PAs has become a big problem over recent decades (DeFries *et al.*, 2005) and is also a great challenge regarding World Heritage forest sites (Patry, 2007). In response, the CBD Programme of Work on Protected Areas[7] adopted the mitigation of ecological isolation and fragmentation of PAs as one of its goals. Furthering ecological connectivity is also a recognized climate change adaptation strategy (Thompson *et al.*, 2009).

Increasing the connectivity of a forest area is not straightforward due to the complexity of the concept (Calabrese and Fagan 2004; Damschen *et al.*, 2006), which needs to pay heed to a "wide range of ecological phenomena, including gene flow, meta population dynamics, demographic rescue, seed dispersal, infectious disease spread, range expansion, exotic invasion, population persistence, and maintenance of biodiversity" (McRae *et al.*, 2008, p. 2712). This description points out that establishing corridors between PAs does not only include a lot of, frequently unknown, variables but might actually result in negative consequences.

REDD+ is a new concept and there are few experiences regarding the impact of REDD+ activities on connectivity. However, activities to conserve or (re)create forest habitat are central to REDD+, and there is potential for synergies between REDD+ activities and the creation of ecological corridors between designated PAs, as exemplified by the cases presented in this section.

Kasigau Corridor REDD Project, Kenya
The Kasigau Corridor REDD Project is located between the Tsavo East National Park and the Tsavo West National Park in Southeast Kenya (Figure 1). REDD+ activities include the protection of the existing carbon stock in the area under threat i.e. by firewood extraction and charcoal production, and some reforestation activities using native trees. According to the Project Design Proposal (WildlifeWorks, 2008; SCS, 2009), the project intends to create a corridor between the two national parks in order to facilitate large mammal migration and to support the conservation of the wildlife and flora within a larger area (Figure 1).

Figure 1. Kasigau Corridor REDD Project in Kenya and connectivity to two neighbouring national parks



1) National Park "Tsavo East"; **2)** National Park "Tsavo West"; **3)** Forest Reserve "Kasigau"; **4)** National Park "Mkomazi"; **5)** Forest Reserve "Chome"; **6)** Game Reserve "Umba"; **7)** National Reserve "Shimba Hills".

Source: USGS & WWF 2006; WildlifeWorks 2008; IUCN & UNEP 2009

7. Refer to Goal 1.2:
http://www.cbd.int/programmes/pa/pow-goals-alone.pdf

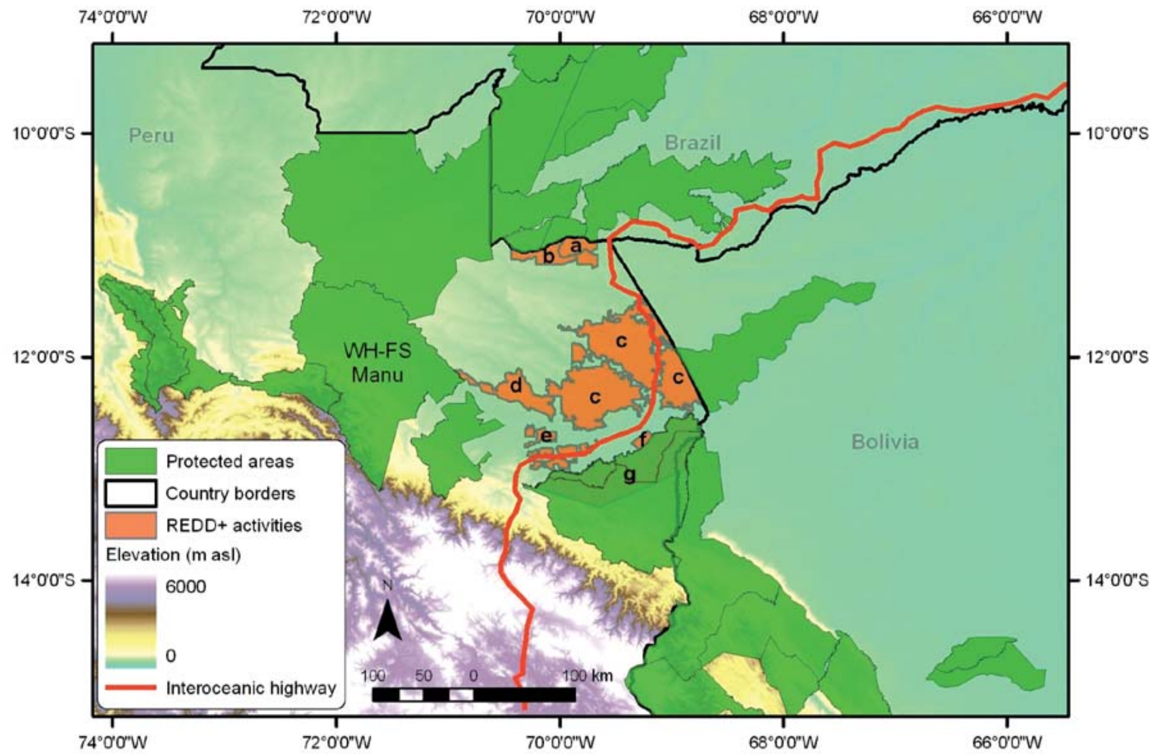
Core activities of the project include measures to reduce poaching within the project area and they have already led to an increase in the animal population within the area. Consequently, developing and monitoring indicators for poaching is one central aspect in the monitoring plan of the project. This case highlights that it is not only necessary to create a physical connection between parks to facilitate migration, but also to reduce threats. In addition, the corridor needs to meet the ecological requirements of the target species in order to fulfil its connecting function (Fischer *et al.*, 2006; Fischer and Lindenmayer 2007). In this regard, it is important to know the home ranges of the species as the conservation activities aim to ensure that the animals can actually use the corridors.

Manú World Heritage Forest Site and National Park, Peru

Another example of how REDD+ can be an instrument to contribute to the conservation and connectivity of PAs are the REDD+ activities that are currently being developed in the Madre de Dios region of Peru. These REDD+ activities involve different stakeholder groups and land use/ownership categories like forestry concessions, brazil nut concessions, indigenous communities, national reserves, and private conservation concessions; they take place within or in direct vicinity to PAs in the greater area around the World Heritage forest site Manú National Park (Figure 2) and within the Vilcabamba-Amboró Conservation Corridor (CEPF, 2000).

A REDD+ project is currently being implemented in the Private Conservation Concession Los Amigos' (Figure 2, d) with the intention of generating financial means to partly cover the costs of investigating, monitoring and controlling the area. The concession occupies the watershed of the Los Amigos River and reaches to the Manú River, which enters into the Manú World Heritage forest site. This means that a control point can be established to monitor the activities on the river that reaches into the lands immediately abutting Manú National Park. Consequently, the concession protects not only the upstream area of the Watershed of the Los Amigos River, but also to some extent the Manú area, since from the concession it is possible to monitor illegal loggers entering or leaving the World Heritage forest site via the Manú River. So, while REDD+ was not the first incentive to initiate the private conservation concessions, the financial means generated through REDD+ can now contribute to securing the World Heritage forest site.

Figure 2. REDD+ activities located in the Department Madre de Dios, Peru



REDD+ activities are implemented in or outside protected areas and in vicinity to the World Heritage forest site Manú National: **a**) REDD+ in indigenous community "Bélgica"; **b**) REDD+ in forestry concessions; **c**) REDD+ in brazil nut concessions ; **d**) REDD+ in conservation concession; **e**) REDD+ in reforestation concessions [8]; **f**) REDD+ in indigenous community "Infierno"; **g**) REDD+ in National Parks and National Reserves.

Source: USGS & WWF 2006; IUCN & UNEP 2009; Regional Government Madre de Dios

8. REDD+ activities take place in a number of concessions within the indicated area

It is important to point out that many serious problems exist in the region that are likely to reduce the positive effect of REDD+ activities on connectivity. It is expected that the recently completed Interoceanic Highway passing through the department of Madre de Dios will significantly reduce the possibility for many species to migrate, which cannot be offset by any REDD+ activity. The same holds true for the impacts of mining on the water quality of the rivers in the area, which also have an important function regarding landscape connectivity.

There is also a socioeconomic constraint that complicates the establishment of corridors between PAs through REDD+. Outside PAs, implementation of a REDD+ project requires prior negotiation with a great number of different stakeholders who are not necessarily in favour of REDD+. Thus, in order to reduce transaction costs, REDD+ activities are often implemented in already existing PAs with a limited number of stakeholders. In this context, new REDD+ projects are currently being developed in cooperation with indigenous communities who live in the buffer zones of PAs. These projects attempt to develop alternative incomes for the communities, like aquaculture or the commercialization of products from agroforestry systems. However, these activities need to be carefully designed in order to avoid leakage of deforestation or forest degradation into the PAs.

Rainforests of Atsinanana, Madagascar

There are currently some efforts to increase the connectivity of a series of World Heritage forest sites in Madagascar, connecting the rainforests of Atsinanana consisting of six non-continuous national parks: Marojejy National Park, Masoala National Park, Zahamena National Park, Ranomafana National Park, Andringitra National Park and Andohahela National Park. The Mantadia Corridor Reforestation Initiative, initiated by Conservation International, employs REDD+ and reforestation activities in an area adjacent to the south of Zahamena National Park. This includes the establishment of a new PA that links Zahamena to Mantadia National Park. The Corridor Ankeniheny-Zahamena REDD+ initiative (CAZ) is an area of 425,000 ha and aims to create new PAs that will be zoned into both strict protection areas and areas under community sustainable management (Harvey *et al.*, 2010).

Another conservation project with REDD+ elements, the Fandriana-Vondrozo Corridor Project, is adjacent to the Ranomafana National Park and connects to the Andringitra National Park and Ivohibe Special Reserve. It covers an area of 240,000 ha and has a similar methodology as CAZ. Another REDD+ initiative, the Makira project, implemented by the Wildlife Conservation Society with support from Conservation International, is adjacent to Masoala National Park (Holmes *et al.*, 2008).

Discussion

REDD+ activities are likely to become an influential element that needs to be taken into account when planning and managing PAs and World Heritage forest sites at the landscape scale. Currently, there are controversial discussions concerning the eligibility of PAs for REDD+ activities, which should be *additional* to ongoing conservation activities. While some argue that existing PAs fall short of meeting the additionality criterion *per se*, others note that the prevailing high deforestation rates in some PAs *de facto* qualify them for REDD+ activities. Scharlemann *et al.* (2010) found that PAs located in humid tropical forests contain about 20 per cent of all carbon sequestered in the tropical biome and that greenhouse gas (GHG) emissions from – mostly illegal – deforestation activities in PAs corresponded to about 9 per cent of the carbon emitted by deforestation in the humid tropics between 2000–2005. Dudley (2010) highlights some cases where REDD+ activities in PAs can comply with the additionality prerequisite. These include improved management effectiveness, especially if there is a high historical deforestation rate in the area (Doyle, 2009), the creation of financial incentives for the long-term designation of PAs, and restoration activities in degraded protected areas.

REDD+ activities can be an important contribution to reduce GHG emissions and improve conservation effectiveness in PAs of all IUCN management categories[9]. In PAs under IUCN categories I-IV, REDD+ measures can help in reducing illegal logging and increasing the conservation effectiveness, while in PAs under IUCN categories V-VI, REDD+ can help in reducing GHG emissions from legal forest management activities i.e. through sustainable forest management and the enhancement of carbon stocks; however, the biodiversity impacts of these activities need to be carefully considered.

REDD+ activities adjacent to World Heritage forest sites can have positive impacts on connectivity and conservation effectiveness of World Heritage forest sites by protecting adjacent forest areas and by creating new forest habitat around the World Heritage forest sites through afforestation or reforestation activities (Bennet and Mulongoy, 2006). Regarding the creation of new forest habitat, Gardner *et al.* (2007) highlighted the controversy between studies stating that secondary forests provide a valuable habitat for species, suffering from primary forest loss (Wright and Muller-Landau 2006), and studies stating that forest quality is essential and more important than the size of the forest area. In particular, structurally poor secondary forests or plantations provide less suitable habitat for specialists and deliver less ecosystem services (citing Brook *et al.* 2006).

9. For an explanation:
http://www.unep-wcmc.org/protected_areas/categories/index.html

It is fair to assume that conservation or the creation of forest corridors, including secondary forests or structurally rich plantations adjacent to World Heritage forest sites, usually has positive impacts on ecological connectivity. Moreover, a scientifically designed, comprehensive and ecologically connected network of representative PAs can be regarded as a viable climate change adaptation strategy (Margules and Pressey 2000; Thompson *et al.*, 2009).

We argue, however, that the effects of REDD+ projects on biodiversity and the connectivity and effectiveness of PAs, especially World Heritage forest sites, need to be systematically evaluated. This is to some degree already done by existing standards, like those from FSC, CCBA or Plan Vivo. They include provisions for evaluating REDD+ activities with regard to their suitability for serving as an ecological corridor between PAs to improve possibilities for species migration. The problem is that assessment of the functioning of ecological corridors requires sophisticated monitoring methods and indicators. In many cases (see case on the Kasigau Corridor REDD project) connectivity is assessed in terms of large mammal migration through degraded forest. In contrast, it is often not clear what the requirements of smaller animals or plants are regarding the ecological characteristics of corridors.

Proximity to World Heritage forest sites could be taken into account when evaluating the effects on biodiversity of a REDD+ project as World Heritage forest sites *per se* have OUV and contain unique species and habitats. At least for the voluntary carbon market, where some buyers of carbon certificates are willing to pay a premium for carbon credits generated in projects with certified positive impacts of biodiversity, this might add value to the conservation effort and increase the price of the carbon credits. In order to keep track of the impacts on biodiversity of REDD+ in the World Heritage forest sites, objectives for biodiversity monitoring must be defined, and monitoring systems need to be established. This is automatically given if the REDD+ project takes place within the World Heritage forest site, but could also be required if it is located outside the World Heritage site, for example, the CCBA standard requires the assessment of off-site biodiversity impacts.

Implementation of REDD+ projects outside PAs or the establishment of new PAs is often restricted by land use conflicts and the high transaction costs of coming to terms with the different land users. Therefore legislative arrangements regarding REDD+ have to be made in order to ensure that the location of REDD+ activities is not just determined by the legal and socioeconomic setting, but that they can also be implemented in areas that are strategically apt in terms of conservation and connectivity of World Heritage forest sites and other PAs.

Further information

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References

Bangladesh Forest Department. 2010. *Bangladesh develops forest carbon financing opportunities*. Bangladesh Forest Department and US-AID. Dhaka, Bangladesh, 2 pp.

Bennet, G., Mulongoy, K. 2006. *Review of experiences with ecological networks, corridors and buffer zones*. Secretariat of the Convention on Biological Diversity. CBD Technical Series No 23. Montreal, Canada, 97 pp.

Brook, B.W., Bradshaw, C.J., Koh, L.P., Sodhi, N.S. 2006. Momentum drives the crash: mass extinction in the Tropics. *Biotropica*, Vol. 38, No. 3, pp. 302–305.

Brown, D., Seymour, F., Peskett, L. 2009. How do we achieve REDD co-benefits and avoid doing harm? In: *Moving ahead with REDD: issues, options and implications*. Angelsen, A. (ed.). CIFOR. Bogor Barat, Indonesia, pp. 107–118.

Butler, R.A. 2009. REDD in Colombia: using forests to finance conservation and communities in Colombia's Choco, a former war zone. http://print.news.mongabay.com/2009/1103-ferguson_interview_choco_colombia.html

Calabrese, J.M., Fagan, W.F. 2004. A comparison-shopper's guide to connectivity metrics. *Frontiers in Ecology and the Environment*, Vol. 2, No. 10, pp. 529–536.

CEPF. 2000. *Ecosystem profile: Vilcabamba-Amboró forest ecosystem of the Tropical Andes biodiversity hotspot Peru and Bolivia*. Critical Ecosystem Partnership Fund, Arlington, VA, USA, 38 pp.

CEPF. 2005. *Chocó-Manabí conservation corridor*. Critical Ecosystem Partnership Fund, Arlington, VA, USA, 39 pp.

Damschen, E.I., Haddad, N.M., Orrock, J.L., Tewksbury, J.J., Levey, D.J. 2006. Corridors increase plant species richness at large scales. *Science*, Vol. 313, No. 5791, pp. 1284–1286.

Danielsen, F., Beukema, H., Burgess, N.D., Parish, F., Brühl, C.A., Donald, P.F., Murdiyarso, D., Phalan, B., Reijnders, L., Struebig, M., Fitzherbert, E.B. 2009. Biofuel plantations on forested lands: double jeopardy for biodiversity and climate. *Conservation Biology*, Vol. 23, No. 2, pp. 348–358.

de la Harpe, D., Fearnhead, P., Hughes, G., Davies, R., Spenceley, A., Barnes, J., Cooper, J., Child, B. 2004. Does 'commercialization' of protected areas threaten their conservation goals? In: *Parks in transition – biodiversity, rural development and the bottom line*. Child, B. (ed.). Earthscan, London, pp. 189–216.

DeFries, R., Hansen, A., Newton, A.C., Hansen, M.C. 2005. Increasing isolation of protected areas in tropical forests over the past twenty years. *Ecological Applications*, Vol. 15, No. 1, pp. 19–26.

Doyle, G. 2009. Additionality and permanence. In: *Legal frameworks for REDD. Design and implementation at the national level*. Costenbader, J. (ed.). IUCN, Gland, Switzerland, pp. 81–101.

Dudley, N. 2010. *Protected areas as tools for REDD: an issues paper for WWF*. WWF, Gland, Switzerland, 11 pp.

10. For more information, please visit the project homepage: http://www.landespflege-freiburg.de/forschung/redd.en.html

Dudley, N. 2008. The use of protected areas as tools to apply REDD carbon offset schemes. *Policy Matters*, Vol. 16, pp. 99-108.

EcoSecurities. 2010. *The forest carbon offsetting report 2010*. EcoSecurities, Conservation International, The Climate, Community & Biodiversity Alliance, ClimateBiz, Norton Rose. Oxford, UK, 35 pp.

Entenmann, S. 2010. Certification of REDD+ pilot projects for biodiversity conservation. In: *Biodiversity conservation in certified forests*. Sheil, D., Putz, F.E., Zagt, R.J. (eds.). Tropenbos International. Wageningen, The Netherlands, pp. 157–162.

Fischer, J., Lindenmayer, D.B., Manning, A.D. 2006. Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes. *Frontiers in Ecology and the Environment*, Vol. 4, No. 2, pp. 80–86.

Fischer, J., Lindenmayer, D.B. 2007. Landscape modification and habitat fragmentation: a synthesis. *Global Ecology and Biogeography*, Vol. 16, No. 3, pp. 265–280.

Gardner, T.A., Barlow, J., Parry, L.W., Peres, C.A. 2007. Predicting the uncertain future of tropical forest species in a data vacuum. *Biotropica*, Vol. 39, No. 1, pp. 25–30.

Harris, N.L., Petrova, S., Stolle, F., Brown, S. 2008. Identifying optimal areas for REDD intervention: East Kalimantan, Indonesia as a case study. *Environmental Research Letters*, Vol. 3 No, 3, pp. 1–11.

Harvey, C.A., Zerbock, O., Papageorgiou, S., Parra, A. 2010. *What is needed to make REDD+ work on the ground? Lessons learned from pilot forest carbon initiatives*. Conservation International, Arlington, VA, USA, 132 pp.

Holmes, C., Carter Ingram, J., Meyers, D., Crowley, H., Victurine, R. 2008. *Case study: forest carbon financing for biodiversity conservation, climate change mitigation and improved livelihoods: the Makira forest protected area, Madagascar*. Translinks, Washington, DC, USA, 58 pp.

IUCN, UNEP. 2009. The World Database on Protected Areas.
Contact: protectedareas@unep-wcmc.org
To acces the database: http://www.wdpa.org

Klink, C.A., Machado, R.B. 2005. Conservation of the Brazilian Cerrado. *Conservation Biology*, Vol. 19, No. 3, pp. 707–713.

Koh, L.P., Wilcove, D.S. 2008. Is oil palm agriculture really destroying tropical biodiversity? *Conservation Letters*, Vol. 1, No. 2, pp. 60–64.

Lockwood. M,. Kothari, A. 2006. Setting the context – social context. In: *Managing protected areas – a global guide*. Lockwood, M., Worboys, G.L., Kothari, A. (eds.). Earthscan, London, pp. 41–72.

Long, A. 2009. Taking adaptation value seriously: designing REDD to protect biodiversity. *Carbon & Climate Law Review*, Vol. 3, pp. 314–323.

Margules, C.R., Pressey, R.L. 2000. Systematic conservation planning. *Nature*, Vol. 405, No. 6783, pp. 243–253.

McRae, B.H., Dickson, B.G., Keitt, T.H., Shah, V.B. 2008. Using circuit theory to model connectivity in ecology, evolution, and conservation. *Ecology*, Vol. 89, No. 10, pp. 2712–2724.

Miles, L., Kapos, V. 2008. Reducing greenhouse gas emissions from deforestation and forest degradation: global land-use implications. *Science*, Vol. 320, No. 5882, pp. 1454–1455.

Paoli, G., Wells, P., Meijaard, E., Struebig, M., Marshall, A., Obidzinski, K., Tan, A., Rafiastanto, A., Yaap, B., Ferry Slik, J., Morel, A., Perumal, B., Wielaard, N., Husson, S., D'Arcy, L. 2010. Biodiversity conservation in the REDD. *Carbon Balance and Management*, Vol. 5, No. 7.

Patry, M. 2007. World Heritage Forest: what value added? In: *World Heritage Forests. Leveraging conservation at the landscape level*. Proceedings of the 2nd World Heritage Forests Meeting, March 9–11, 2005, Nancy, France. Patry, M., Ripley, S. (eds.). UNESCO, Paris, pp. 13–20.

Patry, M., Bassett, C., Leclercq, B. 2007. The state of conservation of World Heritage Forests. In: *World Heritage Forests. Leveraging conservation at the landscape level*. Proceedings of the 2nd World Heritage Forests Meeting, March 9–11, 2005, Nancy, France. Patry, M., Ripley, S. (eds.). UNESCO, Paris, pp. 21–32.

Phillips. A. 2003. Turning ideas on their head: the new paradigm for protected areas. *The George Wright Forum*, Vol. 20, No. 2, pp. 3–32.

Pistorius, T., Schmitt, C.B., Benick, D., Entenmann, S. 2010. *Greening REDD+: challenges and opportunities for forest biodiversity conservation*. Freiburg University, Freiburg, Germany, 43 pp.

Ripley, S. 2007. World heritage forest meeting. Emerging recommendations and the future of the forest programme. In: *World Heritage Forests. Leveraging conservation at the landscape level*. Proceedings of the 2nd World Heritage Forests Meeting, March 9–11, 2005, Nancy, France. Patry, M., Ripley, S. (eds.). UNESCO, Paris, pp. 33–38.

Sayer J.A. and Maginnis, S. 2005. New challenges for forest management. In: *Forests in landscapes – ecosystem approaches to sustainability*. Sayer, J.A., Maginnis, S. (eds.). Earthscan, London, pp. 1–16.

SCBD. 2009. Connecting biodiversity and climate change. Mitigation and adaptation. Report of the second Ad Hoc Technical Expert Group on Biodiversity and Climate. Secretariat of the Convention on Biological Diversity. *CBD Technical Series No 41*. Montreal, Canada, 127 pp.

Scharlemann, J.P.W., Kapos, V., Campbell, A., Lysenko, I., Burgess, N.D., Hansen, M.C., Gibbs, H.K., Dickson, B., Miles, L. 2010. Securing tropical forest carbon: the contribution of protected areas to REDD. *Oryx,* Vol. 44, No. 3, pp. 352–357.

SCS. 2009. *Final CCBA Project Validation Report Kasigau Corridor REDD Project Taita Taveta, Kenya*. Scientific Certification Systems. Emeryville, CA, USA, 76 pp.

Stickler, C.M., Nepstad, D.C., Coe, M.T., McGrath, D.G., Rodrigues, H.O., Walker, W.S., Soares-Filho, B.S., Davidson, E.A. 2009. The potential ecological costs and co-benefits of REDD: a critical review and case study from the Amazon region. *Global Change Biology*, Vol. 15, No. 12, pp. 2803–2824.

Thompson, I., Mackey, B., McNulty, S., Mosseler, A. 2009. Forest resilience, biodiversity, and climate change. A synthesis of the biodiversity/resilience/stability relationship in forest ecosystems. Secretariat of the Convention on Biological Diversity. *CBD Technical Series No 47*. Montreal, Canada, 67 pp.

TNC. 2009. *Combating climate change in Bolivia – Noel Kempff Mercado Project snapshot*. The Nature Conservancy. Arlington, VA, USA, 2 pp.

U'yool'che, A.C. 2010. *Much Kanan K'aax, Carbon Offset Project, Mexico. U'yool'che A.C., Plan Vivo*. Edinburgh, UK, 15 pp.

UN-REDD. 2009. *Multiple benefits – issues and options for REDD. UN-REDD*. Geneva, Switzerland, 14 pp.

USGS, WWF. 2006. HydroSHEDS.
http://gisdata.usgs.gov/website/HydroSHEDS/viewer.php

Von Scheliha, S., Hecht, B., Christophersen, T. 2009. *Biodiversity and livelihoods: REDD benefits*. GTZ. Eschborn, Germany, 44 pp.

Wendland, K.J., Honzák, M., Portela R, Vitale, B., Rubinoff, S., Randrianarisoa, J. 2009. Targeting and implementing payments for ecosystem services: opportunities for bundling biodiversity conservation with carbon and water services in Madagascar. *Ecological Economics*. In Press.

WildlifeWorks. 2008. *The Kasigau Corridor REDD Project Phase I – Rukinga Sanctuary*. Project design document for validation using the Climate, Community and Biodiversity Project Design Standards Second Edition. WildifeWorks, WildlifeWorksCarbon, Rukinga Ranching Co Ltd, 118 pp.

Wright, S.J. and Muller-Landau, H.C. 2006. The future of tropical forest species. *Biotropica*, Vol. 38, No. 3, pp. 287–301.

Integrating World Heritage Forests into a Future REDD+ Mechanism

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REDD+ is a proposed climate change mitigation strategy under development through the United Nations Framework Convention on Climate Change (UNFCCC). The mechanism would channel funds from industrialized nations and industries to forested developing countries in order to support conservation interventions that reduce forest based greenhouse gas emissions reductions and increase the sequestration of greenhouse gas from the atmosphere. The proposals are unique because they involve performance based payments—payments would only be delivered if emissions reductions were measured, reported and verified.

The mechanism is still under development but will likely involve the transfer of international funds (potentially from a combination of carbon markets, donors and taxes) to participating governments. Governments would then be responsible for national carbon emissions monitoring and accounting, and for a country-wide programme of forest emissions reduction and sequestration. Interventions would be based on national priorities and the opportunity costs of competing land uses (i.e. agriculture, development), but would also likely include enabling conservation policies, protected area establishment and conservation concessions, and support and funds disbursement to local forest managers—potentially including World Heritage forests.

The process of designating a World Heritage forest considers a wide range of factors but has not traditionally addressed carbon stocks (process reviewed in Patry, 2007*a*). Nevertheless, forest carbon storage represents a new global conservation priority that merits increased consideration. In the face of rapid REDD+ policy development and unprecedented donor funding, there is a need to assess the opportunities and limitations of integrating World Heritage forests into future forest carbon emissions mitigation strategies; it cannot be assumed that they will be automatically included into these emissions mitigation strategies. We identify leading issues for World Heritage forest managers interested in upcoming REDD+ policies.

Potential for additionality

Additionality is a major concept in REDD+ planning—whether activities rewarded by a future REDD+ mechanism represent an improvement over a 'business as usual' scenario. It is uncertain whether the financing of existing protected areas represent significant gains for emissions mitigations. Future REDD+ initiatives are likely to maximize resources by directing funds towards countries, forests and sites with the greatest emissions mitigation potentials at the lowest costs. As such, there are some likely limitations to integrating existing World Heritage forests into a future REDD+ mechanism.

Even so, REDD+ financial resources could be used to improve the management of protected areas that have historically faced encroachment (Clark, 2008; Oestreicher *et al.*, 2009; Scharleman *et al.*, 2010; Rickets *et al.*, 2010). Despite a reported overall decrease in threats to World Heritage forests in recent years, the 2001–2006 Threat Intensity Coefficients for a number of tropical sites demonstrate the potential for improved management and enforcement to reduce pressures from agricultural encroachment and deforestation (Patry and Ripley, 2007; Patry, 2007*b*). For World Heritage forests facing considerable encroachment, engagement with REDD+ may depend on their ability to document these threats and the resulting/potential carbon losses.

Additionality can be more clearly demonstrated through incentives to extend protected area networks, through the expansion of existing protected areas, the creation of new protected areas and the establishment of corridors among existing parks. Related proposals have emerged in some REDD+ policy proposals (i.e. CBD, 2010; Harvey *et al.*, 2010; CBD and GIZ, 2011), and several national REDD+ strategies (i.e. in The Philippines, Thailand and Mexico; FCPF, 2011; Phelps *et al.*, 2010). These include landscape level planning, and special consideration for land surrounding existing protected areas. The Convention on Biological Diversity (CBD) Secretariat has further proposed gap analysis, a process underway in forty developing countries with support from the Global Environmental Fund to identify sites for REDD+ interventions and to facilitate landscape level REDD+ planning (CBD, 2010). In this context, World Heritage forests and surrounding landscapes could be attractive for REDD+ resources.

Potential for cost efficient emissions reductions

There is a need to consider the cost efficiency of emissions mitigation achieved through protected areas relative to other REDD+ emissions mitigation approaches, such as reforestation, carbon stock enhancement and sustainable forest management.

Protecting threatened, high-carbon density forests is generally considered among the most cost efficient forest based emissions mitigation strategy (i.e. Rickets *et al.*, 2010). This approach requires comparatively limited inputs and can often benefit from economies of scale (Oestreicher *et al.*, 2009). Large protected areas may thus be especially attractive for cost-effective REDD+ interventions.

However, whether World Heritage forests can deliver low cost emissions reductions is largely country and site-specific, and is dependent not only on project scale, but also on factors such as carbon density, local opportunity costs, governance conditions and population density. Cost efficiency will also depend on national and local objectives. For example, some countries and regions may specifically seek REDD+ interventions that deliver not only emissions reductions, but also livelihood opportunities and additional biodiversity conservation that involve increased costs. Some donors and voluntary buyers may pay a premium price for emissions offsets that also deliver multiple benefits. However, future compliance markets, where emitting industries and countries are required to either reduce emissions at source or offset emissions through programmes such as REDD+, are likely to prefer low cost credits (Ebeling and Fehse, 2009; Venter *et al.*, 2009). As such, low cost forest sector emissions reductions are a likely REDD+ priority.

The strengths of World Heritage forests

Even where World Heritage sites do not have the most cost efficient emissions mitigation strategy, there are still opportunities for REDD+ through World Heritage forests to capture voluntary investment. To date, corporate social responsibility has been a significant motivator of carbon credit purchases (EcoSecurities *et al.*, 2010; Hamilton *et al.*, 2010), and World Heritage forests have the potential to offer charismatic REDD+ projects with substantial additional biodiversity co-benefits.

Emissions mitigation efforts associated with World Heritage forests can also provide valuable guarantees for investors. Well managed protected areas are familiar instruments for the effective conservation of terrestrial carbon stocks (Clark, 2008; Oestreicher *et al.*, 2009; Scharleman *et al.*, 2010). In comparison with other types of prospective REDD+ contracts, such as with individual landholders, World Heritage forests generally benefit from clear tenure, and represent long-term conservation commitments. These factors are important in ensuring permanence emissions reductions that are highly valued within REDD+ contracts.

Many World Heritage forests and surrounding landscapes have also been the sites of monitoring and research, with comparatively large amounts of information about their biodiversity, forest types and associated threats, as well as experience with protected areas management and international reporting. This background may provide some sites with a head start for establishing baselines and identifying conservation interventions for their surrounding landscapes. They may also provide important lessons learned for national level REDD+ strategy development and REDD+ development in protected areas.

Scope for diverse tenure arrangements

Yet there remains considerable debate regarding whether traditional protected areas are most the effective and efficient approaches to conservation in all situations when compared with community based conservation and other conservation arrangements (Adams *et al.*, 2004). While initial research highlights the importance for REDD+ initiatives to address local needs and engage local populations (i.e., Oestreicher *et al.*, 2009), it remains uncertain which land tenure and governance arrangements will yield optimal REDD+ outcomes (Clark *et al.*, 2008; Chhatre and Agrawal, 2009; Rickets *et al.*, 2010).

While World Heritage forests are generally traditional protected areas registered as IUCN I-IV category forests, broad scope national level REDD+ policies are likely to integrate a range of tenure types. Efforts to leverage REDD+ resources to expand and connect World Heritage forests are likely to encounter diverse tenure scenarios, and there is a need to maintain scope for diverse arrangements. REDD+ policies may combine incentives for traditional protected areas with incentives and technical support for community based and co-managed protected areas, and voluntary financial incentives for private landholders and concessionaires (Agrawal *et al.*, 2008). They may also allow for strict conservation areas alongside sites with multiple use objectives, including sustainable management of forests. The challenges, effectiveness, efficiency and transaction costs associated with REDD+ on different tenure instruments are not well understood and will need to be assessed as World Heritage forests are further integrated into the broader landscape through REDD+.

The terms of REDD+ engagement will be largely dictated by international agreements and central government agencies. However, forest managers need to consider how existing protected areas, including World Heritage forests, might be integrated into a future REDD+ mechanism.

References

Adams, W.M., Aveling, R., Brockington, D., Dickson, B. Elliott, J., Hutton, J., Roe, D., Vira, B., Wolmer, W. 2004. Biodiversity conservation and the eradication of poverty. *Science*, Vol. 306 (5699), pp. 1146–1149.

Agrawal, A., Chhatre, A., Hardin, R. 2008. Changing governance of the world's forest. *Science*, Vol. 320 (5882), pp. 1460–1462.

Chhatre, A., Agrawal, A. 2009. Carbon storage and livelihoods generation through improved governance of forest commons. In: *Proceedings of the National Academy of Sciences U.S.A.* Vol, 106,No. 42, pp. 17667–70.

Convention on Biological Diversity. 2010. *Global Expert Workshop on Biodiversity Benefits of REDD in Developing Countries*. 20–23 Sept. 2010, Nairobi. http://www.cbd.int/doc/?meeting=EWREDD-01

Convention on Biological Diversity Secretariat, and Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH. 2011. *Biodiversity and livelihoods: REDD-plus benefits*. Montreal and Eschborn. http://www.cbd.int/doc/publications/for-redd-en.pdf

Clark, S., Bolt, K., Campbell, A. 2008. *Protected areas: an effective tool to reduce emissions from deforestation and forest degradation in developing countries?* Working Paper, UNEP World Conservation Monitoring Centre, Cambridge. http://www.unep-wcmc.org/protected-areas-an-effective-tool-for-redd_472.html

Ebeling, J., Fehse, J. 2009. *Challenges for a business case for high-biodiversity REDD projects and schemes*. EcoSecurities Limited, UK. Prepared for the Secretariat of the Convention for Biological Diversity, Oxford. http://www.cbd.int/forest/doc/other/ecosecurities-report-2009-02-en.pdf

EcoSecurities *et al*. 2010. The Forest Carbon Offsetting Report 2010, Dublin. http://www.greenbiz.com/business/research/report/2010/04/29/forest-carbon-offsetting-report-2010

Forest Carbon Partnership Facility. 2011. *Participant Country Readiness Preparation Proposals*. http://www.forestcarbonpartnership.org/fcp/node/257

Hamilton, K., Sjardin, M., Peters-Stanley, M., Marcello, T. 2010. *Building Bridges: State of the Voluntary Carbon Markets 2010*. Ecosystem Marketplace and Bloomberg New Energy Finance, Washington, DC. http://moderncms.ecosystemmarketplace.com/repository/moderncms_documents/vcarbon_2010.2.pdf

Harvey, C.A., Dickson, B., Kormos, C. 2010. Opportunities for achieving biodiversity conservation through REDD. *Conservation Letters*, Vol. 3, No. 1, pp. 53–61.

Oestreicher,, J.S., et al. 2009. Avoiding deforestation in Panamanian protected areas: an analysis of protection effectiveness and implications for reducing emissions from deforestation and forest degradation. *Global Environmental Change*, Vol. 1, No. 2, pp. 279–291.

Patry, M. 2007*a*. Forest protected areas warranting further consideration as potential WH Forest sites: Summaries from various and thematic regional analyses. In: Patry, M., Ripley, S. (Eds.). *Proceeding of the 2nd World Heritage Forests Meeting: World Heritage Forests, Leveraging Conservation at the Landscape Level*. 09–11 March 2005, Nancy, France.

Patry, M. 2007*b*. World heritage forests: what value added? In: Patry, M., Ripley, S. (Eds.). *Proceeding of the 2nd World Heritage Forests Meeting: World Heritage Forests, Leveraging Conservation at the Landscape Level*. 09-11 March 2005, Nancy, France.

Patry, M., Ripley, S. 2007. Threat intensity trends for World Heritage Forests, 2001–2006. In: Patry, M., Ripley, S. (Eds.). *Proceeding of the 2nd World Heritage Forests Meeting: World Heritage Forests, Leveraging Conservation at the Landscape Level*. 09–11 March 2005, Nancy, France.

Phelps, J., et al. (Eds.). 2010. Philippines National REDD-plus Strategy. CoDe REDD, Department of Environment and Natural Resources-Forest Management Bureau, Manila. http://www.ntfp.org/coderedd/the-philippine-national-redd-plus-strategy

Phelps, J., Webb, E.L., Agrawal, A. 2010. Does REDD+ threaten to recentralize forest governance? *Science*, Vol. 328, No. 5976, pp. 312–313.

Rickets, T.H., et al. 2010. Indigenous lands, protected areas, and slowing climate change. *PLoS Biology*, Vol. 8, No. 3: e1000331. doi:10.1371/journal.pbio.1000331.

Scharlemann, J.P.W., *et al*. 2010. Securing tropical forest carbon: the contribution of protected areas to REDD. *Oryx*, Vol. 44, pp. 352–357.

Venter, O., Laurance, W.F., Iwamura, T., Wilson, K.A., Fuller, R.A., Possingham, H.P. 2009. Harnessing carbon payments to protected biodiversity. *Science*, Vol. 326, p. 1368.

What World Heritage Can Offer REDD+ Policy Development

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The majority of World Heritage forests (66 sites) are in tropical and subtropical developing countries, covering an area of nearly 43 million hectares. These forests protect sizeable stores of terrestrial carbon, important to global climate regulation. The continued and enhanced protection of these sites is potentially relevant to a future REDD+ climate change mitigation mechanism under development through the United Nations Framework Convention on Climate Change (UNFCCC). The World Heritage Committee has vested interests in these large scale, transformational policies as they would affect World Heritage forests across the globe. This paper reviews the status of REDD+ policy development and highlights issues of interest to the World Heritage community, including possible contributions to the REDD+ policy debate.

Through a REDD+ mechanism, industrialized countries and carbon emitting industries would provide developing countries with financial incentives to reduce forest based greenhouse gas emissions and increase forest-based removal of greenhouse gases from the atmosphere. A REDD+ mechanism would reward a range of conservation interventions:

- Reduced deforestation
- Reduced forest degradation
- Conservation of existing forest carbon stocks
- Enhancement of forest carbon stocks (i.e. through tree planting)
- Sustainable management of forests (i.e. selective cutting and replanting)

The UNFCCC has entered its sixth year of negotiations on the design of a future REDD+ mechanism. Despite the prolonged process, recent pledges for billions of dollars in donor support have spurred rapid REDD+ policy developments both within and outside the UNFCCC. Nearly every one of the large, international non-governmental organizations has developed a REDD+ programme. Dozens of REDD+ pilot projects have emerged, and more than two dozen developing countries are in the process of developing REDD+ national strategies. The engagement of World Heritage forests with a future REDD+ mechanism would promise harmonization with broader environmental conservation goals, and could offer a novel and large source of funding for forest managers. Yet there are a number of remaining, unresolved policy and methodological issues.

The UNFCCC process

To date, no formal concrete REDD+ mechanism has been established through the UNFCCC. Nevertheless, the UNFCCC 16th Conference of Parties (COP16) held in Cancun, Mexico, in late 2010 demonstrated considerable political support for REDD+. In fact, REDD+ is one of the areas of broadest consensus within the UNFCCC climate negotiations (UNFCCC, 2010). The resulting Cancun Agreement defined a broad scope for REDD+, urging developing country Parties not only to reduce deforestation and forest degradation, but also to plan for the conservation and enhancement of existing forest carbon stocks and the sustainable management of forests. While this broadened scope increased opportunities for participation, a remaining challenge is to specifically define the land uses that would be rewarded through a future REDD+ mechanism. The Cancun Agreements further ensured continued REDD+ negotiations among the UNFCCC Parties and early development of REDD+ pilot projects, setting guidelines for future policy development (including rudimentary safeguards), and setting ambitious pledges for donor finance. However, COP16 discussions revealed a number of unresolved methodological issues, including those related to the monitoring, reporting and verification (MRV) of carbon stocks, the monitoring of forests, and the identification of the drivers of deforestation, much of which have been tasked to the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA). A number of other UN, non-governmental and academic institutions were also actively engaged in UNFCCC REDD+ policy development in what has become a unique, relatively participatory process (i.e. Cadman and Maraseni, 2011).

Parallel developments

Parallel with negotiations through the UNFCCC, REDD+ policies are also under development by a number of external multilateral and bilateral initiatives. The UN-REDD Programme, the World Bank's Forest Carbon Partnership Facility and Forest Investment Program, the multilateral REDD+ Partnership, and a number of bilateral agreements (most involving Norway) are supporting developing country partners to establish national strategies and build capacity to engage with a future REDD+ mechanism. These efforts include dozens of pilot projects, which are reforming forest governance strategies, pioneering forest and carbon inventory accounting and monitoring techniques, and developing strategies to identify and limit the drivers of deforestation and degradation. As such, opportunities to engage in REDD+ are not limited to the official

UN process or policy development. There is also a widespread need for pilot initiatives and best practices in reducing deforestation and forest degradation, including through protected areas management.

National approaches to REDD+

Most existing forest carbon initiatives are project based and limited in geographic scope. However, there is mounting evidence that a future REDD+ mechanism will operate at the national level. The UNFCCC has requested that Parties ensure national-level coordination in REDD+ implementation, and that they develop national REDD+ strategies, reference levels and monitoring plans (2010). As a result, future implementation and funding will probably be managed at the national level with a relatively high degree of central oversight. A national level approach to REDD+ may increase the likelihood of broad land use planning, in line with the focus on landscape level planning discussed in recent World Heritage publications (i.e. Patry and Ripley 2007). Yet there are still few international statutory incentives for ensuring that REDD+ implementation occurs in the context of landscape level management. Government directed implementation of REDD+ is also likely to lead to the establishment and expansion of protected areas, which are traditionally largely when under government control. Protected areas are important tools for protecting forest carbon stocks (Scharleman *et al.*, 2010), and are a focal part of many national REDD+ proposals (i.e. Indonesia, Mexico; see FCPF, 2011). As such, there are considerable links between REDD+ and existing protected areas networks, including World Heritage forests.

Despite the emergence of an international REDD+ framework, the independent development of national REDD+ strategies and the identification of nationally appropriate emissions mitigation strategies suggest that approaches on the ground may vary considerably. The role of protected areas and landscape level planning in reducing forest based emissions is also likely to vary based on national priorities, resources and leadership. External donor support and Party commitments to existing international agreements are also likely to be pivotal in determining countries' REDD+ strategies.

Safeguards and additional co-benefits

REDD+ actions are generally expected to also deliver positive biodiversity and social outcomes. However, some REDD+ actions also have the potential for unintended negative consequences, such as the displacement of deforestation and degradation pressures into other areas of high biodiversity (Putz and Redford, 2009; Paoli *et al.*, 2010). The Cancun Agreement adopted compulsory, if rudimentary, biodiversity and social safeguards for participating countries aimed at reducing the potential for unintended consequences and to promote multiple benefits from REDD+ (UNFCCC Annex I, 2010). The operationalization of safeguards, however, remains uncertain with specifics under review through the UNFCCC, the Convention on Biological Diversity (CBD) and among individual Parties. Related negotiations will likely prove contentious, involving decisions on the monitoring and reporting of safeguards and the development of related indicators, including for measuring the biodiversity impacts of REDD+ actions.

REDD+ is principally concerned with carbon sequestration and the non-release of forest carbon, rather than with forest conservation in and of itself. While protecting forests generally equates to positive biodiversity outcomes, ensuring, measuring, monitoring and reporting additional biodiversity and social co-benefits involves increased costs. While the UNFCCC promotes co-benefits, these additional costs will likely be externalized. The financial and technical support required to deliver co-benefits will likely come from donors and voluntary buyers that favour REDD+ interventions with multiple benefits. However, it is uncertain whether a future REDD+ mechanism will recruit adequate voluntary and donor resources to deliver additional co-benefits (Phelps *et al.*, 2011). As a result, some policy makers, including the CBD Secretariat, are advocating for a REDD+ mechanism that integrates not only safeguards, but also internalizes the costs of delivering additional livelihood and biodiversity co-benefits (i.e. CBD and GIZ, 2011). The co-benefits debate, in parallel with negotiations on REDD+ safeguards, will largely dictate the conservation potential of REDD+ interventions and influence the involvement of World Heritage forests.

The status of REDD+ funding

REDD+ offers unprecedented resources for forest conservation. During the mid-1990s, annual spending on protected areas in developing countries totaled approximately US$600 million (James *et al.*, 2001). In contrast, donors have already pledged over US$4 billion in finance for early REDD+ planning in tropical developing countries, most by 2012 (Ballesteros *et al.*, 2010). Investments could grow considerably, as the estimated annual cost of reducing tropical deforestation by 50 per cent is between US$12–35 billion (compiled in CI *et al.*, 2010). The recent establishment of the UN Green Climate Fund, with a target of providing US$100 million per year for climate change mitigation and adaptation in developing countries, including support for REDD+, suggests that greater funding is forthcoming (UNFCCC, 2010).

Yet there are also considerable uncertainties regarding REDD+ finance. The UNFCCC has yet to define long-term financing strategies for REDD+, including for its Green Climate Fund. The reliability of donors finance is already in question, with the United States likely to renege on a US$1 billion REDD+ pledge in light of its budget crisis

(Hurowitz, 2011). Both voluntary and compliance market based funding options also face considerable challenges and at present remain very uncertain (discussed in Phelps *et al.*, 2010). These limitations are clear indications that despite the rapid rate of REDD+ policy development, financing mechanisms are immature and international bodies need to ensure reliable donor support and identify long-term financing mechanisms that can deliver the promised resources.

Recommendations for the World Heritage Committee to help shape REDD+ policy

REDD+ negotiations are ongoing in preparation for the UNFCCC COP17 in South Africa, alongside parallel international programmes and domestic initiatives. There are opportunities for the World Heritage Committee to engage in REDD+ policy development at multiple scales.

Possible international policy engagement

- The World Heritage Committee might formally contribute to debates within the UNFCCC process and the parallel REDD+ progammes, notably the UN-RED Programme. Not only will the World Heritage community have opinions regarding the design of a future REDD+ mechanism, but it can also offer practical experience relevant to some of the technical questions being addressed by the Parties and SBSTA.

- The World Heritage Committee might engage with the CBD effort to maximize the biodiversity conservation outcomes of REDD+ interventions. It might contribute to the development of indicators for measuring the biodiversity impacts of REDD+ actions. The CBD is also lobbying for a REDD+ mechanism that also prioritizes co-benefits, and the Committee might consider whether to take a similar advocacy position.

- There are still relatively few international guidelines for REDD+ development. The Committee could help to provide international statutory incentives for ensuring that Member States implement REDD+ within the context of landscape level management in a way that enhances protected area networks, and has clear safeguards.

Possible national-level engagement

As Member States develop National REDD+ Strategies, the World Heritage Centre is positioned not only to provide general guidelines, but also technical support to help ensure integration of World Heritage forests, best practices and landscape level management. The broader World Heritage community has also designed and managed successful protected area networks, identified drivers of deforestation and degradation, and designed conservation interventions. These experiences may feed into national level REDD+ planning efforts.

- The World Heritage Committee may consider building internal REDD+ capacity so that the Centre can serve as a resource to its Members States and designated forest managers. As individual World Heritage forests contemplate engagement with REDD+ policies and carbon markets, the World Heritage Centre may become responsible not only for helping designated forests to identify opportunities, but also its associated risks (environmental, financial, legal). Similarly, World Heritage forest manages are likely to be involved in national discussions about state UNFCCC submissions and national REDD+ strategy design, and it is important that they have the resources to make well informed contributions.

- To date, there are no records of direct involvement of a World Heritage forest with early REDD+ initiatives, yet many of these are well positioned to contribute as pilot projects. These opportunities are discussed in the adjoining article, 'Integrating World Heritage forests into a future REDD+ mechanism'.

During a period when a great number of conservation agencies are jockeying for position within the REDD+ process, the World Heritage Community is pressed to identify its opportunities, responsibilities and capacity for engaging in global and domestic REDD+ policy formulation.

References

Ballesteros, A., Polycarp C., Stasio K., Chessin E., Hurlburt, K. 2010. *Summary of Developed Country 'Fast-Start' Climate Finance Pledges*. World Resources Institute, Washington, DC. http://www.wri.org/publication/summary-of-developed-country-fast-start-climate-finance-pledges

Cadman, T., Maraseni, T. 2011. The governance of climate change: Evaluating the governance quality and legitimacy of the United Nations REDD-plus Programme. *International Journal of Climate Change: Impacts and Responses*, Vol, 2, No. 3, pp. 103–12.

Convention on Biological Diversity Secretariat and Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (CBD and GIZ). 2011. *Biodiversity and livelihoods: REDD-plus benefits*. CBD, Montreal and Eschborn. http://www.cbd.int/doc/publications/for-redd-en.pdf

Conservation International, Environmental Defense Fund, Natural Resources Defense Council, Rainforest Alliance, The Nature Conservancy, Union of Concerned Scientists, Wildlife Conservation Society, Woods Hole Research Center. 2010. *Financing Options for REDD*. Washington, D.C. Conservation International.

Forest Carbon Partnership Facility (FCPF). 2011. *Participant Country Readiness Preparation Proposals*. http://www.forestcarbonpartnership.org/fcp/node/257

Gronewold, N. 2011. Chicago Climate Exchange closes nation's first cap-and-trade system but keeps eye to the future. *New York Times*, 3 Jan. 2011.

Hamilton, K., Chokkalingam U., Bendana M. 2010. *Carbon markets 2009: taking root & branching out*. Ecosystem Marketplace & Bloomberg New Energy Finance, Washington, DC. http://www.moderncms.ecosystemmarketplace.com/repository/modernc ms documents/SFCM.pdf

Hurowitz, G. 2011, 16 Feb. Budget for rainforests puts Obama's $1 billion pledge at risk. *Grist*. http://www.grist.org

James, A., Gaston, K.J., Balmford, A. 2001. Can we afford to conserve biodiversity? *Bioscience*, Vol. 51, No, 1, pp. 43–52.

Paoli, G.D. et al. 2010. Biodiversity conservation in the REDD+. *Carbon Balance and Management*, Vol. 5, No. 7.

Patry, M., Ripley, S. (Eds). 2007. *Proceeding of the 2nd World Heritage Forests Meeting: World Heritage Forests, Leveraging Conservation at the Landscape Level*. 09–11 March 2005, Nancy, France. Paris, UNESCO.

Phelps, J., Webb, E.L., Koh, L.P. 2011. Risky business: an uncertain future for biodiversity conservation through REDD+. *Conservation Letters*, Vol. 4, pp. 88–94.

Putz, F.E., Redford, K.H. 2009. Dangers of carbon-based conservation. *Global Environmental Change*, Vol. 19, pp. 400–401.

Scharlemann, J.P.W. *et al*. 2010. Securing tropical forest carbon: the contribution of protected areas to REDD. *Oryx*, Vol. 44, No. 3, pp. 352–357.

United Nations Framework Convention on Climate Change Ad Hoc Working Group on Long-term Cooperative Action under the Convention. 2010. Draft Decision [1/CP.16] Outcome of the Work of the Ad Hoc Working Group on Long-term Cooperative Action Under the Convention, Annex I. http://www.unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf

The Contribution of Rainforest Alliance/FSC Certification to the Conservation of World Heritage Sites

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Introduction

Since the World Heritage Convention came into force in 1972, the designation 'World Heritage Site' has been awarded to 911 properties of outstanding natural or cultural importance. Natural World Heritage sites have exceptional natural beauty and/or outstanding biodiversity [1], and typically have a national level designation such as National Park or Wildlife Preserve in addition to their World Heritage status.

Protected areas are the cornerstones of *in situ* conservation. Safeguarding these areas remains the most effective means of conserving habitats essential for the survival of threatened species and the flow of ecosystem services that benefit communities, enterprises, and entire countries [2]. However, the activities occurring in the zone around protected areas – the zone that we call the buffer area – also influences a protected area's ability to maintain habitat quality and ecosystem services. Buffer areas contribute to the creation of biological corridors, which have been shown to expand the effective area of otherwise isolated habitats, and enhance ecological processes such as pollination and seed dispersal.[3] Good management practices in the buffer area can also reduce the potential for fire or invasive species to spread to the protected area.

From a socioeconomic perspective, the buffer area also has a role to play. If the farms, forest companies and other industries that are located within the buffer area provide good jobs, they can reduce the number of unemployed or disenfranchised residents who might otherwise turn to illicit activities such as illegal logging or wildlife poaching within the protected area. The presence of jobs and law enforcement within the buffer area can also counter the negative spillover effects that have been observed when protected areas become off-limits for certain economic activities that were previously allowed.

The standards of the Forest Stewardship Council (FSC) are internationally accepted principles and criteria of good forestry, which are adapted to local contexts by working groups made up of scientists, community members, and members of the forestry sector. The resulting set of indicators and verifiers essentially denotes best practices for sustainable forestry in a given region. Interested forestry operations are then audited by third-party certifiers such as Rainforest Alliance's SmartWood program, which conducts extensive site and office visits to determine whether an operation is in compliance with the FSC standards.

For forestry operations located within the buffer area of a World Heritage site, there are many elements of the FSC standards that, when implemented, could improve the ability of the site to function as an intact and robust ecosystem. These include requirements that FSC-certified forestry operations identify and conserve High Conservation Value Forests (HCVFs) and habitats for threatened and endangered species, and include having systems in place to prevent fires and the movement of invasive species, paying workers fairly, and ensuring that local communities benefit from employment and access to the forest for cultural practices and the harvesting of non-timber forest products. These sustainable forestry practices, within a landscape matrix, can also serve as an important link between multiple protected areas.

The purpose of this report is to explore the relationship between natural World Heritage sites and FSC-certified forests [4], and describe the potential contribution of certified forestry to the integrity of World Heritage sites.

Approach

Using GIS, we first overlaid polygons of the World Heritage sites [5] with those of FSC-certified operations that were audited by Rainforest Alliance (referred to as 'RA/FSC-certified operations' in this report). We then identified those operations that were adjacent to or at least partially within 20 km of the World Heritage sites.

1. For a full list of criteria for World Heritage Site designation see http://whc.unesco.org/en/criteria
1. Chape, S., Harrison, J., Spalding, M., Lysenko, I. 2005. Measuring the extent and effectiveness of protected areas as an indicator for meeting global biodiversity targets. *Philos. Trans. R. Soc.* Vol. 360, No.1454, pp. 443–55.
3. Tewksbury, L.T., R.A. Casagrande, B. Blossey, M. Schwarzlaender and P. Haefliger. 2002. Potential for biological control of *Phragmites australis* in North America. *Biological Control*, Vol. 23, pp. 191–212.
4. Our analysis only includes those forestry operations that were certified to the FSC standards by the Rainforest Alliance.
5. From the UNEP-WCMC World Database on Protected Areas: http://www.unep-wcmc.org/world-database-on-protected-areas-wdpa_76.html

Out of 375 RA/FSC-certified operations, nine met these criteria. These operations are located around the following six World Heritage sites: Canadian Rocky Mountain Parks and Waterton Glacier International Peace Park (on the Canada/US border), Río Plátano Biosphere Reserve (in Honduras), the Tropical Rainforest Heritage of Sumatra (in Indonesia), Central Sikhote-Alin (in Siberia, Russia), and Tikal National Park (in Guatemala).

Next, we examined the certification assessment reports for each of these nine operations. Among other things, the assessment report identifies areas of non-conformance – areas where the candidate forestry operation is not in compliance with FSC standards. When this happens, operations are issued a Corrective Action Request, or 'CAR', that clearly specifies the action that must be taken to come into compliance with the standard. If the non-conformance is minor, the FSC certificate is awarded and the operation is given time – typically one year – to implement the CAR. If the infraction is severe, a major CAR is issued and the FSC certificate is not awarded until CAR implementation is verified.[6]

Though not a perfect proxy for impact, we believe that the CARs issued to an operation do provide valuable insights into the areas where certification has resulted in forest management improvements. Because we were specifically interested in the changes that RA/FSC-certified companies made that might affect the adjacent World Heritage sites, we looked for CARs that required operations to take corrective actions that would:

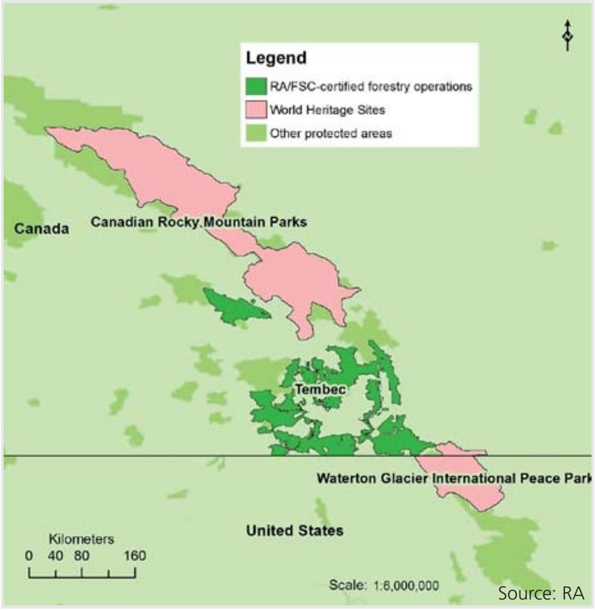
- Improve High Conservation Value Forest (HCVF) assessment
- Conserve HCVFs
- Protect rare, threatened or endangered species or their habitats
- Limit the movement of invasive species
- Prevent or contain forest fires
- Improve worker wages or working conditions
- Enhance the viability of local communities

In the sections that follow, we identify those World Heritage sites with adjacent RA/FSC-certified forestry operations, outline the current threats that these sites face, and describe the ways that their certified neighbours might be contributing to their effectiveness and integrity.

6. Unless otherwise noted, Rainforest Alliance auditors confirmed that all CARs discussed in this report were in fact implemented within the required time period.

Canadian Rocky Mountain Parks and Waterton Glacier International Peace Park

Figure 1. Canadian Rocky Mountain Parks, Waterton Glacier International Peace Park, Tembec Forest Products



Source: RA

The Canadian Rocky Mountain Parks World Heritage site includes the Banff, Jasper, Kootenay and Yoho National Parks, and three adjacent Provincial Parks, for a combined area of 2,306,884 hectares. These parks contain montane, subalpine and alpine ecoregions, as well as glaciers and the Burgess Shale fossil site.[7] The Waterton Glacier International Peace Park combines the Waterton Lakes National Park in Canada and Glacier National Park in Montana and is 457,614 hectares in size, also with a wide variety of ecosystems.[8] These sites are exceptionally rich in plant and mammal species, and are home to bighorn sheep, hoary marmot, moose, caribou, grey wolf, grizzly bear, black bear, wolverine, lynx and puma.[9]

Much of the land bordering these parks is used for logging, the extraction of oil and gas, and recreational activities such as skiing. The roads for these activities have facilitated increased public access to formerly remote areas and increased wildlife mortality. Roads are considered one of the primary threats to the integrity of these parks and to the viability of the ungulate migration routes that run through them.[10]

Tembec is a large integrated Canadian forest products company that sells solid wood, pulp and paper products in over fifty countries. Its FSC certificate in this region

7. http://www.eoearth.org/article/Canadian_Rocky_Mountain_Parks,_Canada
8. http://whc.unesco.org/en/list/354
9. http://whc.unesco.org/en/list/304
10. http://www.eoearth.org/article/Canadian_Rocky_Mountain_Parks,_Canada

includes the Kootenay Lake and Cranbrook Timber Supply Areas (TSAs), which total approximately 267,834 hectares.[11] The company operates on Crown land, which is owned by the government and managed by Tembec through volume-based forest licenses. In total, 29 communities are considered local to Tembec's Kootenay Lake and Cranbrook TSAs.

Wildlife surveys reveal that 47 wildlife species found within the Kootenay Lake and Cranbrook TSAs have been nationally designated as red- or blue-listed. Natural disturbances such as fire, insects and disease have created a mosaic of age classes and seral stages in this area. Large fires occurred in 1985 and 2003, and at present an unprecedented outbreak of mountain pine beetle is affecting vast areas of lodgepole pine throughout Tembec's tenure and many other areas in British Columbia.

Tembec's Kootenay Lake and Cranbrook TSAs were first assessed by Rainforest Alliance in 2005. The operation received three major and 23 minor CARs. These CARs were issued in all seven thematic areas that we examined, except forest fire prevention and containment.

Tembec's CARs required the assessment and management of HCVF areas, and the creation of larger 'protected reserve' areas. Practices within riparian zones were also addressed, with one CAR requiring the creation of a 7-metre machine-free zone along all water bodies, except where required for stream crossings. Tembec was also required to mitigate the damages associated with mineral exploration roads in areas designated as HCVFs.

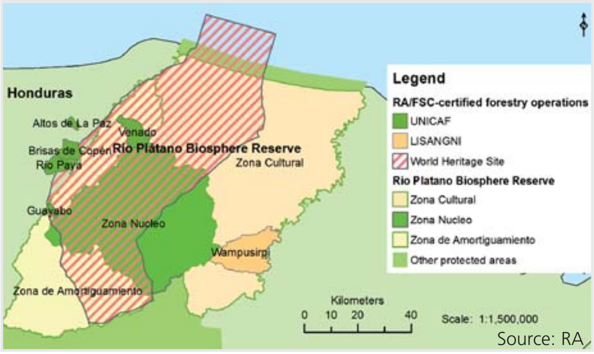
A CAR was issued that required Tembec to prevent cattle grazing in riparian areas, with the aim of decreasing the ability of invasive species to gain a foothold in the area.

A number of actions were required to ensure that workers were operating safely on steep slopes, including, among others, training on the risk rating system for steep slopes and information on their right to refuse unsafe work without discrimination. Finally, a CAR was issued that required the implementation of the company's local purchasing policy, and the identification of local employment opportunities in the town of Creston.

11. Tembec East Kootenays Certification Reassessment Report, 2009. Available online: http://www.fsccanada.org/docs/tembec%20east%20kootenays_2009%20reassessment.pdf

Río Plátano Biosphere Reserve

Figure 2. Río Plátano Biosphere Reserve, UNICAF and LISANGNI



Source: RA

At 500,000 hectares in size, the Río Plátano reserve is the largest remaining undisturbed tropical rainforest in Honduras, and one of the few remaining humid tropical rainforests in Central America. The majority of the area is covered by mature broadleaf forests, with pine savannahs, mangroves, swamp forest and hardwood gallery forest found along the Plátano river and its tributaries. Over 2,000 indigenous people have preserved their traditional way of life within this mountainous landscape.[12]

This World Heritage site is under threat from agricultural expansion into the southern and western sides of the reserve and illegal logging for species such as mahogany (*Swietenia macrophylla*). Wildlife within the reserve is under threat from uncontrolled commercial hunting and the introduction of exotic species.[13] A lack of park staff has been cited as compounding the problem.[14]

Two RA/FSC-certified forestry operations are located within or adjacent to the Río Plátano Biosphere Reserve (RPBR). The first is UNICAF-BRP (Union of Agro-Forestry Cooperatives of the Río Plátano Biosphere Reserve) an organization that was created in 2008 with the goal of sustainable management and the sale of timber and non-timber forest products, environmental services such as carbon retention and sequestration, ecotourism and others. The group is composed of five FSC-certified operations, each managing its own forest resources within the RPBR's buffer and cultural zone.

This cooperative was assessed by Rainforest Alliance in August 2010. Most wood is harvested for export, with the main species being mahogany. The total land area is 14,795 hectares, of which 9,839 are designated as no-harvest areas.

12. http://whc.unesco.org/en/list/196
13. http://www.eoearth.org/article/R%C3%ADo_Pl%C3%A1tano_Biosphere_Reserve,_Honduras
14. http://www.eoearth.org/article/R%C3%ADo_Pl%C3%A1tano_Biosphere_Reserve,_Honduras

The operation 'Empresa de Servicios Múltiples LISANGNI' was created in 2008 by a group of 37 citizens representing 16 groups from communities in the Municipality of Wampusirpe. The group produces oil from the seed of cedro macho (*Carap guianensis*), a non-timber forest product that is used in cosmetics. In total, LISANGNI manages 24,686 hectares and provides employment for indigenous people in a region where few other opportunities exist.

UNICAF was issued 17 CARs (five major and twelve minor), and LISANGNI was issued 23 (ten major and thirteen minor). Because the assessments were both conducted within the past year, a follow-up audit to confirm that the CARs were addressed has not yet occurred.

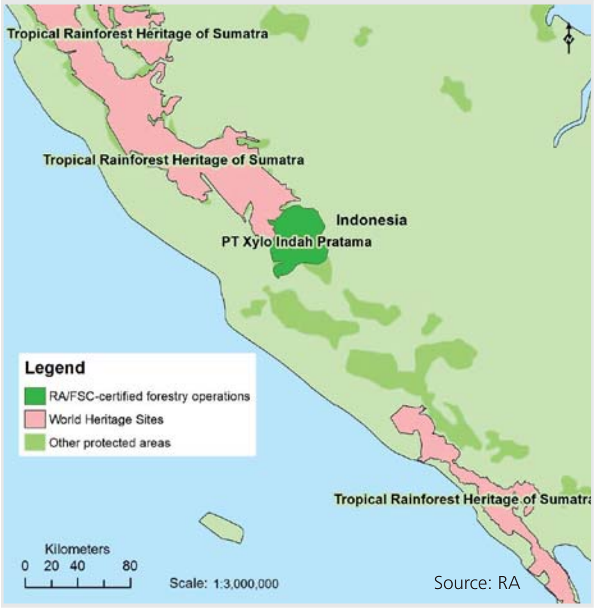
Auditors issued CARs related to HCVFs to both operations. UNICAF was required to implement the HCVF identification and monitoring methodology that they had previously developed. LISANGNI was required to identify both HCVFs and the actions they are taking to protect them.

UNICAF was issued a CAR requiring the implementation of a fire prevention programme.

Both operations had CARs that required improvements to worker conditions. UNICAF was required to ensure that in the future all workers are paid the minimum wage and benefits, and use adequate safety equipment. LISANGNI was required to create a fund to pay for the medical treatment for accidents, and provide protective equipment for use during seed extraction and processing.

Tropical Rainforest Heritage of Sumatra

Figure 3. Tropical Rainforest Heritage of Sumatra and PT Xylo Indah Pratama



The three Indonesian National Parks that make up the Tropical Forest of Sumatra World Heritage site contain rich and diverse habitats that range from coastal lowlands to subalpine volcanic mountains. This wide range of vegetation and habitat types, combined with physical barriers, have increased sub-speciation and resulted in a rich mammalian fauna, numbering around 180 species and including the endemic Sumatran orangutan (*Pongo abelii*).[15] Fifty-eight bird species in the site are listed in the 2000 IUCN global Red List. There are around 200 species of herpetofauna, at least 30 fish species, along with a rich diversity of invertebrates. The three parks have a combined area of 2,595,124 hectares.

There are many threats to the integrity of the Sumatran forests. Illegal logging is a critical issue. The clearing of forests for agriculture or settlements through fire or logging has lead to serious degradation and fragmentation of the area within the parks. The poaching of large animals such as rhinoceros, tiger and elephants is a serious threat to these species' survival. All of the above threats are exacerbated by road building, which is providing access to previously remote areas.

Law enforcement activities and management planning have not been able to quell these threats. There are insufficient funds for law enforcement staff, vehicles and equipment.[16] Park managers' successes in limiting logging,

15. http://www.eoearth.org/article/Canadian_Rocky_Mountain_Parks,_Canada
16. http://www.unep-wcmc.org/medialibrary/2011/06/30/3d2d9f0e/Sumatra%20Rainforest.pdf

poaching and the building of new roads have sometimes alienated local governments and communities, whose poverty, and in some cases attitude that the forest is theirs to use by right, have sometimes led to conflict and a lack of cooperation.[17]

The forestry company PT Xylo Indah Pratama (PT XIP) was first certified to the FSC standard in 2000. This certificate was suspended in 2004 due to a failure to address the Corrective Action Requests. A reassessment was conducted by Rainforest Alliance in 2006, which is the assessment that is discussed in this report. This most recent assessment is limited to the production of wood from pulai (*Alstonia scolaris* and *Alstonia angustiloba*) and labu (*Endospermum* spp.), which are grown in smallholder rubber plantations and community forestry plantations under joint management agreements between PT XIP and farmers. PT XIP has no concession area of its own.

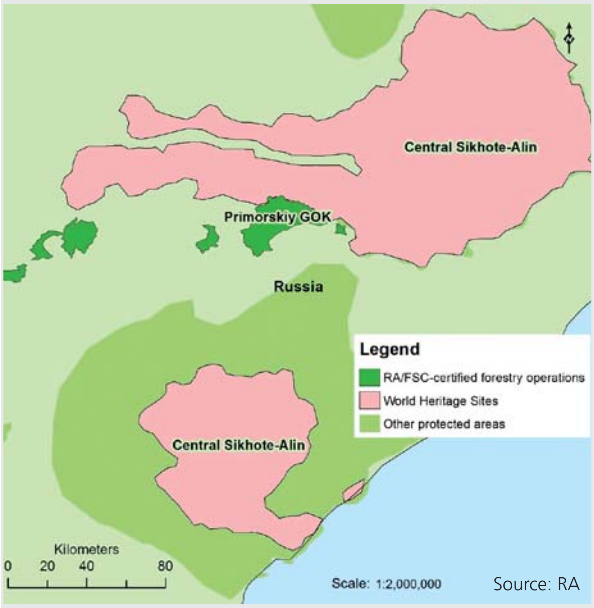
In its 2006 reassessment, PT XIP was issued 29 CARs (eight major and 21 minor). Development of an HCVF management system, including stakeholder consultation and an annual monitoring system, as well as an assessment of rare and threatened ecosystems and species, was issued as CARs.

CARs also addressed socioeconomic issues. Auditors required PT XIP to improve worker safety through the development and implementation of safety procedures, and pay all delinquent retribution payments, taxes, fees and royalties. In addition, PT XIP was required to establish a mechanism to resolve current and future land conflicts with local communities and farmers, who were dissatisfied with the growth rate of the pulai trees and were reportedly disputing the area for which they could claim compensation for lost productivity.

17. http://www.eoearth.org/article/Tropical_Rainforest_Heritage_of_Sumatra,_Indonesia

Sikhote-Alin Nature Reserve

Figure 4. Central Sikhote-Alin and Primorskiy GOK



Source: RA

The Sikhote-Alin Nature Reserve is 1,553,928 hectares in size and located in the Southeastern corner of Russia, where taiga and subtropics meet and southern species such as the tiger and Himalayan bear cohabit with northern species such as the brown bear and lynx. The site contains many endemic species, and is important for the survival of the endangered Amur tiger.[18]

Fire is the primary threat to this World Heritage site. Lightning and neighbouring agricultural burns are both sources of wildfires in the region, and reports suggest that there is inadequate state funding for firefighting.[19] Due to the low population densities in this region, economic activities such as tourism are essentially absent from the reserve. However, 60 per cent of the population is involved with the forest in some way, primarily the harvest of non-timber forest products or firewood. Some concern has been raised about poaching of wild animals and valuable plant material.[20]

The forestry operation JSC Primorskiy GOK is 49,018 hectares in size and operates on a long-term concession on state lands. The forest was exploited heavily in the 20th century and at the time of assessment primarily consisted of secondary forests. Local communities have free access to the concession area for berry and mushroom picking up, hunting and recreation.

18. http://whc.unesco.org/en/list/766
19. http://www.eoearth.org/article/Central_Sikhote-Alin,_Russian_Federation
20. http://www.eoearth.org/article/Central_Sikhote-Alin,_Russian_Federation

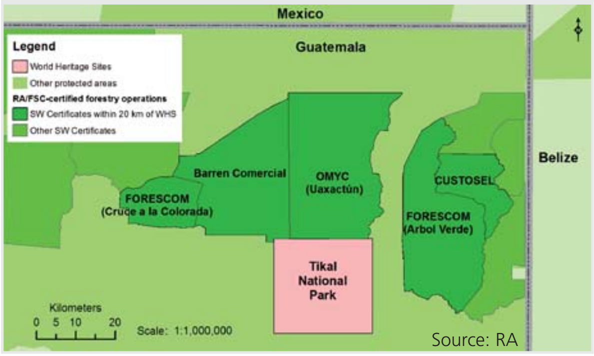
A pre-assessment visit was conducted in 2007. Afterwards, the Amur branch of WWF-Russia, aided with the identification and mapping of the key habitats, biotopes and High Conservation Value Forests, developed an ecological monitoring system and held training courses with company staff.

Rainforest Alliance conducted the formal assessment of the concession in 2008. A certificate was awarded, with twelve minor CARs issued.

Corrective Action Requests related to the seven categories we examined mainly centred on the identification, mapping and conservation of High Conservation Value Forests, and potential habitats of rare and endangered plant and animal species.

Tikal National Park

Figure 5. Tikal National Park and RA/FSC-certified operations that are adjacent or within 20 km



Source: RA

The 57,600 hectare Tikal National Park is located within the 1.6 million hectare Maya Biosphere Reserve (MBR), in the Petén region of Guatemala. The MBR is the largest stretch of tropical rainforest in Guatemala and Central America, consisting of large tracts of broadleaved forests and more than 300 tree species, including mahogany. There are abundant palms, epiphytes, orchids and bromeliads within the reserve, as well as a large number of threatened and CITES-listed species.

Tikal National Park is best known for its Mayan ruins. The site contains over 3,000 buildings dating between 600 BC and 900 AD, including temples, residences, tombs and religious monuments decorated with hieroglyphics. Much of the area remains to be excavated.[21]

Poaching is a threat to the species of Tikal, as is the annual burning of pasturelands, which can affect nesting birds such as the endangered ocellated turkey. In the nearby buffer and multiple use zones of the MBR, human settlements, grazing and industrial development have been cited as significant threats. Some theft of archaeological artifacts has been reported within Tikal.[22]

Four RA/FSC-certified operations are located adjacent to or within 20 km of Tikal National Park: OMYC (Sociedad Civil Organización, Manejo y Conservación Concesionaria de la Unidad de Manejo Uaxactún), CUSTOSEL (Sociedad Civil Custodios de la Selva, Unidad de Manejo 'La Unión'), FORESCOM (Empresa Comunitaria de Servicios del Bosque, S.A.), and Baren Comercial (or Barrios Comercial / La Gloria). These operations have a total combined area of 273,898 hectares. They primarily extract mahogany and cedar, in addition to non-timber forest products such as *chicle*, *xate* and pepper.

21. http://www.eoearth.org/article/Tikal_National_Park,_Guatemala
22. http://www.eoearth.org/article/Tikal_National_Park,_Guatemala

These operations are all located within the Maya Biosphere Reserve, and thus operate under a broader framework of sustainable management established for the MBR by the Guatemalan government, which requires FSC certification as a condition of land tenure. Fauna registries report 24 species of large mammals, about 303 species of birds, and a rich diversity of plants in the MBR. On average, over 25 per cent of the certified operations' land is set aside for protection of natural ecosystems and archeological sites.

All four RA/FSC-certified operations were assessed between May 2001 and December 2003 and have been certified since. All combined, they were issued 126 major CARs and 24 minor CARs[23]. Many of these CARs required improved assessment and protection of HCVFs, as well as the safeguarding of rare, threatened and endangered species. One operation was required to map its members' conservation areas, and adjust or add areas to the conservation zone to fill gaps and improve landscape level conservation. Another operation was required to create corridors for the movement of rare, threatened and endangered species. One CAR was issued that required training on firefighting, and the acquisition of firefighting equipment.

Corrective Action Requests that addressed worker and community issues included the requirement that all workers have access to social security benefits and first aid kits that are adequately stocked with supplies and medicine. Local communities will also benefit from the requirement that *chicleros* and *xateros* – the men and women who harvest *chicle* and *xate* – are consulted with, and their opinions incorporated into forest management plans.

Reflections on the contributions of RA/FSC-certified forests to the integrity of World Heritage sites

On average, RA/FSC-certified operations were given CARs that required improvements in five of the seven thematic areas that we consider important influences on the health and viability of neighbouring World Heritage sites (Table 1). Often, these CARs directly addressed one or more of the external threats to the site, such as road building (in the case of the Canadian Rocky Mountain / Waterton Glacier), and fire prevention (in the case of Tikal National Park).

As shown in Table 1, all certified operations located near World Heritage sites were required to improve the way they assess and conserve High Conservation Value Forests (HCVFs). Characteristics of HCVFs range from areas of high biodiversity to areas that provide important

Table 1. Thematic areas in which Corrective Action Requests were issued for RA/FSC-certified forestry operations adjacent to or within 20 km of World Heritage sites

Thematic Area	World Heritage Sites				
	Canadian Rocky Mountain / Waterton Glacier	Sikhote-Alin Nature Reserve	Tropical Rainforest Heritage of Sumatra	Tikal National Park	Río Plátano Biosphere Reserve
Improve HCVF assessment	✓	✓	✓	✓	✓
Conserve HCVFs	✓	✓	✓	✓	✓
Protect rare, threatened or endangered species or their habitats	✓	✓		✓	
Limit the movement of invasive species	✓				
Prevent or contain forest fires				✓	✓
Improve worker wages or working conditions	✓		✓	✓	✓
Enhance the viability of local communities	✓		✓	✓	✓

23. Due to space constraints we will describe the CARs from each of the six RA-certified operations combined.

ecosystem services such as freshwater flows for downstream beneficiaries, climate mitigation and adaptation benefits and soil stability for surrounding production lands. Having functional HCVFs near or adjacent to the World Heritage sites enhances the range of habitats available for their wildlife species, acts as a source of genetic material, and enhances the flow of these ecosystem services. In one case, near Tikal in Guatemala, a RA/FSC-certified forestry operation was explicitly required to develop wildlife corridors that would aid the movement of rare, threatened and endangered species. Near two other World Heritage sites, RA auditors required certified operations to identify and conserve the habitats of rare, threatened and endangered species.

RA/FSC-certified operations were also required to undertake actions that buffer the World Heritage sites from external threats. In one case, auditors required measures to minimize the movement of invasive species. In two cases, auditors required actions that would prevent or contain forest fires, such as the acquisition of firefighting equipment and training of staff in its use.

In the RA/FSC-certified operations around four out of five World Heritage sites, workers wages and/or working conditions and safety were addressed, as were the viability of local communities through local purchasing and hiring. The importance of well paid, safe jobs around protected areas is known to be critical for countering perverse incentives for illicit activities within protected areas, such as illegal logging or wildlife poaching – activities that often have immediate economic interest to local communities. These findings suggest that RA/FSC certification contributes in a meaningful way to this end.

Based on this analysis, the future potential for forest certification to enhance the functionality and integrity of World Heritage sites seems high. By explicitly targeting the areas around World Heritage sites and other protected areas for RA/FSC certification, the benefits of certified forestry will likely extend beyond the operation's boundaries and into nearby forests and communities.

Enhancing Community Management of World Heritage Forests Through Landscape Labelling

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Most frameworks and initiatives that seek the conservation of natural and cultural landscapes recognize the complexities and challenges involved, namely, the need to reduce the threats to natural habitats while promoting and sustaining the livelihoods of people living within such landscapes. In seeking to deconstruct these complexities, we are forced to resolve issues such as how to define forest, how to manage forests under dynamic conditions with incomplete system knowledge, and how to deliver the benefits of conservation in an equitable manner. These issues are neither simple, nor can they be properly resolved by any single disciplinary approach. Indeed, recognition of this by, for example, the World Heritage Convention and the Convention on Biological Diversity (see for instance, the report on World Heritage and Sustainable Development), has led to the promotion of ecosystem management approaches that seek, among other things, to promote equity and benefit-sharing though the integration of local stakeholders into decision-making, which necessarily requires the consideration of socio-economic and institutional concerns along with the ecological concerns that provided the primary impetus for these conventions. In this light, successful conservation is less about biophysical aspects and rather more about the management and adaptation of governance systems across societal scales.

This is coupled with the observation that the conservation of forested habitats is not exclusively confined to the preservation of large and relatively undisturbed tracts of primary forest, but now also needs to include the often heterogeneous landscape matrices. While some tropical landscapes have been converted to large-scale intensive crop production or pasture, many others are comprised of diverse agricultural land uses, as well as natural habitat features such as rivers and streams, wetlands, natural grasslands, and forest remnants. The persistence of non-protected natural elements in these human dominated landscapes is invariably the result of long-standing local management practices, which may be imbued with cultural associations as well as livelihood needs. Further, in many tropical locations the distinction between agricultural and natural lands is often not so clear; many agricultural land uses, including various forms of shifting cultivation and agroforestry, retain native trees and associated biodiversity to a considerable extent. Similarly, there is broad acceptance that forested areas can support livelihoods as well as biodiversity, particularly through the provision of non-timber forest products and various ecosystem services. In other words, anthropogenic landscape mosaics that support biodiversity, ecosystem services and livelihoods, and encompass a wide range of cultural as well as biological values, are also worthy of conservation attention. This is particularly the case now, as many of these landscape mosaics are increasingly threatened by agricultural intensification.

Existing frameworks for participatory landscape management

Recognizing these issues is, of course, not sufficient to meet the various demands of conservation and local livelihoods. Systems of management need to be developed and implemented to account for the complexities and uncertainties inherent in any holistic land management programme. The main objectives of such a programme is the environmental sustainability *and* comparative profitability of local livelihoods, coupled with the conservation of biodiversity and the continued provision of ecosystem services to local, regional and global communities. Meeting these objectives requires the resolution of threats and challenges at landscape scales in an equitable and participatory manner so as to minimize conflicts and distribute benefits among stakeholders. It also requires local institutions to be effective, and integrated with decision-making at larger societal scales.

There are several precedents for such programmes. The Model Forest approach (Box 1) leads from the bottom up and promotes sustainable forest management through local governance based on participation by all stakeholders. By recognizing a plurality of resource needs and rights, and by jointly identifying the barriers and challenges to meeting stakeholder aspirations (i.e. jobs, NTFP, recreation, hunting, wood, biodiversity conservation), it seeks to create a shared local vision for development from which all stakeholders would benefit. Other approaches have their origins in international research institutions such as ICRAF's Rewarding Upland Poor for Environmental Services (RUPES) initiative, which seeks to build capacity among poor smallholder communities to access and benefit from payments for environmental service schemes (Box 2).

These schemes all seek broadly similar objectives, but they also face a similar set of challenges. Principle among these is the degree to which they are able to empower local communities to manage their landscapes in order to deliver the broad objectives to which these approaches subscribe. Biosphere reserves provide government sponsored international visibility, but the approach is largely top-down in that activities in core areas are constrained by regulations determined by the reserve's authorities, albeit often in consultation with agriculture and forestry authorities, administrations for water management, as well as local governments. The functioning of biosphere reserves is also heavily dependent on financial support from central governments, but when financial and political support is reduced the extent of participatory efforts declines. Biosphere reserve administrations might also be perceived by local communities to be too closely tied to nature protection objectives and therefore not a neutral arbiter. Indeed, the designation of a biosphere reserve is usually an external intervention, and the zonation of core areas and associated regulations may conflict with local land use rights, and people's perceptions of the main issues.

The Model Forest and the Community-based Payments for Environmental Service schemes must include effective locally inclusive and broadly representative institutions that provide accountability of local representation for decision-making and conflict management. These organizations need to be sensitive to gender issues and represent the interests of the poorest members of society. Trust between individuals, communities, regional and national governments, and external actors is a basic condition for the successful outcome of negotiated agreements. Such conditions might be difficult to establish in community led approaches on account of the power and influence invested in certain stakeholder groups, social or ethnic classes, or individuals. Further, the success of these schemes assumes an adequate financing framework. The Model Forest promotes rural entrepreneurship through capacity-building and skills development, but commercial outcomes might conflict with forest and natural resource conservation objectives. Community-based Payments for Environmental Service schemes suffer from relatively high transaction costs of engagement that might limit smallholder participation.

Landscape labelling

Building on this foundation is the concept of Landscape Labelling, which proposes that managed rural landscapes that are recognized to be delivering ecosystem services (based on local and regional evaluation by appropriate institutions) should be acknowledged as such through the designation of an exclusive 'Landscape Label' applicable across the whole landscape. A Landscape Label would represent the delivery of various ecosystem services, and thus be the conduit through which payments for ecosystem services to appropriate community-based organizations are made. Such payments would incentivize the continued delivery of these services through community-based management of the landscape. The Landscape Label could additionally be used to identify a product as originating from an ecosystem service-providing region, as

Box 1. Model Forest

In Model Forests all stakeholders within an agricultural and forested landscape mosaic collaborate to manage the landscape's natural resources. Their management approach is based on their shared cultural history, and recognition of the landscape's natural values as well as their current and future economic needs. The collaborative partnership across stakeholders seeks to define sustainability in the local context, and then develops governance structures and strategic plans, to implement a set of common goals that seek to integrate economic and non-economic priorities. Important features of Model Forests are the comprehensiveness of their approach, the landscape scale of their operation, and their inclusiveness. Model Forests are driven by bottom-up processes in that local stakeholders collectively set their own priorities, relating to conservation of biodiversity, economic enterprise, public education, and infrastructural development. As such, the system is flexible and allows for local adaptation.

Box 2. Community-based Payments for Environmental Services

Reward schemes based on payments for environmental services (PES) seek to incentivize conservation. Such schemes are often inefficient on private smallholdings (typically less than 50 ha), and this many poor smallholders are excluded from accessing such benefits. ICRAF's Rewarding Upland Poor for Environmental Services (RUPES) programme and the similar Pro-poor Rewards for Environmental Services in Africa (PRESA) (ICRAF 2008) seek to promote community-based action to socially and politically empower communities to engage in PES schemes. RUPES experience in the Kulekhani watershed, Nepal, has shown that the likelihood of achieving broadly acceptable PES systems for smallholders depends on shared perceptions of environmental services and opportunity costs, and representative community institutions that manage the implementation of PES scheme.

well as serve to symbolize the wide variety of ecosystem services provided by the landscape. The Landscape Label could also represent and indeed publicize the cultural and symbolic attributes of the landscape, as defined by local communities, thereby helping to define its heritage value and uniqueness for people beyond the landscape. This in turn would provide greater recognition to communities, and help to empower them in negotiations with outside agencies (including government or companies), while promoting landscape recognition that could serve to generate new livelihood opportunities through, for example, tourism.

A Landscape Labelling approach therefore provides a mechanism by which payments for environmental services are delivered to the community on the basis of effective landscape management. Individual landowners and producers additionally benefit from higher market recognition of their products through the use of the Landscape Label as a certificate of good land and environmental management. Thus a Landscape Label potentially permits producer communities to improve market recognition, secure premium payments, gain access to niche markets, and attain market benefits for minor products by association through the label with more commercially important products. The derived benefits can, in turn, secure an incentive for managing the landscape in such a way as to continue to meet the ecosystem service criteria required for certification. Landscape Labelling potentially has other benefits such as reducing transaction costs, improving inclusivity and equity, cheaper conditionality determination, allowing more flexibility in response to changing market environments, and providing social pressure to limit freeloading.

Landscape Labelling affords flexibility in management at the landscape scale. Thus one limitation of Payment for Environmental Services (PES) schemes is that landowners are contractually bound to restrict their land use activities, and are therefore limited in the extent to which they can respond to changing commodity markets. Assessing ecosystem service provision at the aggregated scale of the landscape, as proposed by Landscape Labelling, allows greater flexibility with regard to land use decisions. Notably, it allows for development when opportunity costs at a particular location are high, so long as this development is offset elsewhere within the landscape. This raises the potential for landscape wide offset markets, permitting landowners to offset certain environmentally damaging activities while retaining the benefits of Landscape Labelling. Such flexibility is likely to make Landscape Labelling more attractive to wide participation, as there is recognition that high opportunity costs can be accommodated through reforestation or improved forest protection elsewhere within the landscape where opportunity costs are less.

Applying Landscape Labelling concepts to World Heritage forests

World Heritage forest designation is applied to regions where forest ecosystems contribute to the site's outstanding universal value. The broad objectives of World Heritage forest management must respond to threats (including invasive species, pollution of waterways, and forest conversion to agriculture) but in the context of human development ambitions. This in turn requires that different land uses, values, and management approaches be defined in consultation with local stakeholders.

Landscape Labelling can provide a mechanism by which local stakeholders can be more effectively integrated in World Heritage forest management. The World Heritage forest can provide the logical framework for a sustainable landscape management. For example, the overriding principle for the landscape might be 'management to contribute to the long term conservation of the World Heritage forest, by maintaining its ecological connectivity with the broader landscape context'. Local landowners, NGOs, and community institutions that work towards this goal would be credited with the use of an exclusive 'World Heritage Conservation Landscape' label or certificate, which could be exploited for commercial purposes such as product labelling or attracting payments for ecosystem services.

The World Heritage forest designation already offers international recognition in terms of environmental values. Landscape Labelling – the explicit association of the label with a sustainably managed landscape – could allow local stakeholders to capitalize on World Heritage status. Thus landscapes that encompass World Heritage forests might be managed in such a way as to minimize impacts on the protected forests by, for example, encroachment, pollution, invasive species, and so on. Remnant forest patches or other natural habitats might also be actively maintained within the landscape, thereby improving the quality of the landscape matrix for forest species, and thus extending the conservation benefits of the World Heritage forests into the surrounding landscape. Recognizing such management activities through the designation of a wider Landscape Label might provide one pathway by which these activities can continue to be incentivized and rewarded.

Landscape Labelling approaches rely on strong and representative community institutions responsible for coordinating activities across the landscape as well as the equitable distribution of benefits through investments in community programmes and infrastructure. Often this is likely to require the strengthening of existing local stakeholder networks, and perhaps the establishment of new ones. The Model Forest approach thus provides an existing system to emulate. The adoption of a RUPES approach to the dissemination of ecosystem service payments with financial benefits invested through community based organizations for infrastructure development and social projects would ensure the broad and equitable distribution of benefits. Thus inclusivity and equitable distribution of benefits to all community members is an important element of Landscape Labelling. By allocating payments from ecosystem service buyers to community-based organizations, and investing in social and community projects, the Landscape Labelling approach provides the potential to secure benefits to all community members including the landless poor. While these benefits are indirect, they may be important in providing improved access to markets, better education and healthcare, micro-insurance, and so on.

People living within the broader World Heritage forest landscapes might additionally benefit through the use of a World Heritage Conservation Landscape label by which their products could be differentiated from others in the market place, thereby securing greater market access or possibly a price premium. This might be best applied to products with a large international market, such as coffee and cocoa, but could conceivably be applied more generally. Indeed, the Landscape Label need not be restricted to a particular product, as is the case with most certification or labelling initiatives, but could be associated with a landscape. Hence, any product that is derived from that landscape can use the label to indicate that it has been produced under a management system that continues to provide ecosystem services. This provides benefits in terms of market recognition – and potentially price premiums – to all farmers regardless of the type of goods produced. Indeed, the label may be advanced further by enlarging the concept to include non-agricultural products, such as artisanal commodities or ecotourism.

The management of the World Heritage forest landscape, through the collective action of the communities living within it, would need to recognize and respond to the criteria of the World Heritage forest designation if the benefits of PES funds and the World Heritage forest label are to be maintained. These benefits, provided they are sufficient to overcome the costs (including opportunity costs), would therefore provide an incentive for local communities to work closely and align themselves with the World Heritage objectives to ensure the sustainability of the landscape. The success of community-wide schemes is dependent on effective institutional structures that provide appropriate negotiation and communication pathways among the variety of community organizations. A diversity of community-based organizations and interests is typical of many rural landscapes; ensuring effective interaction among such organizations is one of the most serious challenges to the implementation of landscape-level PES processes. The success of the Landscape Labelling approach rests on the effective functioning of such organizations, and cooperation among them. Payments to support a certified landscape are expected to be made to appropriate community institutions responsible for making investment decisions. Conflicts among community-based organizations and corruption within them is perhaps the single most important threat to the successful implementation of Landscape Labelling. Nevertheless, there is considerable awareness and knowledge regarding empowerment of and collaboration among community-based organizations, and examples of collaborative networks to secure wider community benefits are known. These include the Model Forest system, which encompasses a network of stakeholders that share the common goal of sustainable landscape and forest management with a view to preserving ecosystem services and local livelihoods.

Conclusions

World Heritage forests recognize the value of forests, not just for their natural heritage but also for their contribution towards well-being and the cultural identity of the people living in association with broader forested landscapes. Indeed, there is increasing acceptance that forested landscapes, encompassing other forms of land use and habitat cover than just forests, should be the focus of management attention and conservation. This implicitly recognizes humans as part of those landscapes. This thinking has led to a more inclusive and bottom up approach to management and conservation that integrates local stakeholder value systems and decision-making.

The Landscape Labelling approach seeks to provide mechanisms by which such a bottom-up approach is linked to an internationally recognized programme though which access to PES funding might be promoted and ultimately realized. Thus well conserved World Heritage forests can form the basis of a rigorous logical framework against which sustainable development at the landscape level can be constructed. A healthy landscape, contributing to the long-term conservation of a World Heritage forest by, for example, promoting land use systems that improve ecological connectivity and that secure its integrity, could be formally recognized as such. The contribution of local communities to this objective, through appropriate land management, could be evaluated and recognized by a label through which PES might be sought and secured. Moreover, through the use of the World Heritage forest name and label, the Landscape Labelling approach offers a second independent mechanism of securing market benefits from products emerging from a World Heritage forest. In this way, local communities might be able to secure real benefits from World Heritage status, and therefore gain increased incentive for its effective management. The Landscape Labelling approach suggests a strong community identity and effective local networks and institutions. The Model Forest Trust Network provides an example on how such identity and coherence might be developed and sustained.

3

Global Governance –
What is the Relationship Between World Heritage Forests and Global Governance Processes?

Jiuzhaigou Valley Scenic and Historic Interest Area, China © Andy Leong

Forests and Protected Areas: Outcomes of the Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity

by Johannes Stahl, Tim Christophersen and Jason Spensley
Secretariat of the Convention on Biological Diversity, Montreal, Canada

Introduction

The Convention on Biological Diversity (CBD) is an international treaty for the conservation and sustainable use of biodiversity, and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. Over the years, the Conference of the Parties to the CBD developed programmes of work on thematic areas, corresponding to the major biomes the world. It also initiated work on key cross-cutting issues that are of relevance to all thematic areas.

Forests and forested protected areas are particular areas of focus of the CBD, which are addressed in numerous ways. The CBD's programme of work on forest biodiversity (CBD decision VI/22), for example, promotes measures to enable the conservation and sustainable use of forest resources and the equitable sharing of benefits arising from their use. Similarly, the CBD's programme of work on protected areas (decision VII/28) promotes the establishment and maintenance of comprehensive, effectively managed, and ecologically representative national and regional systems of forest protected areas.

Most recently, at the Tenth meeting of the Conference of the Parties to the CBD in October 2010 held in Nagoya, Japan, a new Strategic Plan for Biodiversity was adopted with the overall vision of living in harmony with nature by 2050. The new plan contains several targets that are directly related to forests and protected areas. The Conference of the Parties (COP) also adopted a series of a series of forest-related decisions as well as a Protocol on Access and Benefit-Sharing (ABS), which in the future may have major implications for forests.

This paper provides a brief overview of the forest related targets of the Strategic Plan and the relevant COP decisions and ABS Protocol. The chapter also highlights some key forest related activities carried out by the CBD Secretariat.

The Strategic Plan for Biodiversity 2011–2020

The CBD's new Strategic Plan promotes the effective implementation of the Convention through a strategic approach that will inspire broad based action by all Parties and stakeholders in order to halt the loss of biodiversity and ensure that by 2020 ecosystems are resilient and continue to provide the essential services that are securing the planet's variety of life, and are contributing to human well-being and poverty eradication. As such, the plan is intended as the overarching framework on biodiversity, not only for the biodiversity related conventions, but also for the entire United Nations system.

The new Strategic Plan builds on the analysis of past failures to slow biodiversity loss. As highlighted in Figure 1, past action in support of biodiversity generally focused on addressing the direct pressures causing biodiversity loss, intervening directly to improve the state of biodiversity, for example in programmes to protect particular endangered species. The approach taken in the new Strategic Plan broadens the action to include addressing the underlying causes of indirect drivers of biodiversity loss (such as demographic change, consumption patterns or the impacts of increased trade), and protecting the benefits provided by ecosystems.

At the heart of the Strategic Plan are twenty ambitious but realistic targets collectively known as the *Aichi Biodiversity Targets*. These targets must be met over the next decade if the plan is to be realized. The implementation of the Plan coincides with the International Decade of Biodiversity 2011–2020 announced by the UN General Assembly in December 2010. There are four targets that are directly relevant to forests and protected areas, including World Heritage sites. These 2020 targets include:

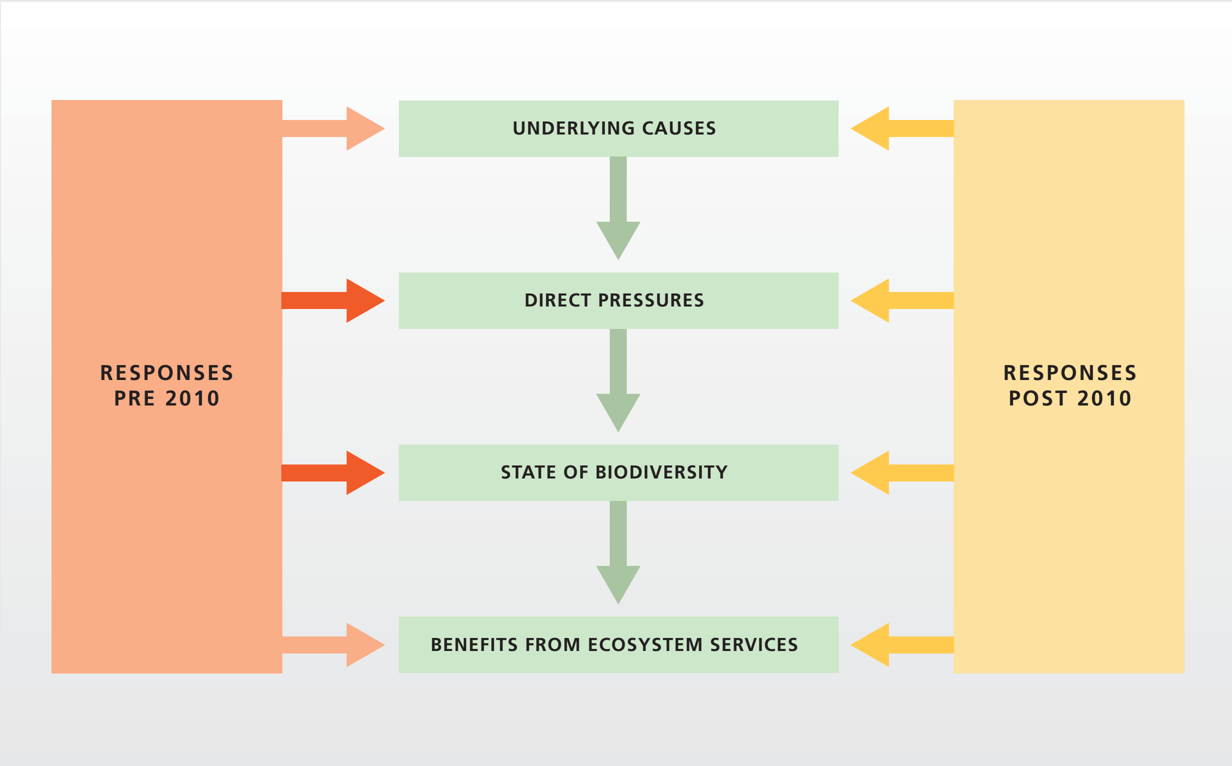
- to at least halve, and where feasible bring close to zero, the rate of loss of all natural habitats, including forests, and to significantly reduce degradation and fragmentation (Target 5);
- to manage areas under agriculture, aquaculture and sustainably managed forests (Target 7);
- to conserve at least 17 per cent of terrestrial and inland water and 10 per cent of coastal and marine areas (Target 11); and

Protected: Consolidation and expansion of forest protected areas create essential refuges and buffers against climate change and poverty. © UNESCO / Patry

- to enhance the resilience and the contribution of biodiversity to carbon stocks through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation, and to combating desertification (Target 15).

Other targets that are also relevant to forests, aim to eliminate negative incentives harmful to biodiversity, apply positive incentives for conservation and sustainable use (Target 3), and to restore and safeguard ecosystems that provide essential services and contribute to health, livelihoods and well-being, in particular for women,

Figure 1. Broadening action on biodiversity



Not for food: Control of bushmeat harvesting is a key part of the CBD forest agenda. © CBD Secretariat

indigenous and local communities, the poor and vulnerable (Target 14).[1]

Target 11 on protected areas is particularly relevant to World Heritage forests, as its aim to increase terrestrial protected areas from 12 per cent at present to 17 per cent in 2020 may lead to more nominations of World Heritage sites.

Progress towards the targets of the Strategic Plan needs to be monitored and measured. Developing criteria and indicators on how to achieve that will be the task of an Ad Hoc Technical Expert Group (AHTEG) in 2011 that will develop guidance and options for the development of national indicators and associated biodiversity monitoring and reporting systems. The AHTEG is also tasked to provide advice on the strengthening of linkages between global and national indicator development and reporting.

Other forest related decisions

In addition to the Strategic Plan, the Conference of the Parties also adopted a series of decisions related to the conservation and sustainable use of forest biodiversity:[2]

- Decision X/36 on forest biodiversity invites Parties and other stakeholders to closely collaborate in implementing the forest related targets of the Strategic Plan. The decision also requests the Executive Secretary of the CBD Secretariat to work on streamlining forest related reporting and monitoring, on forest ecosystem restoration, and on further capacity-building on how forest biodiversity and climate change could be better addressed in national biodiversity and forest policies.

- Decision X/31 on protected areas invites Parties to develop long-term national and regional action plans for strengthening the implementation of the programme of work on protected areas (PoWPA). In particular, the decision invites Parties to develop and implement sustainable finance plans for protected area systems by 2012, and support individual protected areas based on realistic needs assessments and a diversified portfolio. In addition, the decision encourages developing country Parties to express their protected area system-wide and project funding needs, based on their National Biodiversity Strategies and Action Plans and the action plans developed for the programme of work on protected areas. The decision urges donors and countries, in a position to do so, to support the identified funding needs, and encourages them to hold subregional and national donor roundtable meetings to support the mobilization of funding, involving relevant funding institutions including the CBD LifeWeb Initiative.

- Decision X/32 on sustainable use of biodiversity invites Parties and other governments to implement the recommendations for the sustainable use and conservation of bushmeat species, developed by the CBD Liaison Group on Bushmeat in 2009. The decision requests the Executive Secretary to develop through the Liaison Group, options for small-scale food and income alternatives to bushmeat hunting that are based on the sustainable use of biodiversity. The decision also requests the Executive Secretary to compile information on how to improve the sustainable use of biodiversity in a landscape perspective, including sectoral policies, international guidelines, and best practices for sustainable agriculture and forestry.

- Finally, decision X/33 on biodiversity and climate change contains several paragraphs related to reducing emissions from deforestation and forest degradation in developing countries (REDD-plus). The decision invites

1. The full text of the Strategic Plan, including all the Aichi Biodiversity Targets, is available at: http://www.cbd.int/sp

2. The full texts of these decisions are available at: http://www.cbd.int/decisions

Carbon and biodiversity: REDD-plus can support carbon storage and have significant biodiversity benefits as well.
©CBD Secretariat

Parties and other governments to enhance the benefits for and avoid negative impacts on biodiversity from REDD-plus, and other sustainable land management and biodiversity conservation and sustainable use activities. It requests the Executive Secretary to provide advice on relevant REDD-plus safeguards for biodiversity, based on effective consultation with Parties and their views, and with the participation of indigenous and local communities. It also requests the Executive Secretary to identify possible indicators that assess the contribution of REDD-plus towards achieving the objectives of the CBD, and to assess potential mechanisms that monitor the impacts of REDD-plus on biodiversity.

The Nagoya Protocol on Access and Benefit-Sharing

Next to the Strategic Plan, the Nagoya Protocol on Access and Benefit-Sharing is one of the most important outcomes of the Nagoya COP 10. The aim of this new protocol is to provide a transparent legal framework for the effective implementation of the third objective of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

Genetic resources are of interest in scientific research and in the development of commercial products in a variety of sectors, including pharmaceutical, biotechnology, cosmetic, and seed and crop industries. At its most basic, the Nagoya Protocol regulates the relationship between users and providers of genetic resources, including forest genetic resources, within and across scientific and economic sectors. In other words, the protocol regulates the access to genetic resources in exchange for a fair and equitable share of the benefits derived from their utilization.

- Users seeking access should get permission from the provider country (known as prior informed consent or PIC)

- Users and providers should negotiate an agreement to share resulting benefits (known as mutually agreed terms or MAT)

In many cases, users of genetic resources consult indigenous and local communities on their traditional knowledge of biodiversity for leads in identifying useful properties of genetic resources. Such information can enable industries to develop new products for the benefit of humankind and have helped scientists better understand biodiversity. Whenever traditional knowledge associated with genetic resources is used, the prior informed consent of the indigenous and local communities concerned must be obtained, and mutually agreed terms for the sharing of benefits with these communities must be established.

Green gold: Intact forests provide a wealth of genetic resources, including for pharmaceutical use.
©CBD Secretariat

Benefits to be shared may be monetary, such as royalties and profits, or non-monetary, such as technology transfer, research results, and training. As some of the world's most biologically diverse ecosystems, forests harbour a diverse pool of genetic resources, and as we move into the future the use of these resources may be greatly affected by the new protocol.

Key forest related activities of the CBD Secretariat

ITTO and CBD Initiative

Based on a Memorandum of Understanding and with generous funding from the Government of Japan, the Secretariat of the International Tropical Timber Organization (ITTO) and the CBD started a joint initiative for the conservation and sustainable use of tropical forest biodiversity. The initiative supports the implementation of the CBD programme of work on forest biodiversity in ITTO producer member countries through specific country projects related to capacity building, technical support and guidance. It builds on the experiences of the 'Friends of the PoWPA' in support of the CBD programme of work on protected areas.

The implementation of the initiative is led by ITTO in close consultation with the CBD Secretariat and the Government of Japan. The initiative prioritizes activities related to relevant goals identified in the CBD's Strategic Plan. The country projects of the initiative focus *inter alia* on the linkages between forest biodiversity and climate change, biodiversity conservation in production forests, and transboundary conservation of tropical forest resources. The focus on transboundary conservation, in particular, may present new opportunities for existing or future World Heritage sites in tropical forests.

CBD LifeWeb Initiative

The CBD LifeWeb Initiative facilitates financing for protected areas to conserve biodiversity, address climate change and secure livelihoods. Managed by the CBD Secretariat, LifeWeb was invited by the Conference of the Parties to the CBD in its decision IX/18(11–12), and was reinforced by decision X/31 in 2010. It provides value-added by: (i) serving as an electronic clearing house of funding priorities; (ii) supporting Parties to hold financing roundtable meetings to strengthen international cooperation based on national priorities for protected area systems; and (iii) recognizing financing for priorities conveyed through CBD LifeWeb. Since 2009, sixteen donor partners have provided over US$120 million in funding support for projects profiled through this clearing house. Much of this support has been for the conservation and restoration of forest areas. Over thirty-five countries are currently profiling further priorities, and partnerships are being sought with support of CBD LifeWeb for an additional US$720 million. World Heritage Sites are of special relevance to CBD LifeWeb, particularly given their unique visibility and the need for good examples of ecosystem goods and services that can be derived from the effective management of protected areas.[3]

REDD-plus consultations

In collaboration with partners, the Secretariat organizes a series of regional consultation and capacity-building workshops on REDD-plus, including on relevant biodiversity safeguards. The workshops aim to consult effectively with Parties on biodiversity aspects of REDD-plus. They develop advice on REDD-plus and relevant safeguards, on possible indicators to assess the contribution of REDD-plus to achieving the objectives of the CBD, and on potential mechanisms to monitor the impacts of REDD-plus on biodiversity. The workshops also contribute to capacity-building on REDD-plus. The results are intended to support both the CBD and the United Nations Framework Convention on Climate Change discussions on safeguards, as well as on the monitoring of biodiversity in the context of the forest related targets of the Strategic Plan.

Conclusion

The decisions of the Conference of the Parties to the Convention on Biological Diversity (CBD), in particular the Strategic Plan for Biodiversity 2011–2020, are highly relevant for the future management and possible expansion of the network of protected forests globally, including World Heritage forests and the Man and Biosphere Programme. The International Decade for Biodiversity 2011-2020 will be a decisive period in setting the right policies through National Biodiversity Strategies and Action Plans and other relevant instruments for a sustainable future, and for achieving the vision of the Strategic Plan that states, "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people."

3. For more information on the CBD LifeWeb Initiative, please refer to: http://www.cbd.int/lifeweb

World Heritage Forests for People

by Benjamin Singer
United Nations Forum on Forests Secretariat

On 2 February 2011 the Secretariat of the United Nations Forum on Forests launched the International Year of Forests, also known as Forests 2011, to celebrate the essential role that forests play in the lives of billions. The network of World Heritage forests provides a unique platform where the benefits of forests can be better harnessed to both improve the well-being of people and the health of forests around the world.

Forests for people

For over two decades now, decision-makers at all levels have recognized the multiple values of forests: forests for biodiversity, as they harbour 80 per cent of the world's land species; forests for climate, as they act as essential carbon sinks; and forests for the economy, as they uphold many industries that depend on timber and non-wood forest products. These are only a few examples of the many contributions that forests make in ecological, economic and social terms.

Among these, however, the social values of forests are frequently underestimated or simply ignored. Forests keep 1.6 billion people out of extreme poverty by providing food, shelter, medicine and clean water to local populations. Many of these forest-dependent communities see forests as a safety net for their well-being as they are often marginalized, both figuratively and physically, from the world economy.

Forests thus contribute to reducing poverty – the first and most important of the United Nations Millennium Development Goals. But forests are also of crucial cultural and spiritual importance, not least for the 300 million indigenous and local communities living within them. To them and many beyond, forests represent the spiritual, the pure, the primordial; and the place where ancestors reside as spirits, intimately bound to countless cosmologies and myths of creation.

Despite this, the social and cultural values of forests are only rarely mentioned. Two main reasons could be put forward to account for this. First, local people have long been held as culprits of environmental degradation, and particularly of deforestation. For much of the nineteenth and twentieth centuries, Western conservationists saw humans as the antithesis of nature, and believed that the former could only harm the latter. In more recent decades, both decision-makers and experts further emphasized the allegedly destructive role of local communities in a bid to wrest away both management and knowledge of forests respectively from local hands. In particular, shifting cultivation (also known as slash-and-burn) and extraction of wood and non-timber forest products by communities for subsistence purposes were highlighted as the primary causes of deforestation. This also had the advantage of turning the attention away from other causes that included industrial logging and large-scale agriculture.

Since the 1990s, however, scientific research has largely shown that the role of local communities in deforestation is very limited, and that in many cases these same people often contribute to enhancing their natural environment. While experts deconstructed the discourse denouncing communities as the primary culprits of deforestation[1], decision-makers began to see the benefits that community participation could have in all forms of sustainable forest management, including conservation. Despite such advances, however, local communities continue to be largely marginalized and their rights to access the multiple values of forests frequently denied, for the simple reason that they do not have the capacity to influence decision-making processes.

The second reason why the social and cultural values of forests are so rarely highlighted lies in the fact that unlike other forest functions, these are difficult – if not impossible – to quantify. Unlike the millions of cubic metres of timber or tonnes of carbon dioxide that help us put a more or less accurate 'price' on forests, the importance that they represent in the eyes of local communities cannot be labelled in the same, measurable way. This is either because these values are subjective – notably the cultural and spiritual ones – or because the products local people extract from forests never enter markets and are thus never given any monetary value.

A study carried out by IUCN in Burkina Faso[2] is particularly revealing in this regard. Table 1 shows the distribution of income from the nearby forest according to the type of forest user and gender as a percentage of total revenue in Tenkodogo, a farming village about three hours from Ouagadougou. Non-cash income appears as the main source of total revenue, but more importantly, the forest provides almost four times more non-cash income than cash income to the village. In other words, based on this

1. Such researchers include James Fairhead and Melissa Leach in such publications as Fairhead, J. & Leach, M. 1995. False forest history, complicit social analysis: Rethinking some West African environmental narratives. *World Development*, Vol. 23, No. 6, pp. 1023–35.
2. IUCN (2009). *Applying the forests-poverty toolkit in the village of Tenkodogo, Sablogo Forest*. Ouagadougou (Burkina Faso): The World Conservation Union.

example, if economists limited themselves to the cash value of forests for local communities, they would only see about a fifth of the total value – the mere tip of the iceberg.

It is also worth noting the major correlations between cash and non-cash income from forests on the one hand, and household wealth and gender on the other. The same table shows that both women and poorer households tend to depend more on forests for their income than men and wealthier households. This only confirms the essential role that forests play in reducing poverty, particularly for women, and thus further highlights the understated values that forests represent in the eyes of local people.

Celebrating forests for their social values, however, is distinct from allowing local communities free and unrestricted access. In the past century, rural populations have increased dramatically with improved access to food and health thereby putting pressure on surrounding natural resources to provide additional food, medicine and construction materials to these growing populations. Moreover, while many rural populations rely on nearby forests as a means of subsistence, some communities have also been known to take part in the extraction of forest products for commercial purposes.

To cite just one example in Central Africa, the growing taste of urban populations for bushmeat has encouraged members of rural communities to contribute to the alarming depletion of forest wildlife well beyond their subsistence needs. Likewise, in eastern Democratic Republic of the Congo, the participation of communities in the charcoal trade to provide fuel to the region's cities has become one of the greatest threats to a number of protected areas, including the World Heritage Okapi Wildlife Reserve. It is therefore essential to strike a balance between the different functions of forests so as to ensure that the use of forests, whether by local communities or large-scale industries, remains compatible with the preservation of ecosystem services, particularly in the world's most ecologically valuable forests such as those inscribed on the World Heritage List.

Table 1. Forest use in the village of Tenkodogo, Burkina Faso (per cent)

Category of forest user	Cash income	Non-cash income	Total	Forest income as a percentage of total income
Wealthy and average men	42	58	100	
Of which forest	**7**	**31**		**38**
Wealthy and average women	36	64	100	
Of which forest	**10**	**34**		**44**
Poor and very poor men	38	62	100	
Of which forest	**9**	**36**		**45**
Poor and very poor women	32	68	100	
Of which forest	**12**	**38**		**50**
Average contribution of cash and non-cash income to total income	37	63	100	
Average contribution of forest income to total income	9	35		44

The importance of World Heritage forests

World Heritage forests could play a tremendous role in promoting the essential values of forests. With 104 protected forests now recognized as World Heritage properties, the network of World Heritage forests brings together the world's most outstanding forests, many of which provide the greatest value in terms of beauty, but also biodiversity, carbon storage, erosion prevention, and of course social and cultural values, which after all lie at the core of the concept of the World Heritage Convention.

A number of World Heritage forests cover protected areas with restrictions on the use of natural resources by local communities, in particular parks and reserves classified as IUCN categories I and II.[3] Even in these cases, local communities still benefit *ex situ* from forests by having access to clean rivers originating from forests, by using local rainfall patterns generated by nearby forests to grow crops or by relying on wildlife dispersing from these protected forests. In many other World Heritage forests, however, local communities are allowed to use natural resources for cultural/spiritual purposes and as a means of subsistence or both.

In fact, if any forests provide social and cultural values to both local communities and beyond, it is precisely those of the World Heritage Programme. A large number of these forests lie in densely populated rural areas, including Tropical Rainforest Heritage of Sumatra in Indonesia and Virunga National Park in the eastern Democratic Republic of the Congo. While the sharp increase in population in these areas, coupled with the spread of trade in forest products, threatens their ecological integrity, these forests still provide countless benefits to surrounding populations. Their listing as World Heritage forests increases their visibility and thus the chances that they will be protected more effectively. In so doing, the World Heritage Forest Programme already strongly contributes towards the value of these forests, including their social and cultural values, making them more sustainable in the long term.

The World Heritage Forest Programme can also enhance social and cultural values of forests in many other ways. One such way is through its network of exceptional sites covering all five continents. As such, it offers a unique opportunity to share experiences and lessons beyond national and even regional levels in terms of the challenges and successes of the use of forests by local communities in protected areas, thus helping to spread good practices more rapidly to the global level across the world's most valuable forests.

Another area in which experience could be shared is through the role of local communities in ecotourism. All the forests listed on the World Heritage Forest Programme have been selected for their outstanding universal values, many of which have a very high potential in terms of tourism. Involving local and indigenous communities in responsible and ecologically sensitive forms of tourism in these sites would not only allow local people to increase their benefits from the forest, thus contributing to poverty alleviation, but it would also provide a unique cultural experience to visitors, thus further enhancing the potential of tourism in these forests.

These are only a few of the ways in which World Heritage forests can increase visibility of the close bond between forests and local communities. The International Year of Forests is an unprecedented opportunity to build on this so that the social and cultural values of forests may be fully recognized and enhanced for both present and future generations.

3. IUCN Category Ia: Strict Nature Reserves; Ib: Wilderness Areas; II: National Parks. Due to the great fragility of these natural ecosystems, the use of the environment by local communities is often extremely restricted or simply non-existent in these categories.

Biosphere Reserves, World Heritage Sites and People: Enhancing Synergies for Sustainable Forests

by Ana Persic and Melody Ocloo

Man and the Biosphere Programme, UNESCO

'Forests for People', the main theme of the 2011 International Year of Forests (IYF), highlights the ecological, economic and cultural importance of forests for human life as well as the central role of people in the conservation and sustainable management of the world's forests. By placing people at the heart of the current global debate on forests, IYF places emphasis on the power of human action not only as part of the problem, but also as part of the solution.

The vision of human populations acting as key players in biodiversity conservation and sustainable use has been embedded in UNESCO's Man and the Biosphere (MAB) Programme since its launch in 1971. The issue of forests, infused with the notion of their ecological, economic and cultural values, has been addressed by the MAB Programme since its earliest days. From scientific projects, addressing the issues of ecological effects of increasing human activities on tropical and sub-tropical forest ecosystems, and ecological effects of different land uses and management practices on temperate and Mediterranean forest landscapes, the MAB Programme has gradually shifted its focus towards exploring how the improved protection and management of forested landscapes in and around specific sites, or biosphere reserves, could contribute to biodiversity conservation while improving social, economic and cultural well-being of resident human communities.

During the past four decades, the biosphere reserve concept, which originated in the framework of the MAB Programme, evolved from a conservation focus to its current form of land and seascape units dedicated to sustainable development. The adoption in 1995 of the Seville Strategy and Statutory Framework of the World Network of Biosphere Reserves was a key milestone in this evolution as it reaffirmed biosphere reserves as internationally recognized sites with three interconnected goals: biodiversity conservation; social, economic and cultural development of local communities; and learning on sustaining mutually beneficial relationships between conservation and development through research, monitoring, education and capacity-building. It also called for systematic adoption of a multi-stakeholder governance system, and the specific biosphere reserve zonation system comprised of a legally protected core area surrounded by buffer and transition zones, including resident communities.

The World Network of Biosphere Reserves (WNBR) currently consists of 564 sites in 109 countries with 338 being fully functional biosphere reserves according to the 1995 Seville Strategy and Statutory Framework. More than half of the biosphere reserves (298) include forest ecosystems and habitats, ranging from temperate forests, such as is characteristic of the Great Sandy Biosphere Reserve in Australia; deciduous forests characteristic of the 'W' Region, the first transboundary biosphere reserve in Africa with components in Benin, Burkina Faso and Niger, to tropical humid forest of the Yasuni Biosphere Reserve in Ecuador.[1] There are 123 forest biosphere reserves that are post-Seville biosphere reserves, i.e. designated after 1995 and fulfilling the criteria of the Seville Strategy and Statutory Framework in terms of zonation and governance systems.

It is interesting to note that forty out of one hundred and three World Heritage forests[2], thus more than one-third, constitute the legally protected core area of forest biosphere reserves, with eleven located in post-Seville sites (Table 1). In this context, and bearing in mind the alarming rate of forest destruction and degradation worldwide, there is a need to explore and document ways and means in which the dual World Heritage–Biosphere Reserve designation can increase the effectiveness of long-term conservation of World Heritage forests as well as fulfilling the overall conservation and development functions of biosphere reserves.

In the exploration of the relationship between World Heritage forests and biosphere reserves, forest biosphere reserves can certainly bring useful experience, insights, tools and techniques in order to *inter alia*:

- decrease ecological isolation through increased connectivity;
- strengthen the contribution of local communities to forest conservation and sustainable management, linking forest conservation to climate change responses; and
- improve generation, collection and sharing of relevant ecological and social knowledge, and best monitoring and management practices.

1. For more information: http://www.unesco.org/mabdb/br/brdir/directory/resecosy.asp
2. World Heritage sites in which forest ecosystems contribute to the outstanding universal value of the designated site.

Table 1. List of Biosphere Reserves (BR) which are wholly or partially World Heritage Forest sites		
Country	**Biosphere Reserve** (year designated)	**WH Forest Site** (year inscribed)
Australia	Great Sandy (2009)*	Fraser Island (1992)
Belarus	Belovezhskaya Puscha (1993)	Belovezhskaya Puscha / Bialowieza Forest (1979; extension: 1992) with Poland
Brazil	Pantanal (2000)*	Pantanal Conservation Area (2000)
	Central Amazon (2001)*	Central Amazon Conservation Complex (2003)
	Mata Atlantica, including Sao Paulo City Green Belt (1993; extension 2002)*	Discovery Coast Atlantic Forest Reserve (199) Atlantic Forest Southeast Reserves (1999)
	Cerrado (1993; extension 2000 and 2001)	Cerrado Protected Areas: Chapada dos Veadeiros and Emas National Parks (2001)
Bulgaria	Doupki-Djindjiritza (1977)	Pirin National Park (1983)
Cameroon	Dja (1981)	Dja Faunal Reserve (1987)
Canada	Waterton (1979)	Waterton Glacier International Peace Park (1995) with USA
China	Jiuzhaigou Valley (1997)*	Jiuzhaigou Valley Scenic and Historic Interest Area (1992)
	Gaoligong Mountain (2000)*	Three Parallel Rivers of Yunnan Protected Areas (2003)
	Huanglong (2000)*	Huanglong Scenic and Historic Interest Area (1992)
	Wuyishan (1987)	Mount Wuyi (1999)
	Wolong Nature Reserve (1979)	Sichuan Giant Panda Sanctuaries (2006)
Costa Rica/Panama	La Amistad (Costa Rica: 1982; Panama: 2000)*	Talamanca Range-La Amistad Reserves- La Amistad National Park (1983)
Côte d'Ivoire	Tai (1977)	Tai National Park (1982)
	Comoé (1983)	Comoé National Park (1983)
Côte d'Ivoire / Guinea	Monts Nimba (1980)	Mount Nimba Strict Nature Reserve (1981)
Cuba	Cuchillas del Toa (1987)	Alejandro de Humboldt National Park (2001)
Germany / Slovakia / Ukraine	East Carpathians (1998)*	Primeval Beech Forests of the Carpathians and the Ancient Beech Forests of Germany (2007; extension: 2011)
Guatemala	Maya (1990)	Tikal National Park (1979)
Honduras	Río Plátano (1980)	Río Plátano Biosphere Reserve (1982)
India	Sunderban (2001)*	Sundarbans National Park (1987)
	Nanda Devi (2004)*	Nanda Devi and Valley of Flowers National Parks (1988, 2005)
Indonesia	Gunung Leuser Biosphere Reserve (1981)	Tropical Rainforest Heritage of Sumatra (2004)
	Giam Siak Kecil-Bukit Batu Biosphere Reserve (2009)*	
Japan	Yakushima Island (1980)	Yakushima (1983)
Kenya	Mount Kenya (1978)	Mount Kenya National Park / Natural Forest (1997)
Mexico	Sian Ka'an (1986)	Sian Ka'an (1987)
	Mariposa Monarca (2006)*	Monarch Butterfly Biosphere Reserve (2008)
Montenegro	Tara River Basin (1976)	Durmitor National Park (1980)
Panama	Darien (1983)	Darien National Park (1981)
Peru	Manú (1977)	Manú National Park (1987)
Philippines	Palawan (1990)	Tubbataha Reef Marine Park (1993) Puerto-Princesa Subterranean River National Park (1999)
Portugal	Santana Madeira (2011)*	Laurisilva of Madeira (1999)
Poland	Bialowieza (1976)	Belovezhskaya Puscha / Bialowieza Forest (1979; extension: 1992) with Belarus
Russian Federation	Baikalskyi (1986)	Lake Baikal (1996)
	Barguzinskyi (1986)	Lake Baikal (1996)
	Sikhote Alin (1978)	Central Sikhote-Alin (2001)
	Perchoro Ilychskiy (1984)	Virgin Komi Forests (1995)
Senegal	Niokola-Koba (1981)	Niokolo-Koba (1981)
Sri Lanka	Sinharaja (1978)	Sinharaja Forest Reserve (1988)
United States of America	Glacier (1976)	Waterton Glacier International Peace Park (1995) with Canada
	Southern Appalachian (1989)	Great Smoky Mountains National Park (1983)
	Olympic (1976)	Olympic National Park (1981)
	California Coast Ranges (1983)	Redwood National and State Parks (1980)
	Yellowstone (1976)	Yellowstone National Park (1978)

*Post-Seville Biosphere Reserves

In general, although World Heritage forests are protected for their outstanding universal value, they are faced with the problem of ecological isolation as a result of deforestation, or the conversion of surrounding forest ecosystems for pasture, agriculture or mining purposes. Apart from the loss of viable populations of species, most ecologists believe that increased ecological isolation also significantly increases the vulnerability of protected areas, such as World Heritage forests, to climate change (Patry, 2005).

Case Studies

i) Sierra Gorda Biosphere Reserve (Mexico)

Biosphere reserves invite local communities and other stakeholders to design site and context-specific approaches to strengthen landscape level ecological connectivity that translates into the reduction of forest destruction and degradation. Through focused land use policies, such as creating biological corridors and planting trees around farms located in biosphere reserves, more forest cover is established at the landscape level, thus decreasing the ecological isolation of forest habitats. Giving incentives to local communities to plant trees, for example, payment through ecosystem services schemes, not only promotes ecological connectivity but also contributes towards climate change mitigation efforts by enhancing carbon storage and sequestration processes. A notable example can be seen in the Sierra Gorda Biosphere in Mexico where bundles of ecosystem services, provided by forests, are considered simultaneously, including climate and water cycles regulation. On the one hand, private landowners within the biosphere reserve are compensated for planting native trees on their degraded lands and for managing reforestation for optimum growth and carbon sequestration. While on the other hand, forest landowners located in the country's priority watershed zones are encouraged to preserve and protect their lands in order to improve the water caption and infiltration functions of the forest through the Hydrological Services Payment Program in the buffer and transition areas of the biosphere reserve.

ii) Bia Biosphere Reserve (Ghana)

Another example to promote ecological connectivity has recently been initiated in Ghana where communities bordering the Bia Biosphere Reserve are encouraged to sustainably use and manage wildlife resources within a defined area through the creation of biological corridors, referred to as community resource management areas (Attuquayefio and Fobil, 2005). In the long term, the idea is to create similar community managed corridors from the core area to other protected areas in the region, and also to other areas in Côte d'Ivoire.

Similar and other types of community involvement in forest management and governance have been initiated in biosphere reserves worldwide. Experiences, ranging from the Luki Biosphere Reserve in the Democratic Republic of the Congo (DRC) to Clayoquot Sound Biosphere Reserve in Canada and Maya Biosphere Reserve in Guatemala, have shown that the success of community involvement depends on many factors. However, they all concur that community participation at all levels of the management process – from planning, intervention to monitoring – and the respect for their traditional rights and social and cultural values are key to the success of joint management schemes (Kotwal *et al.*, 2008). In the long term, the combination of scientific, local and indigenous knowledge and practices, and the adaptive nature of community driven approaches to forest management greatly benefits the sustainability of forest ecosystems, while boosting economic returns and contributing to sustainable development on local and regional scales (Persha et al, 2011).

iii) Forest Conservation and Climate Change

With the intensified debates linking forest conservation to climate change resilience, forest biosphere reserves and World Heritage sites are expected to adopt strategies to address the challenges of climate change mitigation and adaptation, such as land use changes that integrate the conservation and sustainable use of forest resources with positive social and forest based livelihood outcomes. Interesting opportunities in terms of new incentives to prevent deforestation and for sustainable forest management are offered by the REDD (Reducing Emissions from Deforestation and Forest Degradation) and REDD-plus financial mechanisms. In particular, REDD-plus not only includes traditional approaches to reduced deforestation and degradation, but also covers elements of conservation, sustainable forest management and enhancement of carbon sinks. Hence, the role of forest World Heritage sites and biosphere reserves, including sites with both designations, as well as those with forested landscape linkages in their surroundings, assume special significance. Forest World Heritage sites and biosphere reserves could specifically explore how the improved protection and sustainable management of forested landscapes within and around them could contribute towards improving the conservation of these sites while yielding benefits for a broad range of stakeholders, particularly the dependant local communities. Although much remains to be defined in terms of eventual mechanisms for the implementation of REDD, especially the flow of benefits to communities and people directly involved in land use decision-making and forest related livelihoods, some biosphere reserve authorities are taking initiatives in line with developing climate change mitigation and adaptation options and income generation options for the sites and local communities.

- Bia Biosphere Reserve, Ghana
  Ghana submitted a funding request to the UNESCO Participation Programme during the 2010–2011 funding period to carry out a climate change impact assessment study on the Bia Biosphere Reserve. The aim of this study is to obtain scientific knowledge on the cause and effect relationship of climate change on the biosphere

reserve in order to develop sound mitigation and adaptation measures for the ecosystem. Subsequently, these mitigation and adaptation options will be integrated into the biosphere reserve's current management plans. One of the objectives of this initiative is to explore the potential for introducing an appropriate Payment for Ecosystem Services mechanism in the biosphere reserve. Ghana received funding to undertake this study, which is currently underway.

- Luki Biosphere Reserve, DRC
  Authorities of the Luki Biosphere Reserve, located in the Mayombe Forest, together with WWF in DRC are undertaking an integrated REDD pilot project in the Luki BR. One of the objectives of this project is to address energy needs by establishing a fuelwood plantation. Four hundred hectares of fuelwood plantation was thus cultivated and some members of the local community were trained in managing the plantation, as well as the fifty hectares of forest allocated to bee-keeping and honey production.

  Another component of this pilot project involves giving financial incentives to local communities to ensure the protection and natural regeneration of the savanna ecosystem in the area. The overall goal is to implement a sustainable development model around the Luki BR that will be integrated into the national REDD-plus strategy in order to decrease the rate of deforestation, as well as ensure the production of ecosystem goods and services to the local communities.

Together, World Heritage sites and biosphere reserves cover approximately 300 million hectares of forested landscapes. As sites that are internationally recognized for their outstanding universal value and their contribution to multi-scale sustainability, they are expected to provide models for the protection of the world's forests while enhancing the vital ecosystem services they provide for human well-being. Sharing of knowledge, experiences and good practices within, between and outside these sites, combined with the search for and implementation of effective and innovative ways to enhance the benefits of separate and joint World Heritage–Biosphere Reserve designations in terms of biodiversity conservation and sustainable use, responses to climate change and communities' well-being, should be seen as a priority in UNESCO's contribution to sustainable development from local to global levels. These endeavors should be guided by the recognition that people are an integral part of the biosphere, and that the economic, social and cultural values they associate with biodiversity, including its forest components, will be critical in triggering the behavioral changes that are needed to allow for a more sustainable society for the benefit of present and future generations.

References

Attuqayefio, D.K. and Fobil, J.N. 2005. An overview of biodiversity conservation in Ghana: challenges and prospects. *West African Journal of applied Ecology*, Vol. 7, pp. 1–18.
http://www.ajol.info/index.php/wajae/article/viewFile/45621/29102

Kotwal, P.C., M. D. Omprakash, L. S. Kandari, K. P. Mali, Mohit Badyal and Apurva Mishra 2008. Sustainable forest management through community participation. *Current Science*, Vol. 95, No.8, pp. 1015–1017.

Patry, M. 2005. World Heritage forests: what value added? In: *World Heritage Report no. 21, World Heritage Forests leveraging conservation at the landscape level*. pp. 13–19.

Persha, L., Agrawal, A., Chhatre, A. 2011. Social and ecological synergy: local rulemaking, forest livelihoods, and biodiversity conservation. *Science*, Vol. 331, No. 6024, pp. 1606–1608.

UNESCO, 2002. *Biosphere reserves: Special places for people and nature*. UNESCO, Paris.

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Case Studies – On Connectivity

Jungle river flows by a remote research station – Bukit Barisan Selatan National Park, Tropical Rainforest Heritage of Sumatra (Indonesia)
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Belovezhskaya Pushcha/Białowieża Forest World Heritage Site

by Renata Krzysciak-Kosinska

Białowieża National Park, Poland

General description

The Belovezhskaya Pushcha/Białowieża Forest World Heritage site covers the central part of the larger 143,000 hectare Białowieża Forest that straddles the border of the Republic of Poland and the Republic of Belarus. It protects the unique temperate deciduous forest of primeval character with additional mixed and pure coniferous stands, and is the remnant core of the forests that prevailed in Europe in the past. The site is characterized by natural processes that have been unbroken for thousands of years, as well as rare forest dwelling birds, saproxylic invertebrates and fungi. It was the last remaining area where the largest terrestrial mammal of Europe, the European bison, survived in nature up until the beginning of the twentieth century. Following the restoration of the species, it now roams the entire area of the Białowieża Forest.

The transboundary World Heritage site within its present borders encompasses 92,669 ha. The majority of the site is situated in Belarus and 5,056 ha is situated in Poland within the larger Białowieża National Park. The Polish part of the site was inscribed on the World Heritage List in 1979 while the Belarusian part was added in 1992. Due to huge differences in political systems, as well as nature conservation policies in both countries, each part is managed separately, however a joint management framework has been elaborated and accepted by the management authorities in both countries. Since the Belarusian part was added, there has been a major disparity in size and management between the two areas. The Polish part of the site consists almost exclusively of forest habitats, which have been subjected to a strict protection regime for over eight decades. This area is surrounded by a large forest complex, which in terms of management forms a complicated mosaic of patches of different protection regimes as well as productive forests. The World Heritage site (5,056 ha) also borders the forest lands added to the national park in 1996 (5,155 ha). Out of 53,000 ha managed by the State Forest Administration, 3,600 ha form Białowieża National Park's buffer zone. There are no separate regulations on the forestry practices within the buffer zone but hunting is forbidden there. Another 12,012 ha enjoy nature reserves status. Even though the reserves do not fall under a strict protection regime, timber exploitation is banned. Tree cutting is permitted only for safety reasons and the wood has to remain in the ecosystem. Hunting is also forbidden in the nature reserves. For each nature reserve, management plans should be prepared where detailed information on activi-

Table 1. The Białowieża Forest	
Total area of the Białowieża Forest (A + B)	**143 000 ha**
A. Belarusian part of the Białowieża Forest	80 000 ha
B. Polish part of the Białowieża Forest, of which: (i + ii + iii)	63 000 ha
i. Nature reserves (administered by the State Forests)	12 012 ha
ii. Other State Forestry Forest	40 988 ha
iii. Białowieża National Park, of which:	10 000 ha
• Strictly Protected Area of the BNP	6 061 ha
Area of the World Heritage Site	**92 669 ha**
Belarusian part of the World Heritage Site	87 613 ha
Polish part of the World Heritage Site	5 056 ha

The Białowieża Forest from the air, the Narewka River Valley, Poland ©Renata Krzysciak-Kosinska

The Hwożna River in the Białowieża Forest, Poland ©Renata Krzysciak-Kosinska

ties permitted must be elaborated. Activities permitted are planned in accordance to the main objective of the reserve. Reserves established for the protection of butterfly fauna or grassland habitats are managed in a different manner to those established for the old growth forests.

In addition to the forest ecosystems, the Belarusian part of the Site encompasses the 'Dikoye' marshland complex – one of Europe's largest mesotrophic marshes and of major importance in the regulation of the water regime in the Białowieża Forest.

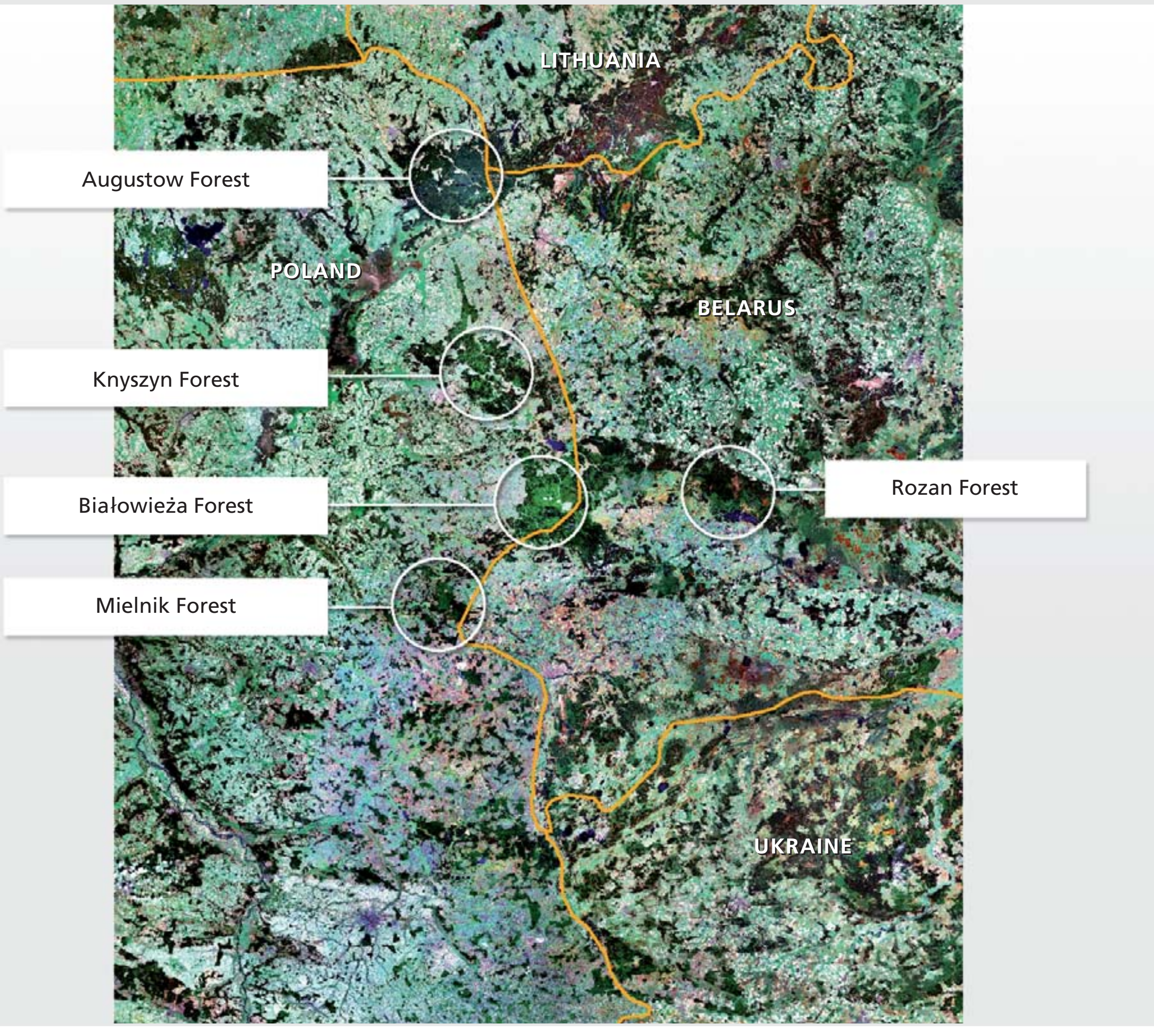
Connectivity issues at Białowieża Forest

Within the Białowieża Forest, the absence of timber exploitation throughout the centuries has ensured continuity in terms of fluctuations of tree stand development processes. Individual trees are able to live until their natural death, reaching exceptional dimensions, unparalleled in other forest complexes of Europe. Within the strictly protected area, one can find exceptionally high amounts of dead trees, where strict conservation measures are in place. Despite the fact that the area of strictly protected forest for the past eight decades is small, it constitutes the perfect place for breeding and resting of many species, including relic species of primeval forests. Invertebrates and fungi are the most diverse groups of organisms in the Białowieża Forest World Heritage site. There are over 11,000 invertebrate species, constituting 10 per cent of European invertebrates and 1,600 macrofungi species, 25 per cent of European fungi. A great number of species are saprophytic or saproxylic species. Some of the species are extremely rare or their existence worldwide is endangered. Białowieża Forest is also famous for its birds: there are nine woodpecker species, of which two are charismatic; the three-toed woodpecker, related to dead or dying spruce trees; and the white-backed woodpecker, confined to dead deciduous trees. There is a high variety of animals using tree holes for breeding, resting or hiding places. Even though the Polish part of the World Heritage site is too small for one pack of wolves or even an individual lynx it is an area where they are safe and have a high breeding success. The territory of an individual lynx varies from little over 10,000 ha to almost 25,000 ha, while one wolf pack (including 4–9 individuals) uses an average area of 20,000 ha.

Radiotelemetry showed that the fence situated along the state border between Poland and Belarus, and dividing the forest complex did not hinder wolf or lynx from crossing the border. It is, however, a barrier for ungulates particularly, the European bison. At present there are over 800 individuals roaming the Białowieża Forest divided by the border fence into two herds. In the Polish part of the forest there are over 470 individuals and it is estimated that the existing mosaic of forest and non-forest habitats, as well as the proper management of the bison, can support such a population. It is clear that the long-term genetic viability of many Białowieża forest species would be at risk if restricted to its relatively small territory. Similarly, under various climate change scenarios, the inability of some species to adapt their ranges to different temperature and rainfall regimes could also spell disaster. Under these circumstances, the identification and development of suitable ecological corridors becomes very important.

Areas described by experts as ecological corridors are not currently protected as such in Poland. They may fall under different forms of protection if they form part of a protected area, such as a national park, nature reserve or landscape park. It is highly recommended though that ecological corridors, including watercourses, should be protected by national law. In 2005, the Polish Ecological Corridors Network was developed, financed by the

Figure 1. Aerial view of the broader landscape in which the Białowieża Forest is located.



Ministry of the Environment. It still functions as a project and it is to be taken into account in the Land Development Framework at the national level. This project serves as a conceptual framework over which discussions on ecological corridors for the Białowieża Forest can take place. Additionally, it can be used as a useful tool in planning activities within frameworks of various projects for species conservation in the region.

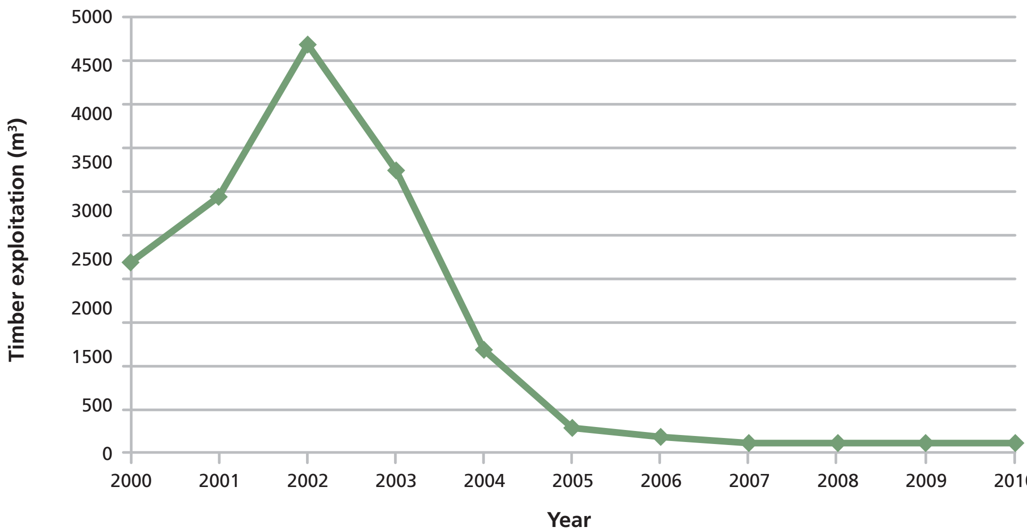
As far as conservation of numerous species goes, the ecological corridors connecting the Białowieża Forest with other forest complexes are very important. On one hand they enable the maintenance of genetic diversity, thanks to the inflow of individuals from the east (Belarus and Ukraine), while on the other hand they make it possible for animals to migrate to the north and north-west (through the Knyszynska Forest of 84,447 ha, protected as a Landscape Park), as well as to the south (through the Mielnicka Forest of 3,000 ha, a production forest with few nature reserves). Figure 1 illustrates the landscape diversity and remnant forest areas. It is also important that animals are able to penetrate the area surrounding the forest where there is an abundance of food. Therefore, the corridors to the south and to the north-west are of high significance. The river valleys of Narewka, Lesna and theirs tributaries: Hwożna, Lutownia and some smaller ones, are natural migration corridors for animals related to such habitats. They are not only used by mammals such as elk, beaver and otter, but also by representatives of other groups, for instance the European pond turtle. River valleys serve as migration routes for water birds. It should also be remembered that corridors along river valleys serve as perfect habitats for numerous rare bird species, such as the corn crake, the red-backed shrike or the barred warbler. These habitats are also hunting grounds for the lesser-spotted eagle. It is crucial to maintain grasslands and stop the encroachment of woodlands. The river valleys situated within the Białowieża Forest are managed by the National Park or State Forest administration, according to their status. Maintaining all the grassland habitats of the Białowieża Forest is not within the financial possibilities of the National Park or State Forests so additional financial resources are obtained from various funds including the funds from the European Union.

Management challenges

The ecological and political situation of the Białowieża Forest is very dynamic. The core area, legally protected since 1921, has for decades been regarded as a sacred place where no disturbance of natural processes was permitted. In 1979, the 5,056 ha Białowieża National Park was listed as a World Heritage site. In 1992, the Bielovezhskaya Pushcha' area of the Belarusian National Park was also listed as World Heritage, creating a trans-boundary site. In 1996, the area of the Polish Białowieża National Park was doubled when the area of 5,155 ha of managed forests was included in the park. The newly included forests are situated along the western and northern borders of the World Heritage site. The managers of these two areas, now joined under one national park, had to take into account that it was subjected to regular forest management practices, and the change of approach should be evolutionary. During the first years, the sanitary cuttings were continued and the amount of exploitation was based on the extent of bark beetle gradation. Starting from the year 2000, statistics show a reduction in the quantity of timber exploited due to a change of management approach. Today, the bark beetle is regarded as a natural element shaping ecosystems of the national park, therefore sanitary cuttings have dropped down to almost zero (Figure 2). The area of strict protection in the national park now measures 6,061 ha. The remaining forest ecosystems (4,456 ha) of the park are partially protected, but the long-term management plan does not include timber exploitation in the area. As the connection of local communities, who have existed here for centuries, and the forest should be maintained, part of the area cannot be closed to people therefore it cannot fall under a strict protection regime. Visiting without a guide is permitted, as well as riding bicycles along marked trails, and picking berries and mushrooms. Meadows and grasslands, especially those situated along the river valleys, are cut in order to maintain enough food for grazers, including the bison. As the entire Białowieża Forest is recognized under the Natura 2000 network, management of the area has to take into consideration the requirements of the European Habitat and Bird Directives. Hence, open habitats, shaped in the past by natural elements as well as human activities, should be maintained in order to support populations of species currently listed in the Annexes to European Union Directives, such as the lesser-spotted eagle and the corncrake.

The current World Heritage site managed by Białowieża National Park, is surrounded by a much bigger and diverse forest complex, including a few human settlements. In Poland, the surrounding forests are managed by the State Forest Administration and are State property administered by the same Ministry of the Environment as the Białowieża National Park. The area administered by the State Forests covers approximately 53,000 ha. Together with the Belarusian part, the entire Białowieża Forest covers an area of approximately 143,000 ha. The whole of the Belarusian part is managed by the Belovezhskaya Pushcha National Park service. The Białowieża Forest is surrounded by a mosaic of natural landscapes, such as forests, peat bogs, meadows, pastures and arable land. There is no industry and the most urbanized area is the town of Hajnowka, inhabited by some 20,000 people. Management of the

Figure 2. Timber exploitation in the Hwożna Protected Area



Analyzing the amount of timber exploitation from the area added to the national park, one can observe the evolution in the management approach.

The Narew River Valley in the Białowieża Forest, Poland ©Renata Krzysciak-Kosinska

forest habitats administered by the State Forests varies depending on the status of particular fragments. Even though the nature reserves (12,012 ha) do not fall under a strict protection regime, timber exploitation and hunting is banned there. In the State Forests' part of the forest there are also numerous regulations, different to those in a typical production forest. Tree stands over 100 years old cannot be exploited, heavy machinery cannot be used, and an inventory of species has to be done before any activities can be undertaken.

Climate change considerations

The Białowieża forest ecosystem is sensitive to climate change and changes in water regime. Permanent monitoring of the groundwater table, carried out since the mid 1980s, shows that the groundwater table is systematically decreasing. In waterlogged biotopes, it has decreased by up to 20 cm, while in fresh and humid habitat types, it has decreased by 40 cm. Mean annual temperature during the last four decades has increased by 2.7°C. This has led to changes in phenology – several species flower 12 to 14 days earlier that half a century ago. Climatic changes, in particular temperature and precipitation, affect the use of forest habitat types by animals. In dry years, the European bison is more frequently observed in alder carr (wet forest found mostly in peatlands and along streams), while in wet years the use of coniferous stands increase.

A detailed inventory of all standing trees, both dead and alive, has been carried out together with measurements of fallen trees and natural regeneration on systematically distributed sampling plots. Results compared to data obtained during an inventory in the 1950s and 1990s show major changes in species percentage in tree stands. Data show that 60 years ago spruce constituted over 25 per cent of the surface in the forest, in the 90s it was 16.6 per cent, while today it varies between 5–8 per cent. The surface percentage of oak remains at the same level at 19 per cent. Other species, such as lime and hornbeam, increase the surface percentage to 30 per cent. The fall in percentage of spruce is directly caused by more intensive and frequent gradations of bark beetle. However, it is necessary to bear in mind that bark beetle infestations are a secondary factor as bark beetles infest trees already weakened by other factors, such as long dry periods, strong winds that break or fell trees, high temperatures or a lowering of the groundwater table. These changes are recognized in the long-term management plan for the national park and regarded as existing and potential threats for existing ecosystems. Nevertheless, it is agreed that the main actions will involve monitoring of the processes and implementing practical measures, as much as possible, which allow the ecosystem to adapt to changes. Throughout its history, the forest has witnessed different climatic periods, but its very existence was never threatened. The main mission of the Białowieża National Park is to protect natural processes, and these may be triggered by climate change.

Case study – Connectivity for the European bison, amphibians and the lesser-spotted eagle

In recent years, in recognition of the need to provide opportunities for the forest ecosystems to adapt, some attempts have been undertaken to increase connectivity among these forest ecosystems and surrounding lands. One of them was the project entitled, 'European bison conservation in the Białowieża Forest' in which all the major stakeholders from the area participated. The main aim of the project was to ameliorate the situation of the species in the Białowieża Forest by creating possibilities for it to expand its range over the forest areas and in the vicinity of the Białowieża Forest. This could be achieved by enhancing connectivity with other forest complexes by improving food and water availability along the dispersion routes. This include dispersion of winter feeding sites managed by the Białowieża National Park as well as agreements with individual land owners for contracting meadows for the use of the bison. The land owners who agreed to be a part of the project were paid for using the land as hay meadows which were cut and then hay was left in hay stacks for the winter as additional feeding places for the bison. The project is continued and the results will bring benefits not only to the European bison but also for other animal species creating migratory corridors. Another project with participation of the Białowieża National Park and the State Forest Administration was, 'Protection of *Emys orbicularis* (European pond turtle) and amphibians in the north European lowlands'. One of the goals of that project was creating breeding and feeding habitats for amphibians as well as their protection during spring migration between forest and grassland habitats. Within the area of the park as well as in the surrounding private lands there were new ponds created, supporting not only breeding populations of amphibians but also serving as water reservoirs for other animals and facilitating migration of numerous species. Enhancing connectivity of ecosystems is also the aim of Protection of lesser-spotted eagle in Natura 2000 sites. The species nests in forest but feeds on grasslands and cut meadows – large scale meadow reclamation in the area of the Białowieża Forest is realized within the framework of that project.

From the past to the future

Legal protection of the World Heritage site, forming part of the Białowieża National Park, goes back to 1921 when there were several nature reserves in the Białowieża Forest. Later on there were 23 nature reserves created in the area managed by the State Forests with the last one, covering an area of 8,582 ha, established in 2003. Meanwhile, the national park had been enlarged. The protected areas contain mainly forest ecosystems with only a small degree of natural forests disturbed by human activity. It is impossible to assess what would have been the result if the entire Białowieża Forest had been protected in 1921. We would definitely have had the unique chance to observe natural processes on a much larger scale than today. It is also certain that some species currently living in the forest would have become extinct. The concept of nature protection has changed over the twentieth century. Forest management practices and the perception of forest functions has also changed, though slowly. Knowledge on the functioning of ecosystems and some species' requirements has been much enhanced today. We should therefore use the experience gained as best we can so as to create a new formula for the Białowieża Forest for the future. It has been already observed that the non-productive functions of forests have a growing number of supporters, and there is even more support for protection. As a result, the protection regime of the Białowieża Forest is gradually being enhanced. It is the result of real involvement by naturalists, scientists, and non-governmental organizations as well as the government administration.

Białowieża Forest often experiences conflict and heated debate over the form of management and protection that should be implemented. Moreover, the issue receives a great deal of international attention and various pressure due to its World Heritage status and to its European Diploma of Protected Areas designation. The management policy of the State Forest Administration was severely criticized over the past decades. Nevertheless, conflicts – if kept within healthy limits – can be constructive and this seems to have been the case in the Białowieża Forest. At present the management bodies of the Białowieża Forest (Belarusian National Park Białowieża Forest, the Polish Białowieża National Park and the State Forest Administration) are working together on the re-nomination dossier for the World Heritage site. It is planned that the Polish part of the site would be enlarged, encompassing a larger territory currently managed by the State Forest Administration. There may be limits to the amount of forest that will be strictly protected, but by working with neighboring forests and with landowners along strategic existing or potential ecological corridors, it may be possible to encourage the establishment of more robust corridors, and in so doing, give the Białowieża Forest ecosystems and species a better opportunity to survive and adapt to change.

Local agricultural landholdings are small and of low intensity and it may be possible to encourage owners, with appropriate agricultural policy mechanisms, to establish land use that will encourage connectivity, while providing benefits to the landowners. The process has already started and we hope it will continue.

World Heritage Sites, Biosphere Reserves and Model Forests: Connecting Mesoamerica

by Eduard Muller[1] and Marc Patry[2]

Mesoamerica is comprised of seven Central American countries (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama) and the five southernmost states of Mexico (Campeche, Chiapas, Quintana Roo, Tabasco and Yucatan) with a total land coverage of approximately 768,000 km^2. As land rose above sea level about 3 million years ago, a bridge formed between North and South America that facilitated the confluence of species from North and South America resulting in unique and diverse life forms, and turning this area into the world's second most important biodiversity hotspot. This region has between 7 –10 per cent of the world's biodiversity and 17 per cent of its terrestrial species in only 0.5 per cent of the landmass (CI, 2004). Due to the proximity of the sea and the presence of mountain ranges, the region is subjected to many different microclimates with a generally drier Pacific coast and a very wet Atlantic slope.

The majority of people live along the Pacific side and thus the large natural areas that are still conserved are found mainly on the Caribbean side and along the central mountain ranges. The decline in soil fertility coupled with an increased occurrence of drought in higher population density areas has lead to a constant stream of migration to the Caribbean. Consequently, there is continued deforestation as a result of forested land being converted for agriculture, mainly cattle production. This is especially noticeable in the large remaining patches of forest in Bosawas (northwestern Nicaragua), Río Plátano (Honduras), and Maya Biosphere Reserve (Guatemala). Bosawas has lost 60 per cent of the forest cover[3] in the buffer zone and 20 per cent in the core areas (GTZ and MASRENACE, 2010). The Maya Biosphere Reserve has lost 45 per cent of the forest cover with extensive deforestation in the Laguna del Tigre core zone after this area was opened to oil prospection and exploitation. According to FAO (2011), Honduras has the highest rate of deforestation in the region, and Río Plátano, a World Heritage Site and Biosphere Reserve, has not escaped a similar fate.

In an effort to conserve these natural areas, countries in the region have made a considerable effort to remedy the situation and have established 526 protected areas interlinked through a network of connected conservation corridors, known as the Mesoamerican Biological Corridor (MBC) – see figure 1. Since the early 1990s this initiative, originally known as *Paseo Pantera* (The Path of the Panther), received strong international support up until 2006. Today, many national efforts continue in addition to the second phase of the MBC Project announced by the Central American Commission of Environment and Development (CCAD) during the Convention on Biological Diversity (CBD) COP10 in Nagoya in 2010.

The World Heritage Convention and the Man and the Biosphere Programme together play an important role in providing a fundamental protected area framework in the region. Efforts over the past three decades have led to the creation of twenty-six biosphere reserves, with several new ones recently recognized and several additional reserves in the process of joining the network. There are seven natural World Heritage sites on the isthmus, or eight if Los Katios National Park in Colombia, adjacent to Darien National Park in Panama, is considered. Several more protected forests are on tentative national government lists, including the very large Calakmul Biosphere Reserve in Mexico. In many cases, World Heritage sites overlap in part or wholly with a Biosphere Reserve.

Sustainable development is achieved in biosphere reserves using an established system of governance that is participatory in its structure: land use planning is determined by a gradient of different uses, from core zones that are dedicated mainly to conservation, to buffer zones that are sustainably managed, and transition zones where human activity is greater and where benefits are shared with the local population. Local participation in conservation, development and research, and learning initiatives will allow for true empowerment of local communities. The biosphere reserve concept is well established and has gained importance with several new nominations in recent years, but has to be strengthened and better enforced. Meanwhile, World Heritage sites offer a unique opportunity to showcase best management practices and increased management effectiveness and should serve as demonstration sites on how to achieve conservation within the national protected area systems.

Though these sites are faced with conservation challenges of their own, in relation to land use changes in the rest of the landscape in which they are located, they are relatively well conserved. As such, they are well positioned to play a key role as conservation nodes at the regional level. The challenge is developing mechanisms through which these nodes can encourage land uses that support connectivity.

1. Universidad para la Cooperación Internacional, Costa Rica
2. UNESCO World Heritage Centre
3. http://prensalibre.com/noticias/Reserva-Biosfera-Maya-pierde-bosque_0_185381580.html

Figure 1. Mesoamerican Biological Corridor

Drivers of deforestation in Mesoamerica

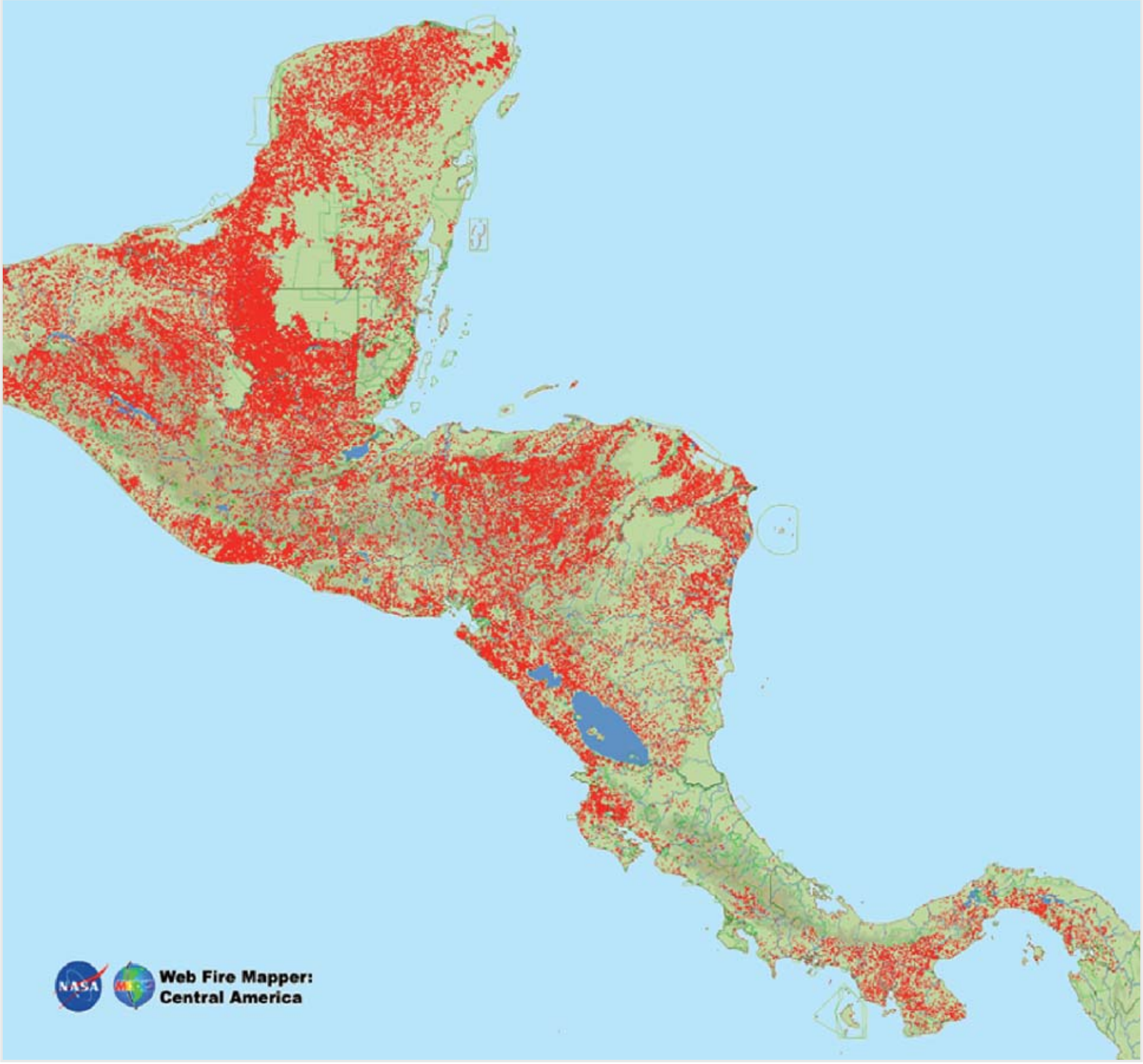
Deforestation between these nodes is a complex problem. According to FAO (2011), Central America shows the largest percentage loss of forest area globally, with an annual change rate of 1.19 per cent between 2000 and 2010. Figure 2 illustrates cumulative forest fires in the region between 2005 and 2009[4]; these fires frequently correspond to forest clearing for agriculture and cattle ranching.

While migrating populations and land use change for subsistence, small scale farming and cattle production remain part of the challenge (contributing to 13 per cent of forest loss in tropical Latin American Countries in the period 1990–2000), today there is significant deforestation through large scale agriculture (47 per cent in the same period) attributed mainly to monoculture crops (pineapple, palm oil, citrus fruits). New threats are on the horizon related to the production of biofuels. In addition, drug related land use change has also recently become an important issue with money laundering feeding forest clearing for cattle ranching, especially in Guatemala and Honduras, further complicating matters.

For people living in more remote forest areas, income generation is one of the most urgent issues, driving them to solutions that are detrimental to forest cover. One example can be seen in Bosawas where most of the remaining forest is in indigenous protected areas. These communities have few possibilities for income generation, mainly due to the remoteness of the areas and lack of infrastructure to get products to the markets. This has lead to many irregularities resulting in the illegal sale of land titles and the permanent invasion of indigenous owned land by migrant *campesinos*.

4. http://maps.geog.umd.edu/website/Activefire_HTML/viewer.htm?MAP=C_America-ArcIMSparam&DATALIST=,CO,mafd09,ER,&BANNER=CAM_banner&ele_fire=fireAims&requiredMap=CentralAmerica

Figure 2. A map of cumulative forest fires in the region between 2005 and 2009



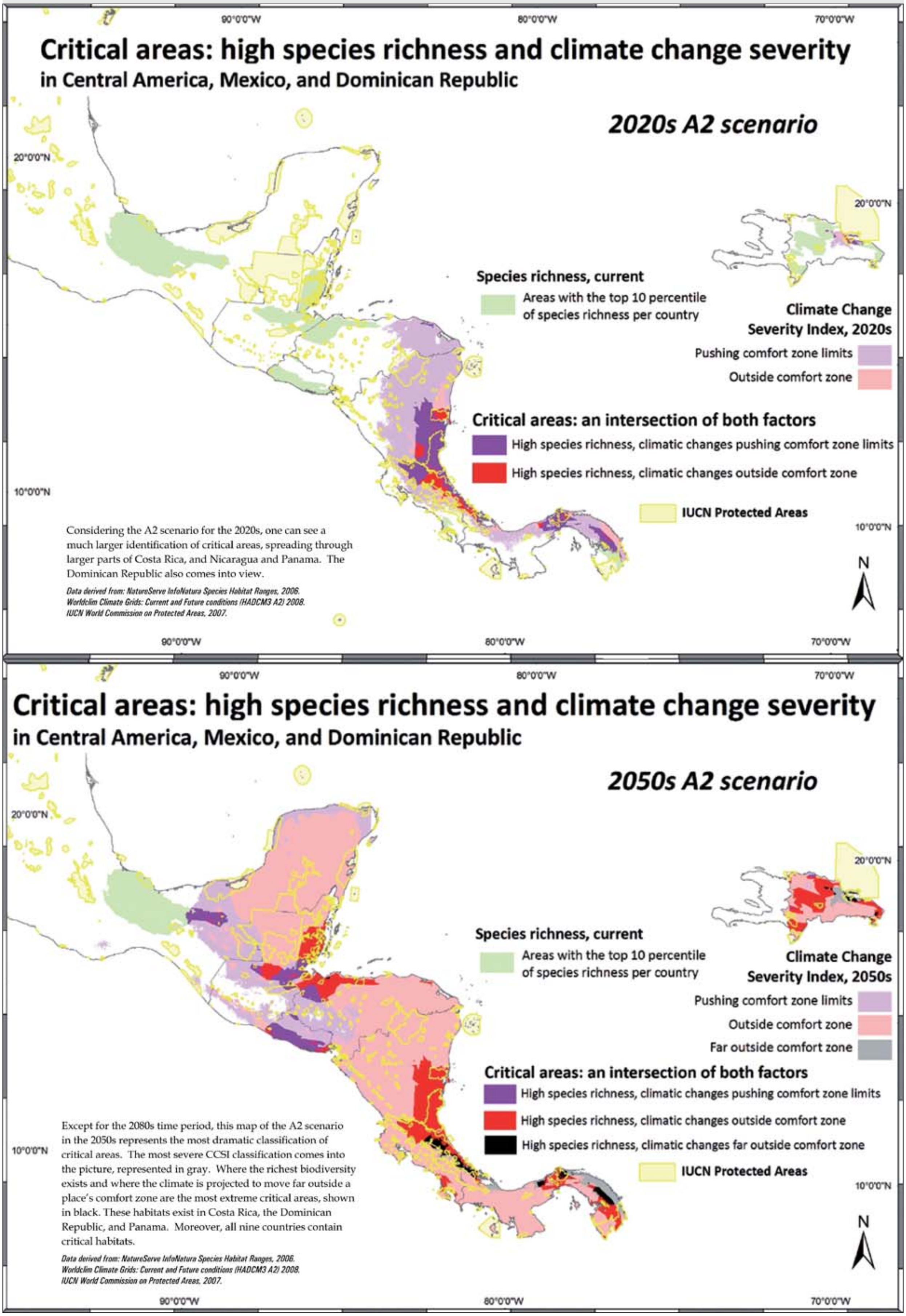
Climate change is a rapidly growing threat that is already affecting the region. In 2007, hurricane Felix destroyed 973,000 ha of forest in Bosawas (GTZ and MASRENACE, 2010). In the national parks of Monteverde and Guanacaste in Costa Rica, worrying ecological shifts in the cloud forests are being observed as cloud formation is rising above the habitual altitudes, exposing the forests to increased cloudless days, which appear to contribute to forest die-offs, increasingly observed in recent years in both areas (Research coordinators, personal communication, 2010). Current projections (Anderson *et al.*, 2008) for the region are not very positive with stronger impacts to be expected within the next decade (Figure 3). The region is actually being cataloged as one of the 'Climate change hotspots' (Giorgi, 2006). Already in the 2020s, significant changes in precipitation and temperature are projected to push ecosystems outside of their comfort zone in many areas (Research coordinators, personal communication, 2010).

It is clear that nurturing connectivity in the critically important region of Mesoamerica remains a major challenge.

Mesoamerican Mechanisms Supporting Connectivity

The challenge of maintaining or re-establishing connectivity is being addressed in many ways in the region. As noted earlier, the Mesoamerican Biological Corridor initiative provides a regional architecture for a coordinated approach where areas that are critical for supporting connectivity were identified. While helping to direct thinking and action, it is typically at the national / local landscape level that changes can be encouraged. The following is a list of initiatives that illustrate ways in which connectivity in the region is being introduced.

Figure 3. Climate change and biodiversity hotspots in Mesoamerica



Source: Anderson, E.R., Cherrington, E.A., Flores, A.I., Perez, J.B., Carrillo R., and E. Sempris. (2008) Potential impacts of climate change on biodiversity in Central America, Mexico and the Dominican Republic. CATHALAC/USAID. Panama City, Panama, p.105.

Payment for Ecosystem Services

The Payment for Environmental (ecosystem) Services (PES) is a promising tool for forest conservation. Two decades ago Costa Rica developed an innovative approach by establishing a fuel tax of 3.5 per cent that goes into paying forest owners a fee for the conservation of standing forests, regeneration areas and forest plantations. Four environmental services were recognized in the Biodiversity Law of 1996: biodiversity, water, carbon and landscape. This has allowed the country to actually double its forest cover over the last two decades, having now over 50 per cent of the country under forest, significantly contributing to re-establishing or maintaining ecological connectivity between protected area nodes.

The Model Forest programme

This international landscape level multi-stakeholder sustainable forestry programme is active in three countries of the region. Focused on identifying and deriving benefits from the multiple values of forests (not only timber, but also ecosystem services, tourism and more), it encourages landowners and the private sector to extract more value from standing forests, with reduced deforestation and forest degradation as an expected result. Such results are also expected to contribute to maintaining or enhancing connectivity. The Reventazón Model Forest in Costa Rica provides a good example. This 312,000 ha landscape is a strategic component of the Central Talamanca Volcanic Biological Corridor, providing a strategic programmatic mechanism that contributes to ecological connectivity between national parks, forest reserves and indigenous territories.

Tapping into the carbon market

With the promise of important investments coming through the carbon markets, Mesoamerica has a great potential for generating income with forest carbon stocks with over 1.7 Gt of carbon in living forest biomass (Table 1). Total carbon storage in Central America and the Caribbean is estimated at 16 Gt, of which 4 Gt (25.2 per cent) is found in protected areas (UNEP and WCMC, 2008).

Conclusion

Conserving the biodiversity and forests in the region requires the strengthening of institutions, the development of well targeted and enabling land use policies, the promotion of inter-sector cooperation, and the empowering of local communities, mainly through education and by increasing their communication and access to information. While mitigation strategies are globally driven and the carbon markets are being handled by a diverse set of organizations, adaptation strategies will have to be developed locally. This implies that research and information networks have to be established, while the meteorological network must be strengthened. Local people and professionals must be trained to use information for decision-making. Local knowledge must be incorporated into knowledge systems.

The use of protected areas as natural solutions to both mitigation and adaptation will be vital (Dudley *et al.*, 2010). Results from surveys conducted in the 1990s indicate that 80 per cent of the forest cover remained in protected areas, while only 31 per cent remained outside of these areas (Sader *et al.*, 2001). Current efforts by the CCAD (Comision Centroamericana de Ambiente y

Table 1. Carbon stock in living forest biomass

	Million tones	Annual change rate (1000 t)
Belize	171	-1
Costa Rica	238	2
El Salvador		
Guatemala	281	-4
Honduras	330	-8
Nicaragua	349	-8
Panama	367	-1
Total	**1736**	

Source: FAO (2011) State of the World's Forests 2011.

Desarollo) to launch a second phase of the MBC are vital in order to conserve the protected areas and connectivity corridors, and thus the forests and other ecosystems as well as the biodiversity within them. Results from the first phase of the MBC indicate that the annual forest clearing within the corridor was 0.26 per cent while outside the corridor this increased 5.5 times to 1.44 per cent. Participation of local communities in the planning and decision-making processes enhances the possibilities to achieve sustainable development.

Of the mechanisms and designations mentioned above, only World Heritage sites enjoy systematic monitoring on the state of conservation on behalf of the global community through the World Heritage Committee. The Committee, in this capacity, has a unique role to play in dialoguing with national governments to encourage the adoption of necessary measures designed to guarantee the long-term conservation of World Heritage sites. In many cases, the World Heritage Committee has requested that governments take action in matters well outside the boundaries of the World Heritage site in order to better ensure the site's conservation. In light of such precedents, it is not unreasonable to consider the role the World Heritage Committee can play in encouraging governments to pay more attention to connectivity issues, and to implement measures such as those mentioned above, not only as good management practices, but also as a strategy to adapt to climate change.

References

Anderson, E.R., Cherrington, E.A., Flores, A.I., Perez, J.B., Carrillo R., and E. Sempris. 2008. *Potential impacts of climate change on biodiversity in Central America, Mexico and the Dominican Republic*. CATHALAC/USAID, Panama City, 105 p.

Conservation International. 2004. *Peril del Ecosistema; Región Norte del hotspot de biodiversidad de Mesoamérica*. Critical Ecosystem Partnership Fund, 64 p.

Dudley, N., S. Stolton, A. Belokurov, L. Krueger, N. Lopoukhine, K. MacKinnon, T. Sandwith and N. Sekhran (eds) 2010. *Natural Solutions: Protected areas helping people cope with climate change*. IUCNWCPA, TNC, UNDP, WCS, The World Bank and WWF, Gland, Switzerland, Washington DC and New York, USA

FAO. 2011. *State of the World's Forests 2011*, Rome, Food and Agriculture Organization, 179 p.

Giorgi, F. 2006. Climate change hot-spots. *Geophys. Res. Lett.* Vol. 33. No. 8

GTZ and MASRENACE. 2010. *Análisis Multitemporal del cambio de uso del suelo en base a imágenes satelitales de los territorios indígenas de Mayangna Sauni As, Mayangna Sauni Bas, Sikilta, MatungBak/Sauni Arungka, SIPBAA, Layasiksa y el área afectada por el Huracán Felix en 2007 para el período de tiempo 2005–2007/08 en los Departamentos de Jinotega y la RAAN*, Nicaragua. Managua, GTZ and MASRENACE, 45 p.

Sader, S., Hayes, D.J., Irwin, D.E. and Saatchi, S.S. 2001. Preliminary forest cover change estimates for Central America (1990's), with reference to the proposed Mesoamerican biological corridor. Manuscript, 11 p.

UNEP-WCMC. 2008. *Carbon Storage in Protected Areas*, Technical Report. 57 p.

Multi-actor Partnership and Sustainability Management of Biodiversity: The Case of the World Heritage Site of the Dja Faunal Reserve (DFR)

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Introduction

The principle of World Heritage is based on the recognition of outstanding universal value granted to a cultural or natural site with an emphasis on the conservation and manifestations of this value. Through the years, the participation of local stakeholders in matters of conservation has been recognized as essential in achieving success. In this regard, the concept of the biosphere reserve leads the way in seeing beyond the nature reserve as hunting grounds of fauna once used by colonialists through the involvement of local populations. However, despite the institutional attempts to reach a balance between conservation and development, forest related conflicts still persist, particularly between the managers of protected areas and resident populations. Several attempts to settle these conflicts have been put in place, but tensions remain and have yet to be resolved.

After a decade of harmonizing forestry policies in the countries adjoining the Congo Basin, the decentralization of natural resources management remains an important issue for *in situ* biodiversity conservation strategies worldwide. This importance demonstrates the central role played by local stakeholders in biodiversity governance strategies, while taking into consideration their interests and diversity. Environmental governance, conceived as a framework for multi-stakeholder dialogue and resource management, distinguishes itself from the ideology of social exclusion. Consequently, Model Forests [3] act within the processes of conflict resolution so as to facilitate community dialogue. As well as linking poverty and development issues, Model Forests also offer a framework of innovation, the promotion of local entrepreneurship, and experimentation on alternative projects of natural resource management. Model Forests also work towards a process that leads to 'standing on their own two feet' by innovating in terms of environmental governance and the improvement of living conditions for local populations.

The Dja Faunal Reserve (DFR) covers an area of 526,004 ha – one of the largest protected zones of Cameroon – and was declared a Biosphere Reserve by the Man and Biosphere (MAB) Committee of UNESCO on 15 December 1982, and was subsequently inscribed on the World Heritage List in 1987. Geographically, it spans two regions: in the East (department of Haut Nyong, comprising the districts of Dja, Lomié and Somalomo), and to the South (department of Dja and Lobo, comprising the districts of Bengbis, Djoum and Mintom).

In 2007, two important legal instruments granted the status of the Dja Reserve: Decree No. 007/1029 PM of 9 July 2007 that established the Dja Faunal Reserve, and Decree No.1052/MINFOF of 17 December 2007 that approved and implemented the development plan for the Dja Faunal Reserve.

On April 28, 2008, Decision No. 0330D/MINFOF/SG/DFAP was taken regarding the management structure of the Dja Faunal Reserve. The text defined its organizational structure consisting of a new managerial framework comprising a Management Committee (MC), a Consultative Committee (CC), a Scientific and Technical Committee (STC), and a Conservation Service (CS), which is the operational arm consisting of forestry stations and communication satellites within the DFR. Given the diverse stakeholders involved, as well as the application of the management's measures, the DFR's vision and objectives evolved such that today, the protected area is considered as a natural and social environment that favours the emergence of frameworks of cooperation and dialogue between the various stakeholder groups.

This approach now represents more of an asset than an obstacle to the social transformation of contemporary society. The DFR has become a functional system that reflects the uses, practices, and occupations of stakeholders within a dynamic and interactive system. Its partnership with the Model Forest of Dja and Mpomo (FOMOD), provides an opportunity for the DFR to share in the experience of Model Forests in the domain of multi-stakeholder governance of biodiversity and natural spaces. Nevertheless, this raises two questions: How to develop and adapt DFR's management to the needs of all the stakeholders? To what extent can DFR and FOMOD respond to the new social condition?

1. Respectively, Focal Point and Executive Secretary of the Model Forest of Dja and Mpomo (FOMOD)
2. Secretariat of the African Model Forests Network (AMFN)
3. The concept of Model Forest was conceived in Canada in the 1990s and was adopted by the government of Cameroon in 2005, and is described as a 'partnership aimed at accelerating the application of sustainable development by systematically taking into consideration the interests of every stakeholder...'

This paper attempts to demonstrate the different positions held in terms of sustainable management by the DFR, and how they integrate dialogue in the FOMOD, and how, in return, local, private, public and community stakeholders could be encouraged to contribute towards the ecological integrity of the DFR. These conditions are essential to the dynamic of local development.

History of the occupation of DFR by local populations and the new management approach to fauna

For several centuries the DFR has been occupied by the Ndjemé, Nzimé, Badjoué, Baka, Bulu, and Fang ethnic groups (Tchikangwa, 1996). These populations lived in the forest environment as hunter-gatherers, and used their surroundings for agriculture and cultural rites. Visible traces of their occupation can be seen in the abandoned cocoa and coffee plantations in ancient forests, by the dikes crossing certain swamps, the sanctuaries, and incision marks left on trees from tapping rubber (Oyono, Diaw and Efoua, 2000). These subsistence practices have never posed a threat to biodiversity and no species has ever been at the brink of extinction as a result, despite the fact that the diet of these populations was essentially based on meat and fish (Madzou, 2008). Consequently, several studies have shown that native populations have ethno-scientific knowledge of plants and therefore were able to benefit from their dietary, therapeutic or mechanical virtues, as well as exploit animal resources, with a principal focus on big mammals (Dounias, 1999; Oyono, 2002).

As regards trees, they were only felled for agriculture or for the construction of footbridges to cross rivers. Moreover, governance, based on secular knowledge and ruled with pre-defined ancestral laws, respected land tenure that was adapted to their way of life (Diaw, 1997; Diaw and Njomkap, 1998). Nevertheless, the pressure exerted on the DFR was real, as were measures currently implemented to mitigate anthropogenic effects.

Over the past several decades, biodiversity in the DFR and its surrounding areas have been threatened by population explosion, urban expansion, and the exploitation of forests and mines, which has attracted the growing population to the outskirts of the Dja reserve. As a result, the DFR has become an area where various activities are taking place at the same time. Agriculture remains the predominant form of land use, while the installation of industrial activity around the reserve has resulted in a population surge. Not only does this contribute to the degradation of the environment but it also leads to conflicts over uses. These factors have contributed in creating groups of stakeholders with divergent interests around the reserve. Thus management decisions in the DFR remain potentially contentious with regard to approaches that seek to valorize natural resources as well as financial returns on activities led by certain investors. The confrontation of these different interests has immediate consequences on the area such as the escalation of illegal activities, namely poaching and illegal exploitation of the forest.

Faced with the real threats to the sustainable management of the DFR, several actions were carried out by the Ministry of Forest and Fauna (MINFOF) so as to reinforce its control, but also to spurr anti-poaching campaigns with the help of partnerships established between the different Model Forest stakeholders. A consultative framework set up at the local level soon became a platform for dialogue between the many partners. Examples include:

- Partnerships forged between forestry and mine developers and the local population, represented by their local forestry committees, through local consultative committees.
- Partnerships forged between local NGOs, conservation projects (IUCN, WWF Nature+ and ZSL, ECOFAC, University of GEMBLOUX, and so forth), and the logging company, Pallisco.
- Through FOMOD, partnerships facilitating the consultation between stakeholders of the four eastern districts of the reserve. This includes phases of consultation and cooperation, as well as various actions in information, communication, dialogue, exchange, and negotiation on issues of territory, and changes requiring implementation. Meetings were held so that each stakeholder recognized the activities of the others. An annual review outlines all the subjects that could contribute towards conflict prevention.

Potential for local development of the DFR

The DFR is located in the Congo Basin widely known for its importance in terms of biodiversity and the regulation and stabilization of the world's climate. Furthermore, it contributes means of subsistence to thousands of people. Organizations such as WWF, IUCN, UNESCO, and the ECOFAC project have for several years conducted studies and research to evaluate the potential of the area's biological diversity. An indication of the biological diversity in the FOMOD is characterized by:

- 372 ligneous species with 166 tree species, having a diameter at breast height (DBH) greater than 70 cm, divided into more than 40 families;
- 429 bird species with 80 migratory species[4];
- 109 mammal species with a wide range of sizes; and
- 60 species of freshwater fish.

With this wealth of biodiversity as well as its status of protected area and World Heritage site, the DFR has a strong potential for ecotourism. On the eastern side of the

4. Note the high ornithological diversity and the presence of endemic species in Cameroon such as the African grey parrot with its red tail, and the Red-headed Picatharte.

reserve, tourists can visit the Schuam rock and its many attractions, the Bouamir rock, frequently visited by buffalo, the site of Mempale Djomedjoh, with its many chimpanzees, and the area of Ndengue, a favorite site for gorillas and elephants. However, this wealth is not exploited.

The fundamental missions of the FOMOD in its partnership with the DFR can be outlined along the four axes outlined here; all adhere to sustainable development principals.

Protection and management of natural and cultural heritage

This coincides with the mission of the World Heritage site with respect to Dja's exceptional heritage and its natural areas and biodiversity. In common with the DFR, the FOMOD, is watchful over the long-term protection and management of the environment, particularly the more fragile and vulnerable environments such as wetlands, agricultural areas in transition, forest lands, flood areas, mountain ranges with little fragmentation, flooded woodlands, forests in ravines, and biodiversity corridors. The DFR must also guarantee the dynamic conservation of landscapes and sites identified as remarkable and/or fragile. In this context, the Model Forest partnership has a serious responsibility to both protect and valorize the area's natural heritage.

Spatial planning

This partnership must have the capacity to implement national and regional policies linked to spatial planning. In particular, it must be able to identify the suitability of projects, and to facilitate their definition and integration that respects the environment.

Economic and socio-cultural development

Thanks to a multidisciplinary technical team, the FOMOD stimulates and coordinates economic and socio-cultural actions (i.e. the introduction of income-generating activities, the creation of ecotourism zones, and so forth) whose objective is to improve the conditions and livelihoods of the local population. The FOMOD/DFR partnership attempts to ensure the promotion of businesses that are respectful of the environment, while ensuring that natural resources and their valorization is respected.

Experimentation

The FOMOD mobilizes stakeholders, techniques, and legal and statutory capacities to experiment and develop new solutions that are capable of contributing towards the different objectives defined by the DFR. Moreover, it contributes towards identifying research topics and towards facilitating the implementation of research or R&D programmes that could be transferred to other Model Forests within the framework of knowledge management; a system of sharing knowledge. This represents a major sub-regional point of reference for issues related to the application of sustainable development in protected areas.

Limitations of established partnerships

In practice, all these partnerships have limitations to the mobilization of resources capable of supporting the efforts necessary to apply the principles of sustainable development at a larger scale that encompasses the entire DFR landscape. The low participation and awareness of local communities in terms of the World Heritage forest concept, and the absence of information on the Dja Forum, which was implemented with the help of IUCN-Central Africa (BRAC) in the 1990s, have contributed to these shortcomings. The impact of these processes on community dialogue established by the 'Model Forest Partnership' is thus still limited. In particular, the issues of biodiversity conservation have yet to be fully appreciated by local and indigenous populations. Nevertheless, they are well aware of the current threat to a number of animal and plant species, for example, the overexploitation of Moabi tree (*Baillonnella Toxisperma*) for economic reasons. Other plant species, which are important for pharmaceutical purposes, are also threatened with extinction due to a lack of specific planning strategies.

Another challenge is the absence of an environmental education curriculum. The impact of the 'Model Forest Partnership' is also limited by the fact that stakeholders do not have the necessary jurisdiction or mandate that would allow them to apply their ideas directly in the field, and which would allow them the opportunity to engage in biodiversity conservation. The notable lack of dialogue among certain local stakeholders is a direct consequence of insufficient consultation and inadequate institutionalization of a co-management system. Every one of the stakeholders has their own management plan for biodiversity in the same area. This is the case of Geovic, a mining company exploiting cobalt and nickel ores close to the reserve.

Building linkages to support environmental governance: the necessity of an institutional consultative framework

In its strategy of promotion and support of decentralization for good forestry governance, the Dja and Mpomo Model Forest aims to reinforce its consultative framework so that it is acknowledged in the field of multi-stakeholder management. This would require cooperation from all stakeholders having activities in and around the DFR. Creating an 'environment of dialogue' would encourage voluntary partnerships between the different stakeholders. Accords between operational partners would encourage the emergence of local governance that allows for the sustainable management and integrated development of the physical and social environment, as well as the application of 'good practices' in forest planning without challenging the rights and obligations of partners. An analysis of ongoing projects reveals that a real dynamic of change could be developed based on the multiple exchanges between institutional stakeholders. Currently, this involves providing feedback to those initiatives developed by the different partners so as to enable each actor to respond to a number of key issues raised through close collaboration, shared learning, and innovation.

Responding to this challenge, the FOMOD identified seventeen stakeholder groups to represent its board of directors, comprising stakeholders from public administrations, mayors, traditional chiefs, artisans, external elites, development committees, religious and church representatives, mine and forestry developers, committees of small-scale foresters, Baka indigenous communities, re-converted hunters, fishers, youth, rural women, local NGOs, forest communities, and tourism agents. Other groups will subsequently be identified. They would be admitted to the FOMOD, conforming to the policies set by its board of directors.

Citing the term employed by Klein in 1991 (cited by Bourque, 2008), a Model Forest partnership built around these stakeholders is a form of new social contract established at the local level. However, there is an urgent need to implement and reinforce the institutional bodies outlined in the Decree No. 1052/MINFOF 17 December 2007 that approved and executed the development plan for the DFR so as to ensure a stronger participation of the local population, particularly the Bakas whose survival depends directly on the forest. The Bakas fully understand the biology of animals, their reproductive cycle, their feeding habits and their migratory movements across the landscape, and are thus one of the key partners for the sustainable management of the entire DFR. The FOMOD incorporates their thoughts and positions on such current issues as forestry governance, the REDD, and anthropogenic climate change. As regards local economic issues, FOMOD's partners participate in discussions on the mitigation of negative impacts as a result of forest exploitation and the mining of cobalt, nickel and iron. Furthermore, stimulating the local economy remains one of FOMOD's priorities so as to find a solution to the endemic poverty visible around the protected areas (Dja Faunal Reserve and Nki National Park).

Conflicts that used to typify the relationships between the different stakeholders are now being replaced by an increasingly institutionalized collaboration. However, there are risks and traps inherent in the consultation and partnership process (Bourque, 2008); while conflicts between groups may wane or diminish, others may appear as new issues are brought to the fore, occurring occasionally within the same group of stakeholders or Model Forest. Furthermore, conflicts are an integral part of the social game whose objectives are constantly changing. The question is whether the 'Model Forest partnership' is sufficient to reassure stakeholders, individuals or institutions that have difficulties in recognizing the value of working together. Unfortunately, this is fairly common and the reason why they should be consistently reassured of the good working and organizational conditions, which facilitates open democracy, including freedom of expression, internal discussion, and conviviality. The institutionalization of co-management and the capacity-building of FOMOD's groups of stakeholders are open opportunities to reinforce consultation and partnerships that seek social compromise. In this vein, FOMOD plans to mobilize resources to create an information centre on social forestry with headquarters located in Lomié. This centre will help create a database that benefits and documents local skills and scientific knowledge on all the local resources, including biodiversity management inside and outside the DFR. Such an initiative would have environmental benefits and ease tensions and prevent conflicts. Thus, projects leaders working for example on medicinal plants and traditional pharmaceutics, will better perceive the benefits of dialogue and cooperation with others.

In forest co-management, the creation of linkages between stakeholders minimizes the time and energy spent on conflicts and therefore attention can easily be directed towards establishing participative actions on environmental management. The FOMOD has identified ways to reconcile biodiversity conservation and the multi-uses of the environment for the purpose of sustainable development. Within this framework, farmers whose practices are based on constructive collaborative action will be better aware of the relationship between the needs for local development and environmental issues. The challenge for FOMOD is to reconcile environmental conservation with promoting local development within the context of ever-changing rural societies.

There are several ways to respond to this challenge. Relying on an evolving legal framework, particularly decentralized taxation, the partnership seeks to develop local mechanisms of distribution and benefit-sharing from forest management for the population. It intends to encourage harmonization and awareness raising among all the stakeholders concerned with biodiversity conservation issues within the World Heritage site and its borders. This will raise greater awareness of the national and international importance of biodiversity and thus help mitigate impacts as a result of the different anthropogenic activities. This approach will rely on synergies in the action plans already implemented within the Model Forest framework, and will be reinforced by awareness-raising activities for the benefit of the populations.

The FOMOD actively works towards synergy in its actions in order to provide every stakeholder with an opportunity to find solutions to their own problems, and to achieve its objectives while reconciling environmental conservation and the development of economic activities. Benefits to the environment will only be effective if there are mutual advantages, for example, a FOMOD project is producing high quality pens using wood residues from community forests. Although this is still in its experimental phase, particularly its transformation into an equitable and sustainable business, this project demonstrates the feasibility of a FOMOD economic and environmental project in the eyes of the stakeholders. Reaching a social compromise in terms of mutual benefits requires the creation of a framework of broad consultation and dialogue among all stakeholders and at all levels – from indigenous people and farmer communities through to forest administrations, forestry and mine developers, rural elites, and so on.

Conclusion

An adage known to all inhabitants of the Dja river says, 'In a group of fishermen aboard the same boat, each member is personally responsible for the safety of all because, in case of shipwreck, even the best swimmer will get wet before reaching the shore.' This adage suggests that the development of partnerships for biodiversity conservation in the DFR calls on the participation of *all* stakeholders. The survival of Dja's biodiversity, and that of the Congo Basin, is in fact a problem of collective safety and survival. All institutional stakeholders must act and become part of consultative frameworks that are implemented so as to provide every member with the opportunity to voluntarily and constructively contribute to the process, however modest. In this way, the FOMOD, responsible for both the framework of action and as an observatory of social change, is structured so as to fully contribute towards environmental governance stemming from the dynamic of local contexts. With regard to the sustainable management of the DFR, the challenge is to bring stakeholders closer in order to 'manage biodiversity together' through a process of building collective vision, objectives, and common projects with the goal of unified action and decision-making. This is the meaning of local consultation given by Beuret (2006).

Since the implementation of the Cameroon Model Forest process, the DFR management has evolved in line with the spirit of the great names of contemporary environmental governance, from the Brundtland report (1987) and the Rio conference (1989), to the Cameroon and Congo Basin forestry decentralizations established since the mid 1990s. Within this political and conceptual space, Model Forests have positioned themselves as a forum for the development and application of sustainable development at various local, regional and global scales. Cameroon joined this movement in the mid 2000s and has made real progress to date. However, as highlighted by several authors, for example, Dounias (1999), reconciling the needs of conservation and the necessity for productive human development remains an extremely complex task. Achieving success in this process remains a pivotal issue for FOMOD and the DFR, whose management aspires to environmental conservation and the equitable distribution of benefits.

References

Beuret, J. E. 2006. *La conduite de la concertation pour la gestion de l'environnement et le partage des ressource*. Ed. L'Harmattan, Paris, 340 p.

Bourque, D. 2008. *Concertation et partenariat. Entre levier et piège du développement des communautés*. Presses de l'université de Québec, Coll. Initiatives, 152 p.

Bruntland, G. (ed.), 1987. *Our common future*. The World Commission on Environment and Development, Oxford, Oxford University Press.

Diaw, M.C. 1997. *Si, Nda bot and Ayong: Shifting Cultivation, Land Use and Property Rights in Southern Cameroon*. Rural Development Forestry Network, Paper 21e.

Diaw, M. C. and J.C.S. Njomkap. 1998. *La terre et le droit: une anthropologie institutionnelle de la tenure coutumière, de la jurisprudence et du droit foncier chez les peuples bantou et pygmées du Cameroun méridional forestier*. INADES-FORMATION, Yaoundé.

Dounias, E. 1999. Le câble pris au piège de la conservation. Technologie du piégeage et production cynégétique chez les Mvae du Sud Cameroun forestier. In: Bahuchet, S., Bley, D., Pagezy, H. et Vernazza-Licht, N. (eds.), *L'Homme et la forêt tropicale*. Travaux de la Société d'Ecologie Humaine.

Joiris, D.V., and B. Tchikangwa. 1995. *Systèmes fonciers et socio-politiques des populations de la réserve du Dja. Approche anthropologique pour une gestion en collaboration avec les villages*. Projet ECOFAC, Composante Cameroun. Groupement AGRECO/CTFT.

Madzou, Y. C. 2008. Forêt du Sud-Cameroun. Utilisation durable et valorisation des ressources cynégétiques dans la région Nord de Mboumba-Bek. Mémoire de recherche doctorale, Université de Bordeaux I, Thèse non soutenue.

Oyono, P.R., M.C. Diaw and S. Efoua. 2000. Structures et contenu anthropologique du Bilik: le potentiel de la 'Maison Naturelle' et de la 'Maison Culturelle' pour la foresterie communautaire au Sud-Cameroun. *Environnement Africain*, Vol. 10, No. 1–2, pp. 10–19.

Oyono, P.R. 2002. Usages culturels de la forêt au Sud Cameroun: Rudiments d'écologie sociale et matériau pour la gestion du pluralisme. *Africa*, No. LVII, Vol. 3, pp. 334–355.

Tchikangwa, B. 1996. *Structure des communautés locales et gestion villageoise dans la réserve de biosphère du Dja*. Faculté de gestion et de sciences sociales, Université Catholique d'Afrique Centrale, Yaoundé.

Ecological Integrity and Sustainable Development in the Chiquitano Dry Forest, Bolivia

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Introduction

Latin America is covered by 22 per cent of the world's forest area. However, the condition of these forests is rapidly changing. Between 1990 and 2005, it experienced a 7 per cent decrease in area (64 million ha) principally as a consequence of the expansion of large-scale agriculture and cattle farming (FAO, 2009). Despite a significant increase in protected areas between 1990 and 2007 in the region, from 213 to 451 million ha, it is unlikely – especially in South America – that the rate of deforestation will decrease (FAO, 2009). Add to that the change dynamic due to agricultural activities, tropical forests – in particular tropical dry forests – are at risk from the development of road infrastructure and the effects of climate change.

Within this context, the largest tropical dry forest of South America, the Chiquitano Dry Forest, originally distributed over Bolivia, Brazil and Paraguay (Figure 1(a)), and declared a Model Forest by the International Model Forests Network, maintains good ecological integrity and functionality levels. This is due in large part to slow-moving socioeconomic and demographic development in eastern Bolivia – its principal geographic distribution area (Dinerstein *et al.*, 1995; Ibisch *et al.*, 2003) – but also to an important network of protected areas and existing forest concessions across its entirety (Vides-Almonacid, Reichle and Padilla, 2007). Today there are more than 15 million hectares of almost continuous forest coverage, constituting an opportunity to design and implement integral ecosystem management strategies that, through the sustainable use of wood resources, non-wood resources and key environmental services, such as water and carbon stock maintenance, allows for the establishment of a base for its management and conservation.

The objective of this case study is to state how different strategies, created on multiple scales, can create opportunities and synergies for sustainable development and the maintenance of ecological integrity.

Chiquitano Dry Forest: characteristics and threats

Tropical dry forests constitute complex and fragile ecosystems, which are still little understood in terms of their biodiversity and ecological functioning (Sánchez-Azofeifa *et al.*, 2005). Around 97 per cent of the remainder of these forests – at a global level – find themselves at risk as a consequence of various threats such as global climate change, fragmentation, fire, and conversion of lands to agricultural and cattle farming uses (Miles *et al.*, 2006). The forests stretch from Mexico to Paraguay on the American continent, forming disjointed mosaics of seasonal tropical ecosystems that share particular ecological and biogeographical traits (Dinerstein *et al.*, 1995; Killeen *et al.*, 1998; Prado, 2000).

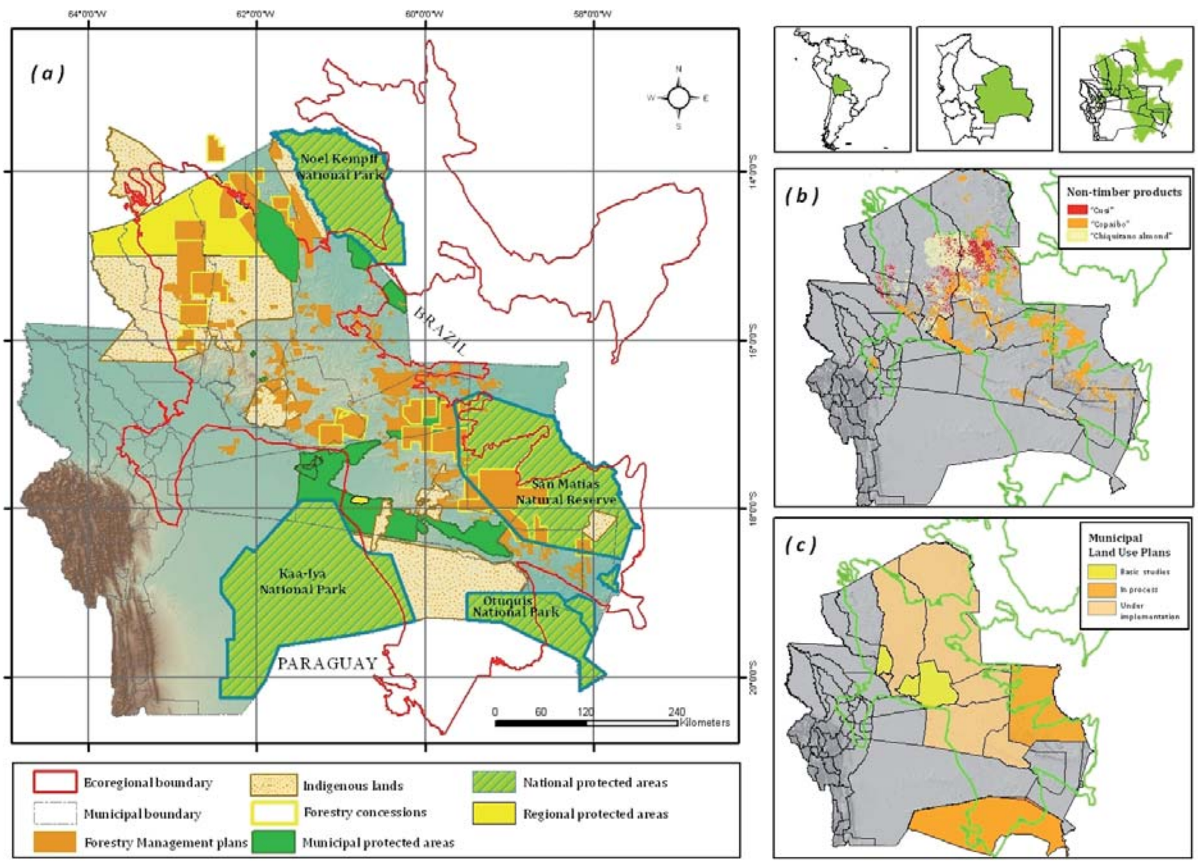
The Chiquitano Dry Forest in Bolivia is an extensive and unique ecoregion that acts as an important link between a handful of other ecoregions: the South American Gran Chaco to the south, the Gran Pantanal to the east, the Amazon rainforests to the north, and the mountain and temperate valley ecosystems to the west, interwoven by the grasslands and shrubbery of the Cerrado (Navarro and Maldonado, 2002). It forms part of the two most important water basins of the continent – the Amazon and the Paraguay-Plata to which it adds its own volume of water. During the glacial and interglacial periods, this forest advanced and retreated in successive episodes, serving as an ample shock-absorber between the dry ecosystems to the south and the humid ecosystems to the north (Pennington *et al.*, 2004). Taking into account current characteristics such as area, state of conservation and connectivity with other ecoregions, including water basins, it plays a key role in mitigating the negative effects of climate change on the continent.

However, other threats are putting this value at risk: the expansion of mechanized agriculture for soy bean production, the increase in grazing lands for large-scale cattle farming, road infrastructure development, colonization (natives from western Bolivia and Mennonite communities), the development of mining for iron ore, gold and rare earth minerals, the iron and steel industry, land tenancy insecurity, and the increase in fires (FCBC, 2010).

The Chiquitano Dry Forest links more than 11.8 million hectares of parks and reserves of different categories and jurisdictions, some of great value for humanity. Among these, the Noel Kempff Mercado National Park (with 1.5 million ha), declared a natural World Heritage site, as well as Ramsar sites such as the Bolivian Pantanal and Concepcion, Kaa-Iya del Gran Chaco National Park (one of the largest parks in South America with 3.3 million ha), Otuquis National Park, San Matías ANMI (Natural Area of Integrated Management), Tucavaca Valley Reserve, Ríos Blanco y Negro Wildlife Reserve, among various others of national, regional and local importance (Figure 1(a)).

Figure 1. Chiquitano Dry Forest Ecoregion

Figure 1(a) shows the different usage rights in the Chiquitano Dry Forest Ecoregion; Figure 1(b) the distribution of three non-wood forest products and Figure 1(c) indications of the design stage of municipal land-use plans in several municipalities of the Chiquitano region.



Source: FCBC, 2011

This is in addition to the more than twenty-two forest concessions, amounting to almost 2.2 million ha, of which eight (868,000 ha) are certified under the Forest Stewardship Council (FSC), as well as twelve community lands (more than 6 million ha) of the Baure, Chiquitana, Ayoreode and Guarani communities, and a significant number of small private reserves and other local forest concessions (Figure 1(a)). This extensive and heterogeneous mosaic of land use rights, superimposed in many cases, confers a complex panorama in terms of governance. But at the same time it also provides an opportunity-filled setting for counteracting deforestation trends, encouraging connectivity between large areas of protected forests, and promoting the conservation and sustainable use of biodiversity.

Land management strategies

In view of this assortment of threats and opportunities, a series of land and natural resource management strategies can be added to the pile, which – when adequately formulated and implemented – could contribute to maintaining the ecological integrity of the Chiquitano Dry Forest in the long term. Land-use planning has different geographic and jurisdiction scales on the one hand, but on the other, the policies applied to the use of natural resources and access rights generate a basis of technical, socioeconomic and political criteria for the appropriate use of land, and the planned occupation of the area.

In the land use planning process, four instruments, corresponding to the different scales, must be represented: the Departmental Land Use Plans (in this case, of the department of Santa Cruz, Bolivia, where the majority of the Chiquitano Dry Forest is located), the Municipal Land Use Plans (PMOT – protected by the New Political Constitution of the Bolivian State), the Indigenous Land Management Plans (applied to native and peasant community lands), and the Land Use Plans (applied to private farms). Each one of these instruments constitutes management opportunities that could promote connectivity on multiple scales, as well as the protection of sites – key for the functioning of ecosystem services such as water, the conservation of biodiversity (establishing protected areas), and for the identification of areas of forest susceptible to deforestation or degradation on which mechanisms like REDD+ could be applied. The PMOT design for the Chiquitana

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region is a significant step towards coordinating the different development approaches, with the need for connectivity and ecological integrity. Figure 1(c) shows the current design stage for these instruments in which technical criteria, such as wildlife corridors, areas of high biodiversity value, and ecosystem service production sites have been incorporated.

For its part, the use of forest resources, under regulations currently in force in Bolivia, allows for large areas of the Chiquitano forest to be kept in good health, especially if they are found to be under voluntary certification mechanisms, creating a source of connectivity and ecological integrity opportunities. The use – still incipient – of valuable non-wood forest resources, such as the Chiquitana almond (*Dipteryx alata*), cusi palm (*Attalea speciosa*) or copaibo oil (*Coppaifera* spp.), also creates a promising option for establishing extensive protection areas for its long term management. Recently, one of the municipalities of the Chiquitano Dry Forest created a new protected area (347,000 ha), stemming from the interest in maintaining and managing the natural forest under a non-wood products exploitation scheme, in this case, for the extraction of copaibo oil (Figure 1(a) and (b)).

The existence of protected areas of differing classes, and the opportunity to create new ones on local scales, within the framework of the application of Ecosystem Approach principles, in particular of decentralization and decision-making at the lowest possible level, completes the mosaic of conservation schemes contributing to connectivity and integrity. The establishment of a departmental system for Santa Cruz of protected areas, which seeks to coordinate between national, regional and local levels, can produce excellent results as long as a legal normative framework and the political will exist to make it effective operationally. Without a doubt, achieving this coordination will be crucial in ensuring connectivity and integrity, not only for the forest, but also between the linked ecoregions (Chaco, Pantanal, Amazon), as well as a climate change adaptation strategy based on healthy ecosystems.

One of the reference cases on the application of mechanisms of economic compensation to prevent degradation and deforestation – even before REDD+ mechanisms were designed – is the PAC-NK project (Climate Action Project – Noel Kempff Mercado), involving more than 600,000 ha of the Noel Kempff Mercado National Park, which – as mentioned earlier – was declared a World Heritage site in 2000, forming part of the ecological connectivity network of the Chiquitano Dry Forest. This project initiated its activities in 1997, and scheduled to end in 2026, demonstrates that the reduction of carbon emissions is viable and economically profitable when programmes that suspend forest exploitation and deforestation are applied – the latter on the part of local communities. During the period 1997–2005, PAC-NK certified that 989,622 t CO2 emissions were averted. Although grave doubts still persist with respect to the politico-institutional viability of the initiative and the distribution of the economic benefits, it is a real-life example that shows – technically and scientifically – that these mechanisms can be applied and accurately quantified.

Socio-ecological resilience and management models

The Chiquitano Dry Forest was incorporated into the International Model Forests Network in 2005. As a Model Forest, it seeks to generate agreements between key actors to develop land and natural resource management, sustainable agricultural production, biodiversity conservation, and the promotion of scientific and traditional knowledge. Despite successive planning efforts on the ecoregion scale (Ibisch, Columba and Reichle, 2002; Vides-Almonacid, Reichle and Padilla, 2007; FCBC, 2010), the governing structure, allowing for the coordination of strategies between different governmental levels and which is agreed on by all sectors involved, is still weak. The application of Ecosystem Approach principles, as a strategy developed by the Convention on Biological Diversity, continues to present a big challenge for meeting the Model Forest objectives in the Chiquitano Dry Forest.

However, the need to ensure the socio-ecological resilience of this tropical forest is becoming increasingly obvious, in view of not only climate changes but also political, economic and cultural changes which are felt ever more forcefully in the region. The participation of local actors, the creation of capacities, and the boost in land management and natural resource capabilities, as a step towards the establishment of collaborative approaches and planning for future development options, constitutes the main path towards maintaining the ecosystem services at landscape level (McAfee *et al.*, 2010). Furthermore, given that biodiversity increases the resilience and resistance of forest ecosystems that are facing the changes, its conservation should be a core element of any management model applied to the terrain (Thompson *et al.*, 2009).

Tabebuia trees flowering ©Hermes Justiniano

The complex mosaic of usage rights in the Chiquitano Dry Forest region (as shown in Figure 1), provides a platform from which initiatives like REDD+ can be developed, as well as other actions that strengthen conservation and natural forest management units. With this in mind, it becomes necessary to:

- Consolidate existing protected areas (national as well as regional and local), through effective administration, providing them with legal security and sufficient staff, and adequately preparing and equipping them with realistic and viable management plans.

- Integrate new sustainable forest management approaches – driven by the national government of Bolivia, in which greater control is given to local communities with reference to the business efforts in the region – while searching to increase voluntary forest certification mechanisms that contribute to a fairer distribution of the economic benefits resulting from forest exploitation.

- Boost the management of non-wood resources as an alternative and/or complement to the use of native tree species, which socially and economically justifies the maintenance of large areas of forest, as is the case in the Copaibo Reserve (Figure 1(a), orange polygon to the north).

- Develop new pilot REDD+ type initiatives, taking as a reference the knowledge from the PAC-NK Project, as well as other similar projects developed in Bolivia and in other Latin American countries. Even though this mechanism is not considered an officially valid strategy for the Bolivian government, it is necessary to test it with wide participation from local communities.

- Promote the implementation of existing instruments for planning and land management, on regional, municipal, indigenous and private scales, as a valid and technically supported strategy for land use and territorial occupation, which considers and strengthens connectivity options either through maintaining environmental easement or by boosting protected forests, private reserves or new local area (municipal or community) networks.

- Establish an effective governance platform between actors and sectors directly involved in the land management of the Chiquitano Dry Forest and management of its natural resources within the framework of the Model Forest management model, using the application of the Ecosystem Approach principles as a guide to its development.

Concluding remarks

In this context, adaptive management as 'active learning' is established as a real paradigm for creating an effective and creative management model against the backdrop of global changes in the Chiquitano Dry Forest. Thus, we must learn more about REDD+ mechanisms on a sub-national scale (in the sense of Angelsen *et al.*, 2008), the coordination of sustainable exploitation models for wood and non-wood resources, the implementation of land-use planning on multiple scales, the effective management of protected areas, and the monitoring of biodiversity as they will be determining factors in maintaining large areas of protected forests, connecting wildlife corridors, and the provision of products and ecosystem services to society. In this sense, the Chiquitano Dry Forest provides an ecoregional platform where approaches and ecosystem management models are put to the test, given the context of growing difficulties and threats that require rapid and effective learning and adaptation.

Considering World Heritage sites – and taking into account the Noel Kempff Mercado National Park in particular – the need to significantly improve the coordination of governance levels and decision-making becomes clear, as does the need to capitalize on lessons learnt and promote new management models. Presently, under the exclusive responsibility of the National State, there are deficiencies in regional (departmental) and local (municipal) government participation and from other civil society organizations necessary for its management and conservation. A few years ago, the shared (public-private) administration management model for the national park allowed a reasonable balance between investments and management results, for which new contexts of consent and participation should be sought within the framework of the Model Forest or other plural authorities with UNESCO involvement. In this way, a World Heritage site and a Climate Action Project area could be preserved in perpetuity as a reference for REDD+ initiatives and as an example of integration on the different geographic and jurisdiction scales.

References

Angelsen, A., Streck, Ch., Peskett, L., Brown, J. and C. Lutrell. 2008. What is the right scale for REDD?. In: A. Angelsen (ed.), *Moving ahead with REDD. Issues, Options and Implications*. CIFOR, Bogor, Indonesia. 156 pp.

Dinerstein, E., Olson, D.M., Graham, D.J., Webster, A.L., Primm, S.A., Bookbinder, M.P., Ledec, G. 1995. *A conservation assessment of the terrestrial ecoregions of Latin America and the Caribbean*. WWF-The World Bank, Washington D.C. 129 pp. + maps.

FCBC, 2010. *Planificación Estratégica 2010-2015*. Fundación para la Conservación del Bosque Chiquitano. Santa Cruz de la Sierra. 93 pp.

FAO. 2009. *Situación de los Bosques del Mundo 2009*. Organización de las Naciones Unidas para la Agricultura y la Alimentación, Roma. 158 pp.

Ibisch, P.L., Beck, S.G., Gerkmann, B., Carretero, A. 2003. Ecoregiones y ecosistemas. In: Ibisch, P.L. and G. Mérida (eds.), *Biodiversidad: la riqueza de Bolivia, estado de conocimiento y conservación*. Editorial FAN, Santa Cruz de la Sierra, pp. 47-88.

Ibisch, P.L., Columba, K., Reichle, S. 2002. *Plan de conservación y desarrollo sostenible para el Bosque Seco Chiquitano, Cerrado y Pantanal boliviano*. Fundación para la Conservación del Bosque Chiquitano. Editorial FAN, Santa Cruz de la Sierra.

Killeen, T.J., Jardim, A., Mamani, F., Rojas, N., Saravia, P. 1998. Diversity, composition, structure, and biomass estimates of a tropical semideciduous forest in the Chiquitania region of Santa Cruz, Bolivia. *Journal of Tropical Ecology*, Vol. 4, pp. 803–827.

McAfee, B.J., de Camino, R., Burton; P.J., Eddy, B., Fähser, L., Mesier, C., Reed, M.G., Spies, T. and R. Vides. 2010. Managing forested landscapes for socio-ecological resilience. In: G. Mery et al. (eds.), *Forests and Society – Responding to Global Drivers of Change*. IUFRO World Series Volume 25. Vienna. 509 pp.

Miles, L., Newton, A.C., DeFries, R.S., Ravilious, C., May, I., Blyth, S., Kapos, V., Gordon, J.E. 2006. A global overview of the conservation status of tropical dry forests. *Journal of Biogeography*, Vol. 33, No. 3, pp. 491–505.

Naciones Unidas. 2008. *Objetivos de Desarrollo del Milenio*. Informe 2008. Nueva York. 51 pp.

Navarro, G., Maldonado, M. 2002. *Geografía ecológica de Bolivia: vegetación y ambientes acuáticos*. Centro de Ecología Simón I. Patiño. Cochabamba. 719 pp.

Pennington, R.T., Lavin, M., Prado, D.E., Pendry, C.A., Pell, S.K., Butterworth, C.A. 2004. Historical climate change and speciation: Neotropical seasonally dry forests plants show patterns of both Tertiary and Quaternary diversification. *Phil. Trans. R. Soc. Lond. B*. Vol. 359, No. 1443, pp. 515–538.

Prado, D.E. 2000. Seasonally dry forests of tropical South America: from forgotten ecosystems to a new phytogeographic unit. *Edinburgh Journal of Botany*, Vol. 57, pp. 437-461.

Sánchez-Azofeifa, A., Kalacska, M., Quesada, M., Calvo-Alvarado, J.C., Nassar, J.M., Rodríguez, J.P. 2005. Need for integrated research for a sustainable future in tropical dry forests. *Conservation Biology*, Vol. 19, No. 2, pp. 285–286.

Thompson, L., Mackey, B., McNulty, S. and A. Mosseler. 2009. *Forest Resilience, Biodiversity, and Climate Change. A synthesis of the biodiversity/resilience/stability relationship in forest ecosystems*. Secretariat of the Convention on Biological Diversity, Montreal. Technical Series 43. 67 pp.

Vides-Almonacid, R., Reichle, S., Padilla, F. 2007. *Planificación ecorregional del Bosque Seco Chiquitano*. FCBC-The Nature Conservancy. Editorial FCBC, Santa Cruz de la Sierra. 245 pp.

Annexes

Plitvice Lakes National Park, Croatia © Coralie Sarron

Annex I: World Heritage Forest Indicator Database [1]

World Heritage Forest Site	Country[2]	Size (ha)	Forest cover[3] (ha)	Forest cover[3] (%)
Iguazu National Park	Argentina	55 500	49 950	90%
Fraser Island	Australia	184 000	165 600	90%
Gondwana Rainforests of Australia	Australia	370 000	370 000	100%
Greater Blue Mountains Area	Australia	1 032 649	1 001 670	97%
Kakadu National Park	Australia	1 980 994	990 497	50%
Tasmanian Wilderness	Australia	1 374 000	412 200	30%
Wet Tropics of Queensland	Australia	894 420	804 978	90%
The Sundarbans	Bangladesh	139 699	139 699	100%
Beloveshskaya Pushcha/Bialowieza Forest	Belarus/Poland	92 669	92 669	100%
Noel Kempff Mercado National Park	Bolivia	1 523 446	1 218 757	80%
Atlantic Forest South-East Reserves	Brazil	468 193	468 193	100%
Brazilian Atlantic Islands (Fernando Noronha archipelago and Atoll das Rocas)	Brazil	42 270	38 043	90%
Central Amazon Conservation Complex	Brazil	5 232 018	2 616 009	50%
Cerrado Protected Areas: Chapada dos Veadeiros and Emas National Parks	Brazil	367 356	220 414	60%
Discovery Coast Atlantic Forest Reserves	Brazil	111 930	106 334	95%
Iguaçu National Park	Brazil	170 086	153 077	90%
Pantanal Conservation Area	Brazil	187 818	131 473	70%
Pirin National Park	Bulgaria	40 060	24 036	60%
Dja Faunal Reserve	Cameroon	526 000	473 400	90%
Canadian Rocky Mountain Parks	Canada	2 306 884	922 754	40%
Gros Morne National Park	Canada	180 500	108 300	60%
Nahanni National Park	Canada	476 560	381 248	80%
Wood Buffalo National Park	Canada	4 480 000	3 136 000	70%
Waterton Lakes Glacier International Peace Park	Canada/USA	457 614	320 330	70%
Huanglong Scenic and Historical Interest Area	China	60 000	54 000	90%
Jiuzhaigou Valley Scenic and Historic Interest Area	China	72 000	46 800	65%
Mount Emei Scenic Area, including Leshan Giant Buddha Scenic Area	China	15 400	8 008	52%
Mount Huangshan	China	15 400	8 624	56%
Mount Sanqingshan National Park	China	22 950	22 262	97%
Mount Taishan	China	25 000	20 000	80%
Mount Wuyi	China	99 975	99 975	100%
Sichuan Giant Panda Sanctuaries - Wolong, Mt Siguniang and Jiajin Mountains	China	924 500	591 680	64%
Three Parallel Rivers of Yunnan Protected Areas	China	939 441	657 609	70%
Los Katíos National Park	Colombia	72 000	36 000	50%
Area de Conservación Guanacaste	Costa Rica	147 000	147 000	100%
Cocos Island Nacional Park	Costa Rica	199 790	21 977	11%
Talamanca Range-La Amistad Reserves / La Amistad National Park	Costa Rica/Panama	567 845	511 061	90%
Comoé National Park	Cote d'Ivoire	1 149 250	976 863	85%
Taï National Park	Cote d'Ivoire	330 000	99 000	30%
Mount Nimba Strict Nature Reserve	Cote d'Ivoire/Guinea	14 760	11 808	80%
Plitvice Lakes National Park	Croatia	19 200	13 440	70%
Alejandro de Humboldt National Park	Cuba	69 341	67 261	97%
Kahuzi-Biega National Park	Democratic Republic of the Congo	600 000	180 000	30%
Okapi Wildlife Reserve	Democratic Republic of the Congo	1 372 625	1 372 625	100%
Salonga National Park	Democratic Republic of the Congo	3 600 000	3 600 000	100%
Virunga National Park	Democratic Republic of the Congo	790 000	513 500	65%
Morne Trois Pitons National Park	Dominica	6 857	6 857	100%
Sangay National Park	Ecuador	271 925	190 348	70%
Pitons, cirques and remparts of Reunion Island	France	105 838	96 313	91%
Ecosystem and Relict Cultural Landscape of Lopé-Okanda	Gabon	491 291	491 291	100%
Primeval Beech Forests of the Carpathians and the Ancient Beech Forests of Germany	Germany/Slovakia/Ukraine	33 670	29 293	87%
Tikal National Park	Guatemala	57 600	11 520	20%

1) June 2011. Available online at http://whc.unesco.org/en/forests
2) More than one country in one cell indicates a transboundary site.
3) Based on information obtained from desktop study of WH nomination files and the WCMC protected areas database. Great variation in availability and quality of data implies that the figures are indicative only and will be permanently subject to refinement. The authors welcome any information leading to improvement of the figures.

Reporting Trend[4]											Danger Listing
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
8	6	6	6	6	3	12	24	24	36	36	
0	0	0	0	0	0	0	0	0	0	0	
12	12	12	12	5	5	5	5	5	3	3	
0	0	0	12	12	12	12	12	5	5	5	
53	58	63	68	73	71	62	53	44	35	32	
46	39	32	25	23	33	31	41	39	48	38	
44	42	35	28	21	18	15	13	11	9	9	
0	0	0	0	0	0	0	12	24	24	36	
24	17	22	34	46	58	56	59	64	57	50	
0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	
68	59	64	69	74	76	83	86	77	80	71	1999 - 2001
0	0	0	0	0	0	0	0	0	0	0	
15	27	39	39	51	41	46	39	51	56	66	
48	41	46	51	63	68	78	69	72	77	80	
37	30	23	23	30	40	38	36	36	26	16	
0	0	0	0	0	0	0	0	0	0	0	
0	12	24	36	36	48	41	34	27	27	20	
14	24	36	45	42	39	29	22	15	15	15	
0	0	0	0	0	0	0	0	12	24	24	
12	12	5	5	5	5	5	3	3	3	3	
17	17	10	10	10	8	8	6	6	6	3	
24	24	36	29	22	22	22	15	13	11	11	
17	17	10	10	10	8	8	6	6	6	3	
							0	0	0	0	
12	12	5	5	5	5	5	3	3	3	3	
0	0	0	0	0	0	0	0	0	0	0	
					0	0	0	0	12	12	
		0	12	24	36	48	60	53	58	63	
36	36	29	22	15	15	15	25	35	45	57	Since 2009
0	0	0	0	0	0	0	0	0	0	0	
0	12	12	12	12	12	5	5	5	5	5	
23	14	26	38	35	32	27	32	37	49	61	
15	15	27	32	44	53	65	70	73	78	83	Since 2003
6	18	27	36	36	36	41	34	39	39	39	
82	85	88	88	88	95	95	95	95	95	97	Since 1992
52	43	34	32	30	25	20	15	12	9	6	1992 - 1997
0	0	0	0	0	0	0	12	24	36	36	
66	71	76	81	83	85	88	91	94	97	100	Since 1997
60	65	70	75	80	85	88	91	94	97	100	Since 1997
36	48	60	65	70	75	80	85	88	91	94	Since 1999
80	85	88	91	94	97	100	100	100	100	100	Since 1994
24	24	17	10	10	10	10	8	6	6	6	
91	82	85	85	88	88	95	95	83	71	59	1992 - 2005
										0	
						0	0	0	0	0	
					0	0	0	0	0	0	
17	17	8	8	8	8	3	3	3	3	3	

4) 0 = Minimum threat intensity; 100 = Maximum threat intensity; for further explanation see "A Selection of WH Forest Indicators" (this volume); for graphs on each site see Annex III

Annex I: **World Heritage Forest Indicator Database** [1]

World Heritage Forest Site	Country[2]	Size (ha)	Forest cover[3] (ha)	Forest cover[3] (%)
Río Plátano Biosphere Reserve	Honduras	500 000	385 000	77%
Manas Wildlife Sanctuary	India	39 100	25 024	64%
Nanda Devi and Valley of Flowers National Parks	India	71 783	14 357	20%
Sundarbans National Park	India	133 010	86 457	65%
Lorentz National Park	Indonesia	2 350 000	1 222 000	52%
Tropical Rainforest Heritage of Sumatra	Indonesia	2 595 125	1 453 270	56%
Ujung Kulon National Park	Indonesia	76 119	60 819	80%
Ogasawara Islands	Japan	7 939	5 557	70%
Shirakami - Sanchi	Japan	16 939	13 890	82%
Shiretoko	Japan	71 100	66 123	93%
Yakushima	Japan	10 747	8 598	80%
Mount Kenya National Park/Natural Forest	Kenya	142 020	113 616	80%
Rainforests of the Atsinanana	Madagascar	479 661	441 288	92%
Tsingy de Bemaraha Strict Nature Reserve	Madagascar	152 000	76 000	50%
Gunung Mulu National Park	Malaysia	52 864	52 864	100%
Kinabalu Park	Malaysia	75 370	52 759	70%
Monarch Butterfly Biosphere Reserve	Mexico	13 552	11 790	87%
Sian Ka'an	Mexico	528 000	369 600	70%
Durmitor National Park	Montenegro	32 100	25 680	80%
Chitwan National Park	Nepal	93 200	65 240	70%
Te Wahipounamu – South West New Zealand	New Zealand	2 600 000	2 470 000	95%
Tongariro National Park	New Zealand	79 596	31 838	40%
Coiba National Park and its special Zone of Marine Protection	Panama	270 125	54 025	20%
Darien National Park	Panama	597 000	71 640	12%
Historic Santuary of Machu Picchu	Peru	32 592	26 074	80%
Manú National Park	Peru	1 716 295	1 716 295	100%
Río Abiseo National Park	Peru	274 520	247 068	90%
Puerto - Princesa Subterranean River National Park	Philippines	5 753	2 877	50%
Laurisilva of Madeira	Portugal	15 000	10 050	67%
Central Sikhote-Alin	Russian Federation	1 553 928	1 553 928	100%
Lake Baikal	Russian Federation	8 800 000	3 520 000	40%
Putorana Plateau	Russian Federation	1 887 251	566 175	30%
Virgin Komi Forests	Russian Federation	3 280 000	3 017 600	92%
Niokolo - Koba National Park	Senegal	913 000	365 200	40%
Vallée de Mai Nature Reserve	Seychelles	18	18	100%
East Rennell	Solomon Islands	37 000	9 250	25%
iSimangaliso Wetland Park	South Africa	239 566	215 609	90%
Garajonay National Park	Spain	3 984	3 944	99%
Central Highlands of Sri Lanka	Sri Lanka	56 844	51 160	90%
Sinharaja Forest Reserve	Sri Lanka	8 864	5 318	60%
Central Suriname Nature Reserve	Suriname	1 600 000	1 600 000	100%
Dong Phayayen-Khao Yai Forest Complex	Thailand	615 500	615 500	100%
Thungyai - Huai Kha Khaeng Wildlife Sanctuaries	Thailand	622 200	559 980	90%
Bwindi Impenetrable National Park	Uganda	32 092	30 487	95%
Rwenzori Mountains National Park	Uganda	99 600	59 760	60%
Selous Game Reserve	United Republic of Tanzania	5 000 000	4 000 000	80%
Great Smoky Mountains National Park	USA	209 000	209 000	100%
Olympic National Park	USA	369 660	369 660	100%
Redwood National and State Parks	USA	56 883	39 818	70%
Yellowstone National Park	USA	898 349	718 679	80%
Yosemite National Park	USA	308 283	262 041	85%
Canaima National Park	Venezuela	3 000 000	2 100 000	70%
	Sum	77 391 856		

1) June 2011. Available online at http://whc.unesco.org/en/forests
2) More than one country in one cell indicates a transboundary site.
3) Based on information obtained from desktop study of WH nomination files and the WCMC protected areas database. Great variation in availability and quality of data implies that the figures are indicative only and will be permanently subject to refinement. The authors welcome any information leading to improvement of the figures.

Reporting Trend[4]											Danger Listing
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
70	63	65	67	67	74	84	87	90	90	92	1996 - 2007; Since 2011
82	85	88	88	88	95	95	95	95	95	97	1992 - 2011
12	12	5	5	5	5	5	3	3	3	3	
0	12	12	12	12	12	5	5	5	5	5	
0	12	24	36	48	60	65	70	63	68	73	
			0	12	24	36	48	60	65	70	Since 2011
0	0	0	0	0	0	0	0	0	0	0	
17	10	10	10	10	8	6	6	6	6	3	
				0	0	0	12	12	12	12	
5	5	5	5	5	3	3	3	3	3	0	
24	36	48	53	53	46	39	44	47	47	57	
						0	0	12	24	36	Since 2010
5	3	3	3	3	3	0	0	0	0	0	
0	12	12	12	12	12	5	5	17	29	29	
0	0	0	0	0	0	0	0	0	0	0	
							0	0	12	24	
0	12	24	36	36	36	29	22	15	15	15	
37	28	21	21	33	40	35	45	45	38	28	
23	35	38	50	47	44	37	25	18	18	18	
22	20	20	23	23	23	20	20	8	8	8	
17	29	22	22	20	20	13	11	11	8	8	
				0	0	0	0	12	12	24	
0	0	0	0	0	0	0	0	0	0	0	
63	68	71	74	79	89	92	92	92	95	85	
3	3	3	0	0	0	12	24	24	36	48	
5	5	5	3	3	3	3	3	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	12	12	12	
0	0	0	0	0	0	0	0	0	0	0	
48	53	58	63	75	80	83	86	89	94	97	
										0	
24	17	10	10	10	10	8	6	18	30	42	
28	26	24	21	18	23	32	41	53	65	68	Since 2007
0	0	0	0	0	0	0	0	0	0	0	
0	0	12	24	36	36	48	41	46	51	51	
0	0	12	24	24	24	24	17	10	10	10	
3	3	3	3	3	0	0	0	0	0	0	
										0	
5	5	3	3	3	3	3	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	
				0	0	12	24	24	36	48	
12	12	5	5	5	5	5	3	3	3	3	
12	12	12	5	5	5	5	5	3	3	3	
36	36	48	53	58	63	75	68	71	62	53	1999 - 2004
6	3	3	3	3	12	24	36	48	60	65	
0	12	12	12	12	24	17	17	17	17	10	
11	9	9	9	6	3	0	0	0	0	0	
10	10	10	8	6	6	6	6	3	0	0	
76	81	83	85	88	91	82	85	76	76	64	1995 - 2003
0	0	0	0	0	0	0	0	0	0	0	
36	29	22	15	15	15	13	11	9	9	9	

4) 0 = Minimum threat intensity; 100 = Maximum threat intensity; for further explanation see "A Selection of WH Forest Indicators" (this volume); for graphs on each site see Annex III

Annex II: World Heritage Forests - Inscription and Geographical Characteristics

World Heritage Forest Site	Country[2]	Year of Inscription	Ecological Zone[1]	Realm[2]
Iguazu National Park	Argentina	1984	TrR	N
Fraser Island	Australia	1992	SubH	Au
Gondwana Rainforests of Australia	Australia	1986	SubH	Au
Greater Blue Mountains Area	Australia	2000	TempO	Au
Kakadu National Park	Australia	1981	TrD	Au
Tasmanian Wilderness	Australia	1982	TempO	Au
Wet Tropics of Queensland	Australia	1988	TrM	Au
The Sundarbans	Bangladesh	1997	TrM / TrR	I
Beloveshskaya Pushcha/Bialowieza Forest	Belarus/Poland	1979	TempC	PW
Noel Kempff Mercado National Park	Bolivia	2000	TrM / TrR	N
Atlantic Forest South-East Reserves	Brazil	1999	TrR	N
Brazilian Atlantic Islands (Fernando Noronha archipelago and Atoll das Rocas)	Brazil	2001	TrM	N
Central Amazon Conservation Complex	Brazil	2000	TrR	N
Cerrado Protected Areas: Chapada dos Veadeiros and Emas National Parks	Brazil	2001	TrM	N
Discovery Coast Atlantic Forest Reserves	Brazil	1999	TrR	N
Iguaçu National Park	Brazil	1986	TrR	N
Pantanal Conservation Area	Brazil	2000	TrM to TrR	N
Pirin National Park	Bulgaria	1983	TempC	PW
Dja Faunal Reserve	Cameroon	1987	TrR	A
Canadian Rocky Mountain Parks	Canada	1984	TempM	Ne
Gros Morne National Park	Canada	1987	BC	Ne
Nahanni National Park	Canada	1978	BM	Ne
Wood Buffalo National Park	Canada	1983	BC	Ne
Waterton Lakes Glacier International Peace Park	Canada/USA	1995	TempM	Ne
Huanglong Scenic and Historical Interest Area	China	1992	SubH	PE
Jiuzhaigou Valley Scenic and Historic Interest Area	China	1992	SubH	PE
Mount Emei Scenic Area, including Leshan Giant Buddha Scenic Area	China	1996	SubH	PE
Mount Huangshan	China	1990	SubH	PE
Mount Sanqingshan National Park	China	2008	TempM	PE
Mount Taishan	China	1987	TempC	PE
Mount Wuyi	China	1999	SubH	PE
Sichuan Giant Panda Sanctuaries - Wolong, Mt Siguniang and Jiajin Mountains	China	2006	SubH / SubM	PE
Three Parallel Rivers of Yunnan Protected Areas	China	2003	SubM	PE
Los Katíos National Park	Colombia	1994	TrR	N
Area de Conservación Guanacaste	Costa Rica	1999	TrR	N
Cocos Island Nacional Park	Costa Rica	1997	TrR / TrM	N
Talamanca Range-La Amistad Reserves / La Amistad National Park	Costa Rica/Panama	1983	TrR / TrM	N
Comoé National Park	Cote d'Ivoire	1983	TrM	A
Taï National Park	Cote d'Ivoire	1982	TrR	A
Mount Nimba Strict Nature Reserve	Cote d'Ivoire/Guinea	1981	TrR	A
Plitvice Lakes National Park	Croatia	1979	TempC / TempM	PW
Alejandro de Humboldt National Park	Cuba	2001	TrM	N
Kahuzi-Biega National Park	Democratic Republic of the Congo	1980	TrR	A
Okapi Wildlife Reserve	Democratic Republic of the Congo	1996	TrR	A
Salonga National Park	Democratic Republic of the Congo	1984	TrR	A
Virunga National Park	Democratic Republic of the Congo	1979	TrR	A
Morne Trois Pitons National Park	Dominica	1997	TrR	N
Sangay National Park	Ecuador	1983	TrMS / TrR	N
Pitons, cirques and remparts of Reunion Island	France	2010	SubM / SubH	A
Ecosystem and Relict Cultural Landscape of Lopé-Okanda	Gabon	2007	TrR	A
Primeval Beech Forests of the Carpathians and the Ancient Beech Forests of Germany	Germany/Slovakia/Ukraine	2007	TempC	PW
Tikal National Park	Guatemala	1979	TrM	N

1) **BC** = Boreal coniferous forest; **BM** = Boreal mountain system; **TempC** = Temperate continental forest; **TempM** = Temperate mountain system; **TempO** = Temperate oceanic forest; **SubD** = Subtropical Dry Forest; **SubD** = Subtropical dry forest; **SubH** = Subtropical Humid Forest; **SubM** = Subtropical Mountain System; **TrD** = Tropical dry forest; **TrM** = Tropical moist deciduous forest; **TrMS** = Tropical mountain system; **TrR** = Tropical rainforest

2) **A** = Afrotropical; **Au** = Australian; **I** = Indomalayan; **N** = Neotropical; **Ne** = Nearctic; **O** = Oceanic; **PE** = Palaearctic East; **PW** = Palaearctic West

	Cultural WH Criteria						Natural WH Criteria				IUCN Category[3]							
	i	ii	iii	iv	v	vi	vii	viii	ix	x	Ia	Ib	II	III	IV	V	VI	n.a.
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3) Further information on IUCN categories available online: http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/

Annex II: World Heritage Forests - Inscription and Geographical Characteristics

World Heritage Forest Site	Country[2]	Year of Inscription	Ecological Zone[1]	Realm[2]
Río Plátano Biosphere Reserve	Honduras	1982	TrR	N
Manas Wildlife Sanctuary	India	1985	TrR	I
Nanda Devi and Valley of Flowers National Parks	India	1988	TrM	I
Sundarbans National Park	India	1987	TrM / TrR	I
Lorentz National Park	Indonesia	1999	TrR	I
Tropical Rainforest Heritage of Sumatra	Indonesia	2004	TrR	I
Ujung Kulon National Park	Indonesia	1991	TrR	I
Ogasawara Islands	Japan	2011	SubH	PE
Shirakami - Sanchi	Japan	1993	TempM	PE
Shiretoko	Japan	2005	TempM	PE
Yakushima	Japan	1993	SubH	PE
Mount Kenya National Park/Natural Forest	Kenya	1997	TrMS / TrD	A
Rainforests of the Atsinanana	Madagascar	2007	TrR	A
Tsingy de Bemaraha Strict Nature Reserve	Madagascar	1990	TrM	A
Gunung Mulu National Park	Malaysia	2000	TrR	I
Kinabalu Park	Malaysia	2000	TrR	I
Monarch Butterfly Biosphere Reserve	Mexico	2008	SubM	N
Sian Ka'an	Mexico	1987	TrM	N
Durmitor National Park	Montenegro	1980	TempM	PW
Chitwan National Park	Nepal	1984	TrR	I
Te Wahipounamu – South West New Zealand	New Zealand	1990	TempO	O
Tongariro National Park	New Zealand	1990	TempO	O
Coiba National Park and its special Zone of Marine Protection	Panama	2005	TrR / TrM	N
Darien National Park	Panama	1981	TrR / TrM	N
Historic Santuary of Machu Picchu	Peru	1983	TrMS / TrR	N
Manú National Park	Peru	1987	TrR	N
Río Abiseo National Park	Peru	1990	TrMS	N
Puerto - Princesa Subterranean River National Park	Philippines	1999	TrR	I
Laurisilva of Madeira	Portugal	1999	SubD	PW
Central Sikhote-Alin	Russian Federation	2001	TempM	PE
Lake Baikal	Russian Federation	1996	BM	PE
Putorana Plateau	Russian Federation	2010	BM	PE
Virgin Komi Forests	Russian Federation	1995	BC	PE
Niokolo - Koba National Park	Senegal	1981	TrM	A
Vallée de Mai Nature Reserve	Seychelles	1983	TrM	A
East Rennell	Solomon Islands	1998	TrM	O
iSimangaliso Wetland Park	South Africa	1999	SubH	A
Garajonay National Park	Spain	1986	SubD	PW
Central Highlands of Sri Lanka	Sri Lanka	2010	TrMS	I
Sinharaja Forest Reserve	Sri Lanka	1988	TrR	I
Central Suriname Nature Reserve	Suriname	2000	TrM	N
Dong Phayayen-Khao Yai Forest Complex	Thailand	2005	TrR / TrD	I
Thungyai - Huai Kha Khaeng Wildlife Sanctuaries	Thailand	1991	TrR / TrM	I
Bwindi Impenetrable National Park	Uganda	1994	TrMS	A
Rwenzori Mountains National Park	Uganda	1994	TrR	A
Selous Game Reserve	United Republic of Tanzania	1982	TrD	A
Great Smoky Mountains National Park	USA	1983	TempM	Ne
Olympic National Park	USA	1981	TempO	Ne
Redwood National and State Parks	USA	1980	TempO	Ne
Yellowstone National Park	USA	1978	TempM	Ne
Yosemite National Park	USA	1984	TempO	Ne
Canaima National Park	Venezuela	1994	TrMS / TrR	N

1) **BC** = Boreal coniferous forest; **BM** = Boreal mountain system; **TempC** = Temperate continental forest; **TempM** = Temperate mountain system; **TempO** = Temperate oceanic forest; **SubD** = Subtropical Dry Forest; **SubD** = Subtropical dry forest; **SubH** = Subtropical Humid Forest; **SubM** = Subtropical Mountain System; **TrD** = Tropical dry forest; **TrM** = Tropical moist deciduous forest; **TrMS** = Tropical mountain system; **TrR** = Tropical rainforest

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	Cultural WH Criteria						Natural WH Criteria				IUCN Category[3]							
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3) Further information on IUCN categories available online: http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/

UNESCO Inscription Criteria:

Cultural

i. to represent a masterpiece of human creative genius;

ii. to exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;

iii. to bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;

iv. to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;

v. to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;

vi. to be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria);

Natural

vii. to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;

viii. to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;

ix. to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;

x. to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

IUCN Protected Area Management Categories:

Ia Strict Nature Reserve

Ib Wilderness Area

II National Park

III Natural Monument or Feature

IV Habitat/Species Management Area

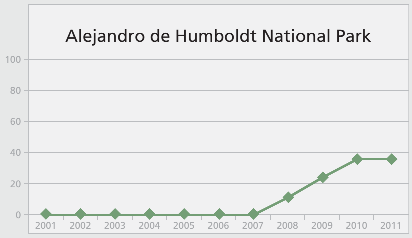
V Protected Landscape/ Seascape

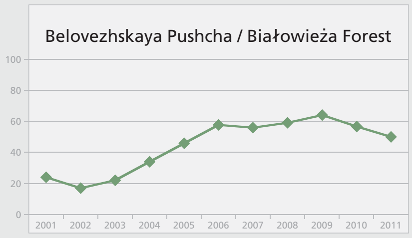
VI Protected area with sustainable use of natural resources

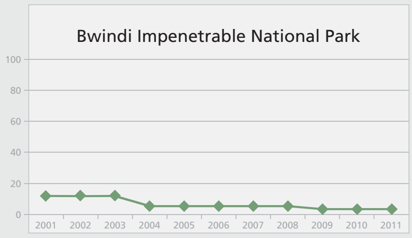
Annex III: Reporting Trend for World Heritage Forests, 2001-2011

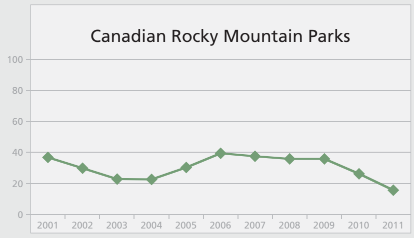
Sites are presented in alphabetical order. Those for which the RT has been zero since 2001 are not included in this list. Triangular points indicate years during site was inscribed onto the list of World Heritage in Danger. The full World Heritage Forest Reporting Trend Indicator Database can be consulted in Annex I.

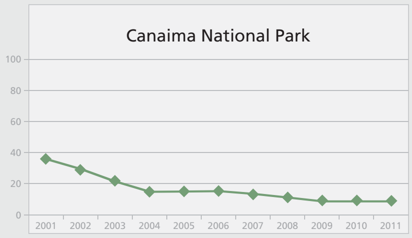
The graphs below show the Reporting Trend (RT; formerly called the 'Threat Intensity Coefficient') for each World Heritage Forest site. The RT seeks to convey the changing state of conservation of a particular World Heritage site over time as a function of the frequency at which the World Heritage Committee officially considers it. The annual RT value is calculated by the number of times the World Heritage Committee has reviewed the state of conservation of a site in the previous fifteen years, while also factoring in the relative distance in time that review has taken place. Plotting the RT provides a rapid visual tool to help assess the changing level of concern expressed by the Committee over the state of conservation of a site, and the degree of intractability of particular conservation issues. For the average reporting trend value of all World Heritage Forest sites, refer to chapter 1 on 'A Selection of World Heritage Forest Indicators' in this volume.

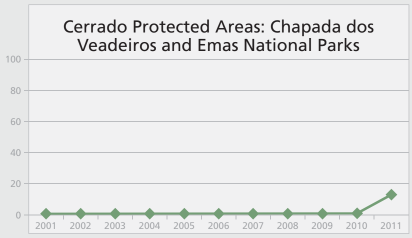

Alejandro de Humboldt National Park


Belovezhskaya Pushcha / Białowieża Forest


Bwindi Impenetrable National Park


Canadian Rocky Mountain Parks


Canaima National Park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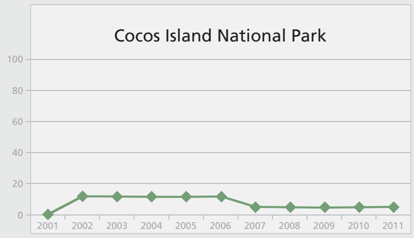
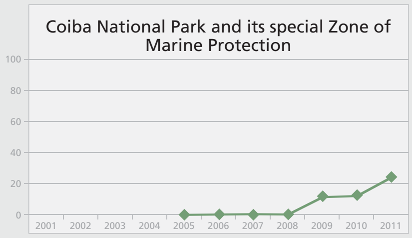
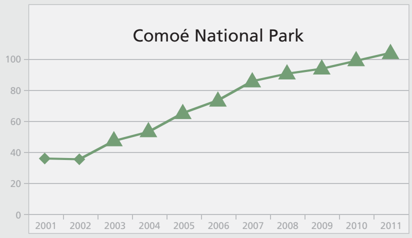

Cocos Island National Park


Coiba National Park and its special Zone of Marine Protection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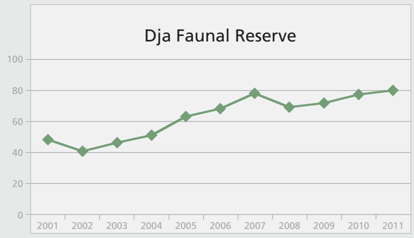
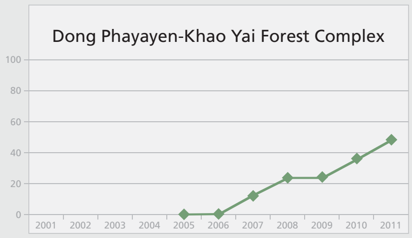

Dja Faunal Reserve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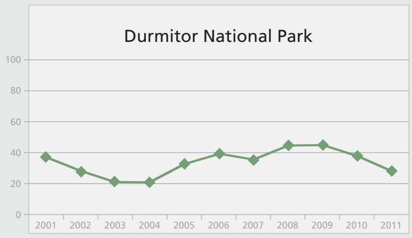
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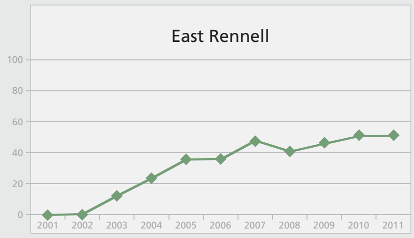
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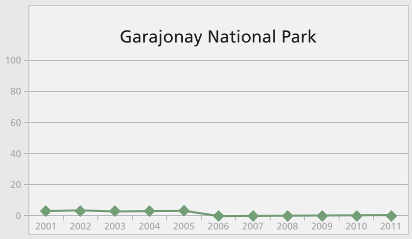
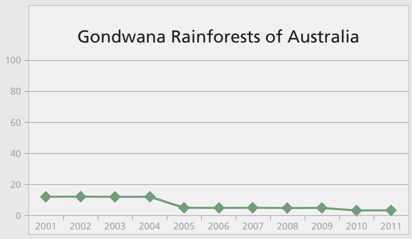
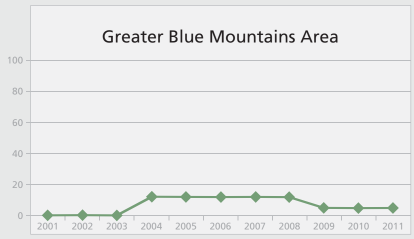
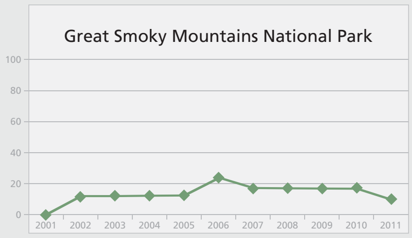
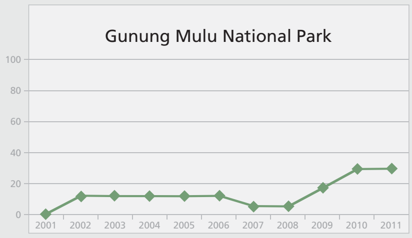

Garajonay National Park

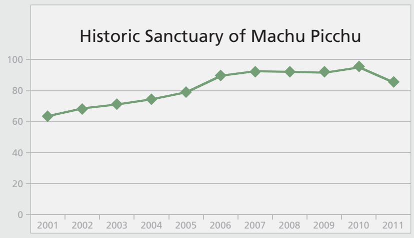

Gondwana Rainforests of Australia

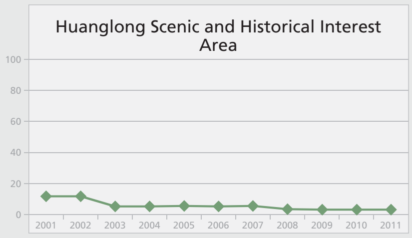

Greater Blue Mountains Area

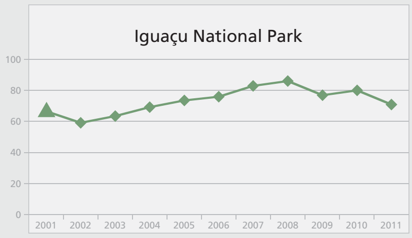
Vertical axis: 0-100 (0 = lowest concern, 100 = greatest concern)
Horizontal axis: Years 2001–2011
▲ = danger list

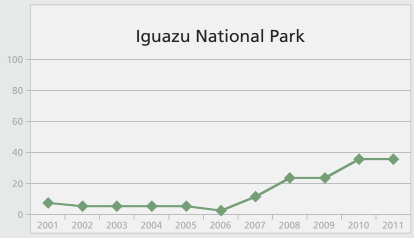


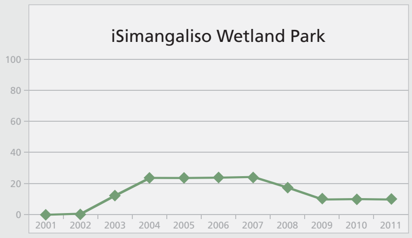


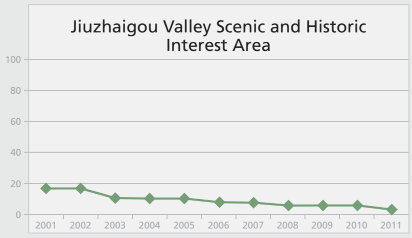


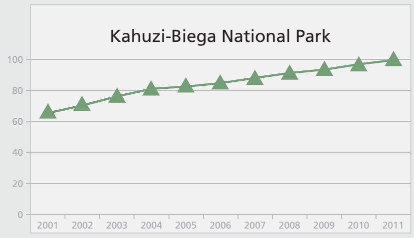


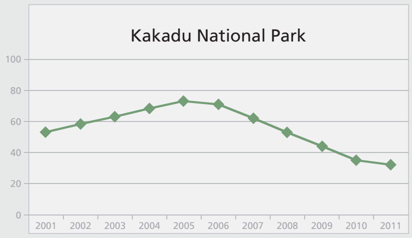


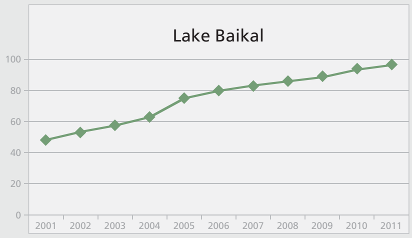


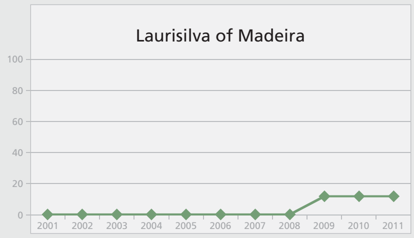


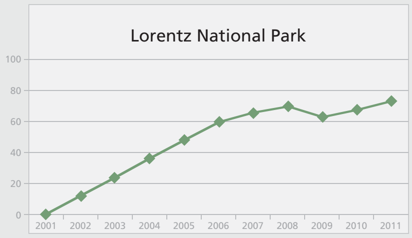


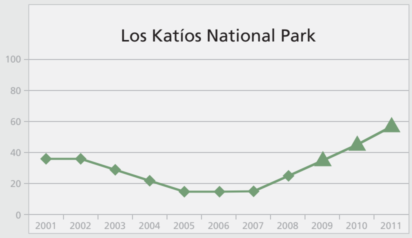


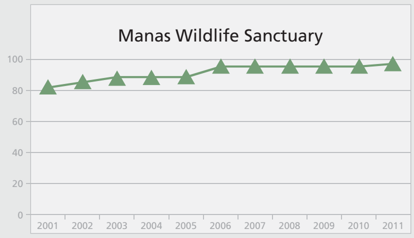


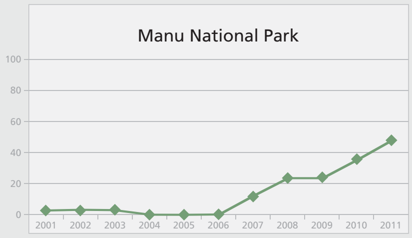


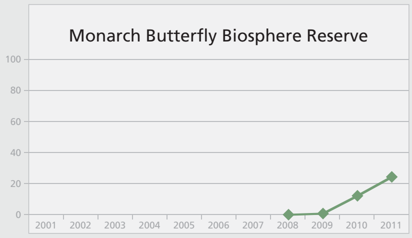


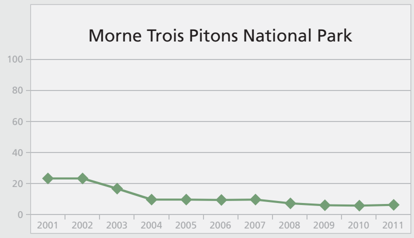


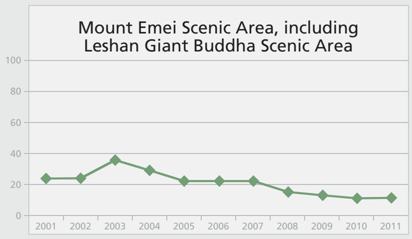


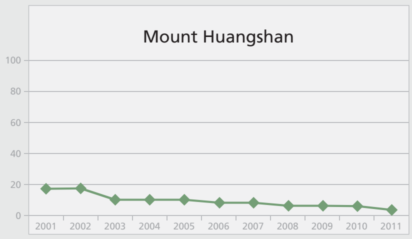


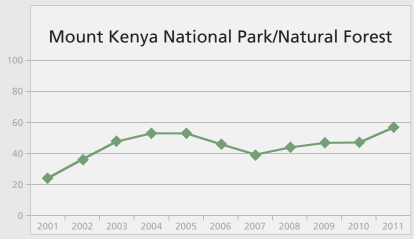












Vertical axis: 0-100 (0 = lowest concern, 100 = greatest concern)
Horizontal axis: Years 2001–2011
▲ = danger list

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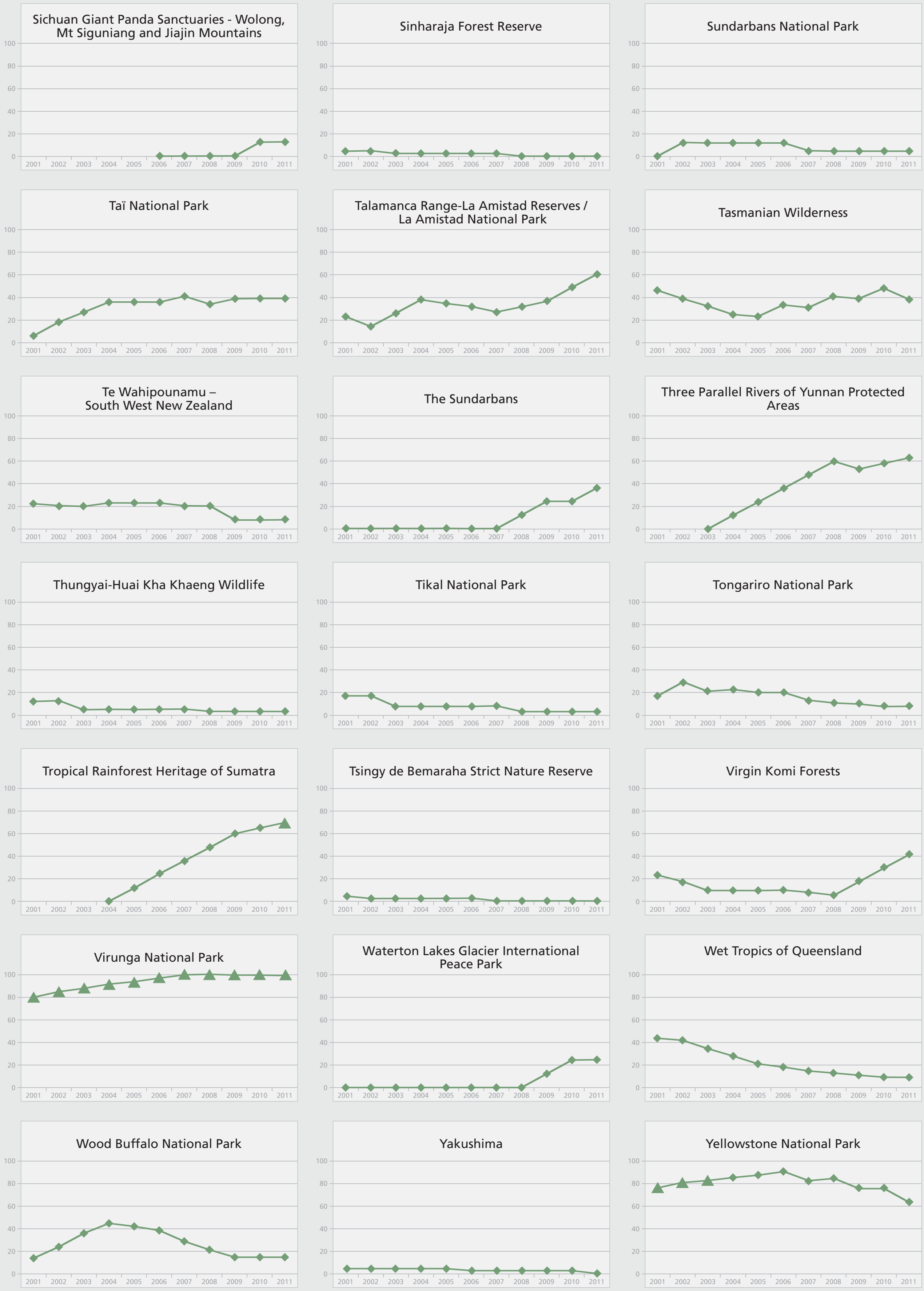

Vertical axis: 0-100 (0 = lowest concern, 100 = greatest concern)
Horizontal axis: Years 2001–2011
▲ = danger list

Annex IV: Forests Previously Identified for Potential Inclusion onto the World Heritage List

by Romy Horn
UNESCO World Heritage Centre

Since 1997, four different initiatives focusing on identifying potential World Heritage forest sites around the world have been undertaken. The full reports of these efforts are available in the last World Heritage Forest report [1]. This annex presents a short overview of these initiatives to give the reader a rapid overview of their content and potential value.

A global overview of forest protected areas on the World Heritage List (1997)

The earliest effort carried out by Thorsell and Sigaty in 1997 [2] was based on the authors' knowledge of protected forests worldwide and resulted in a comprehensive database showing potential forest sites listed by biogeographical realm. Some of the sites identified in this report have since been inscribed, such as Kinabalu National Park in Malaysia.

World Heritage Forest meeting, Berastagi (1998)

This compilation was developed during the 1998 Berastagi meeting (Indonesia) in 1998 that concentrated exclusively on tropical forests with a potential for inscription onto the World Heritage List. The concluding statement acknowledged that tropical forests were already fairly well represented on the List. However, gaps could still be identified and the Convention should therefore aim for a truly representative 'network' of tropical forests under World Heritage protection. Participants not only suggested potential new forest sites but also recommended that the World Heritage Centre prioritize the management of existing sites, hence ensuring the maintenance of their Outstanding Universal Value.

Expert Meeting on Boreal Forests, St.Petersburg (2003)

In 2003, an expert meeting was held in St. Petersburg (Russian Federation) with the objective of identifying boreal forests with the potential for inscription onto the World Heritage List. This initiative mainly involved four countries: Canada, Finland, Norway and Russia. The expert group highlighted the great threat boreal ecosystems faced due to industrial activities and climate change, and reminded the international community of the great urgency concerning their protection. The panel made several recommendations to the World Heritage Centre, States Parties, site managers and IUCN, and identified a list of twelve potential new sites, five proposals for expansions, and seven sites warranting further evaluation.

Review of the World Heritage Network, IUCN and UNEP (2004)

Following those meetings, IUCN and UNEP carried out a more systematic approach in 2004, identifying potential natural World Heritage sites. For this approach, existing World Heritage sites were cross-referenced against a variety of classification schemes of world ecosystems, biodiversity hotspots, and others. This study highlights areas with exceptional biotic values and those with still little existing World Heritage coverage [3]. The study concluded that priority consideration for inscription of additional World Heritage forest sites should be given to:

- Madagascar moist forests
- Forests in southern Chile and southern Argentina
- Dry and moist forests in New Caledonia
- Western Ghats forests (India)

Of the sites named above, Madagascar (Rainforests of Atsinanana) had a successful inscription in 2007, and the World Heritage Committee requested further improvements from India on the Western Ghats in 2011.

1. UNESCO. 2007. *World Heritage Forests – Leveraging Conservation at the Landscape Level*. World Heritage Report 21. UNESCO, Paris. Available online: http://whc.unesco.org/uploads/activities/documents/activity-43-8.pdf
2. IUCN, 1997. *A global overview of forest protected areas on the World Heritage List*. IUCN, Gland. Available online: http://data.iucn.org/dbtw-wpd/edocs/WH-WP-003.pdf
3. UNEP-WCMC: http://quin.unep-wcmc.org/protected_areas/world_heritage/wh_review.htm

Annex V: World Heritage Forest Sites Coinciding with Ramsar Sites and/or Biosphere Reserves

Both the World Heritage and the Convention on Wetlands of International Importance (Ramsar Convention) are multilateral environmental agreements that focus on site-based conservation, and are managed through rigorous intergovernmental political and technical review processes. When effectively leveraged these conventions can be powerful tools in helping advance conservation programmes.

Biosphere Reserves are managed under the Man and the Biosphere (MAB) Programme at UNESCO, and are governed by a non-legally binding international coordination council. The MAB programme focuses on encouraging site-based sustainable development within a network of Biosphere Reserves.

When World Heritage forest sites coincide with Ramsar sites or Biosphere Reserves, there may be opportunities to leverage additional support for conservation efforts by tapping into either the constituencies of the corresponding Convention or programme, or by strengthening an argument for conservation measures under consideration. To this end, providing a ready list of World Heritage forest sites that coincide with Ramsar sites and/or Biosphere Reserves can serve as a tool to facilitate the work of World Heritage forest conservation stakeholders.

This compilation was created using available information online and enhanced thanks to the direct contributions of the MAB Programme and the Secretariat of the Ramsar Convention. The table only shows those World Heritage Forest Sites where there is at least some overlap between World Heritage sites and Ramsar sites or Biosphere Reserves. In some rare cases, the Biosphere Reserve has the exact same boundaries as the World Heritage forest site (i.e. Dja Faunal Reserve, Cameroon).

World Heritage Forest Site	Country
Fraser Island	Australia
Kakadu National Park	Australia
The Sundarbans	Bangladesh
Beloveshskaya Pushcha/Bialowieza Forest	Belarus/Poland
Atlantic Forest South-East Reserves	Brazil
Central Amazon Conservation Complex	Brazil
Cerrado PAs: Chapada dos Veadeiros and Empas NPs	Brazil
Discovery Coast Atlantic Forest Reserves	Brazil
Pantanal Conservation Area	Brazil
Pirin National Park	Bulgaria
Dja Faunal Reserve	Cameroon
Wood Buffalo National Park	Canada
Waterton Lakes Glacier International Peace Park	Canada/USA
Huanglong Scenic and Historical Interest Area	China
Jiuzhaigou Valley Scenic and Historic Interest Area	China
Mount Wuyi	China
Sichuan Giant Panda Sanctuaries	China
Three Parallel Rivers of Yunnan Protected Areas	China
Cocos Island National Park	Costa Rica
Talamanca Range - La Amistad Reserves/ La Amistad National Park	Costa Rica/Panama
Comoe National Park	Cote d'Ivoire
Tai National Park	Cote d'Ivoire
Mount Nimba Strict Nature Reserve	Cote d'Ivoire/Guinea
Alejandro de Humboldt National Park	Cuba
Virunga National Park	Democratic Rep. of Congo
Primeval Beech Forests of the Carpathians	Germany/Slovakia/Ukraine
Tikal National Park	Guatemala
Rio Platano Biosphere Reserve	Honduras
Nanda Devi and Valley of Flowers National Parks	India
Sundarbans National Park	India
Tropical Rainforest Heritage of Sumatra	Indonesia
Yakushima	Japan
Mount Kenya National Park/Natural Forest	Kenya
Monarch Butterfly Biosphere Reserve	Mexico
Sian Ka'an Biosphere Reserve	Mexico
Durmitor National Park	Montenegro
Royal Chitwan National Park	Nepal
Darien National Park	Panama
Manu National Park	Peru
Puerto - Princesa Subterranean River National Park	Phillipines
Laurisilva of Madeira	Portugal
Central Sikhote-Alin	Russian Federation
Lake Baikal	Russian Federation
Virgin Komi Forests	Russian Federation
Niokolo - Koba National Park	Senegal
iSimangaliso Wetland Park	South Africa
Sinharaja Forest Reserve	Sri Lanka
Rwenzori Mountains National Park	Uganda
Great Smoky Mountains National Park	USA
Olympic National Park	USA
Redwood National and State Parks	USA
Yellowstone National Park	USA

Correlations between World Heritage Forest Sites, Biosphere Reserves and Ramsar Sites[1]				
	BR[2]	RS[2]	Associated Biosphere Reserve(s)	RAMSAR Site(s) (Inscription Year)
	✓	✓	Great Sandy (2009)	Great Sandy Strait (1999)
		✓		Kakadu National Park (1980/1989)
		✓		Sundarbans Reserved Forest (1992)
	✓		Belarus: Belovezhskaya Pushcha (1993)	
	✓		Poland: Bialowieza (1976)	
	✓		Mata Atlântica, including Sao Paulo City Green Belt (1993; extension 2002)	
	✓		Central Amazon (2001)	
	✓		Cerrado (1993; extension 2000 and 2001)	
	✓		Mata Atlântica, including Sao Paulo City Green Belt (1993; extension 2002)	
	✓	✓	Pantanal (2000)	Pantanal Matogrossense (1993)
	✓		Doupki-Djindjiritza (1977)	
	✓		Dja Biosphere Reserve (1981)	
		✓		Whopping Crane Summer Range (1982)
		✓		Peace-Athabasca Delta (1982)
	✓		Canada: Waterton Biosphere Reserve and National Park (1979)	
	✓		USA: Glacier Biosphere Reserve and National Park (1976)	
	✓		Huanglong Biosphere Reserve (2000)	
	✓		Jiuzhaigou Valley (1997)	
	✓		Wuyishan National Reserve (1987)	
	✓		Wolong Nature Reserve (1979)	
	✓		Gaoligong Mountain (2000)	
		✓		Isla del Coco (1998)
	✓	✓	Costa Rica: La Amistad Biosphere Reserve and National Park (1982)	Costa Rica: Turberas de Talamanca (2003)
	✓		Panama: La Amistad Biosphere Reserve and National Park (2000)	
	✓		Comoé Biosphere Reserve (1983)	
	✓		Taï Biosphere Reserve (1977)	
	✓		Guinea: Monts Nimba (1980)	
	✓		Cuchillas del Toa Biosphere Reserve (1987)	
		✓		Parc national des Virunga (1996)
	✓		East Carpathians (1998)	
	✓	✓	Maya Biosphere Reserve (1990)	Parque Nacional Laguna del Tigre (1990)
	✓		Río Plátano Biosphere Reserve (1980)	
	✓		Nanda Devi (2004)	
	✓	✓	Sundarban Biosphere Reserve (2001)	Sundarbans Reserved Forest (1992)
	✓	✓	Gunung Leuser Biosphere Reserve (1981)	Berbak (1992)
	✓		Giam Siak Kecil-Bukit Batu Biosphere Reserve (2009)	
			Yakushima Island Biosphere Reserve (1980)	Yakushima Nagata-hama (2005)
	✓		Mount Kenya Biosphere Reserve (1978)	
	✓		Mariposa Monarca (2006)	
			Sian Ka'an (1986)	Sian Ka'an (2003)
	✓		Tara River Basin (1976)	
		✓		Gokyo and associated lakes (2007)
	✓		Darién (1983)	
	✓		Manu Biosphere Reserve (1977)	
	✓		Palawan (1990)	
	✓		Santana Madeira (2011)	
	✓		Sikhote-Alin Biosphere Reserve (1978)	
	✓	✓	Baikalsky State Biosphere Reserve (1986)	Selenga Delta (1994)
	✓		Barguzinsky State Biosphere Reserve (1986)	
	✓		Pechoro-Ilychskiy (1984)	
	✓		Niokolo-Koba (1981)	
		✓		St. Lucia System (1986)
		✓		Turtle Beaches/Coral Reefs of Tongaland (1986)
		✓		Kosi Bay (1991)
		✓		Lake Sibaya (1991)
	✓		Sinharaja Biosphere Reserve (1978)	
		✓		Rwenzori Mountains Ramsar Site (2009)
	✓		Southern Appalachian (1989)	
	✓		Olympic Biosphere Reserve (1976)	
	✓		California Coast Ranges (1983)	
	✓		Yellowstone Biosphere Reserve (1976)	

1. June 2011. This table with the associated URL for each BR and RS is available online: http://whc.unesco.org/en/forests

2. **BR** = Biosphere Reserve, **RS** = Ramsar Site

Annex VI: Cultural World Heritage Sites with Significant Forest Cover

by Nicolas Flack
UN Online Volunteer

The table below illustrates those cultural World Heritage sites that have significant forest cover. It was developed by carrying out a desktop study of nomination files, and by cross checking accompanying maps with the descriptive text. Google Earth was occasionally used to corroborate figures obtained, or to improve the estimate of forest cover. Figures for the surface area of forest cover are indicative only.

Though the World Heritage Forest Programme focuses exclusively on World Heritage sites inscribed under natural heritage criteria, this does not imply that sites inscribed under cultural heritage criteria are devoid of forest cover. Forests included in cultural heritage sites may enjoy protection afforded by the World Heritage Convention, particularly if the Outstanding Universal Value of the site in question relates in part to the presence of forest cover. A closer inspection of a site's statement of Outstanding Universal Value would help identify such sites.

Name (Year of Inscription)	Country
Madriu-Perafita-Claror Valley (2004)	Andorra
Hallstatt-Dachstein / Salzkammergut Cultural Landscape (1997)	Austria
Semmering Railway (1998)	Austria
Serra da Capivara National Park (1991)	Brazil
Temple of Preah Vihear (2008)	Cambodia
Capital Cities and Tombs of the Ancient Koguryo Kingdom (2004)	China
Lushan National Park (1996)	China
Mount Wutai (2009)	China
West Lake Cultural Landscape of Hangzhou (2011)	China
The Great Wall (1987)	China
Coffee Cultural Landscape of Colombia (2011)	Colombia
Stari Grad Plain (2008)	Croatia
Lednice-Valtice Cultural Landscape (1996)	Czech Republic
Konso Cultural Landscape (2011)	Ethiopia
Cistercian Abbey of Fontenay (1981)	France
The Causses and the Cévennes, Mediterranean agro-pastoral Cultural Landscape (2011)	France
Mines of Rammelsberg, Historic Town of Goslar and Upper Harz Water Management System (1992)	Germany
Upper Middle Rhine Valley (2002)	Germany
Mountain Railways of India (1999)	India
Rock Shelters of Bhimbetka (2003)	India
Cilento and Vallo di Diano National Park with the Archeological sites of Paestum and Velia, and the Certosa di Padula (1998)	Italy
Assisi, the Basilica of San Francesco and Other Franciscan Sites (2000)	Italy
Rhaetian Railway in the Albula / Bernina Landscapes (2008)	Italy/Switzerland
Historic Villages of Shirakawa-go and Gokayama (1995)	Japan
Itsukushima Shinto Shrine (1996)	Japan
Sacred Sites and Pilgrimage Routes in the Kii Mountain Range (2004)	Japan
Iwami Ginzan Silver Mine and its Cultural Landscape (2007)	Japan
Sacred Mijikenda Kaya Forests (2008)	Kenya
Gyeongju Historic Areas (2000)	Republic of Korea
Royal Tombs of the Joseon Dynasty (2009)	Republic of Korea
Vat Phou and Associated Ancient Settlements within the Champasak Cultural Landscape (2001)	Lao PDR
Curonian Spit (2000)	Lithuania/Russian Federation
Natural and Cultural Heritage of the Ohrid region (1979)3	Former Yugoslav Republic of Macedonia
Ancient Maya City of Calakmul, Campeche (2002)	Mexico
Cultural Landscape of Sintra (1995)	Portugal
Saloum Delta (2011)	Senegal
Cultural Landscape of the Serra de Tramuntana (2011)	Spain

Cultural World Heritage Sites with Significant Forest Cover

Forest cover (ha)[1]	Type[2]	Notes
4 000	Tmp	Site contains high open pastures and steep wooded valleys.
20 000	Tmp	Extensive upland forests; outstanding example of a natural landscape.
8 500	Tmp	Buffer zone appears to be predominantly forest.
319 000	Tr	Dense thorny scrubland vegetation with a predominance of semi-arid vegetation. Relict isolated patches of forest cover survive in a few deep, narrow canyons.
2 700	Tr	Buffer zone appears to be predominantly forest.
14 000	Tmp	Represent a perfect blending of human creation and nature either with the rocks or with forests and rivers.
15 000	Tmp	One of the spiritual centres of Chinese civilization; cultural landscape of outstanding aesthetic value, interspersed with forest cover (scenic area of 30,200 ha).
42 000	Tmp	Contains thick forests of vertical pines, firs, poplar and willow trees, and lush grassland.
1 500	Sbt	Vegetation includes subtropical evergreen broadleaved forest; there are many old and rare trees around West Lake, most of which are closely associated with temples and monasteries.
25 000	Tmp	The Wall is surrounded by vegetation, often forests, at a length of more than 5000 km.
60 000	Tr	The region houses a significant number of native forests and biological corridors; Valle del Cauca mountain humid forest; Valle del Cauca tropical dry forest.
2 000	Tmp	From visual estimation, the buffer zone appears to have significant forest cover.
5 000	Tmp	Landscape site; important element in the appearance of the area is the very wide range of native and exotic tree species but likely restricted to rather small areas.
2 000	Tr	Traditionally protected forests (Sacred Forests)
1 000	Tmp	The buffer zone mainly consists of forest.
60 000	Tmp	Mountain landscape interspersed by deep valleys that is representative of the relationship between agro-pastoral systems and their biophysical environment.
2 500	Tmp	Buffer zone around the mines and Goslar largely consists of forest.
5 000	Tmp	Coppice forests and nature conservation areas are included in the property of 27,250 ha as well as remnants of riverside forests.
1 000	Tmp	11 km densely forested section from Sukna to beyond Rongtong and a 30 km alpine section to Darjeeling, which is dominated by stands of Himalayan pine and tea gardens.
10 000	Tmp	Many of the rock shelters within the area are set within fairly dense forest, which displays a high diversity of flora and fauna.
50 000	Tmp	Site (159,110 ha) split into three locations, which include fields as well as significant forested areas.
2 000	Tmp	Property includes 'Parco del Monte Subasio', which is mostly covered by forest.
2 000	Tmp	Railway line stretches for around 67 km through various terrain including forest.
4 000	Tmp	Buffer zone appears to be mostly covered by forest.
2 600	Tmp	Buffer zone includes the whole island, which appears to be mostly forested.
1 000	Tmp	Site is surrounded by dense forest.
3 000	Tmp	Site is surrounded by densly forested mountains, forming the buffer zone.
1 500	Sbt	Consist of 11 separate forest sites spread over some 200 km, ranging in size from 30 to around 300 ha.
2 000	Tmp	Mount Namsan is part of the property and mostly covered by forest.
3 000	Tmp	Spots of outstanding natural beauty were chosen for the tombs; core and buffer zone appear to be partly covered by forest (core zone: 1,891 ha; buffer zone: 4,660 ha).
10 000	Tr	Mountain zone is largely covered by old forest; the plain contains some secondary or bamboo forests (39000 ha).
20 000	Tmp	Reforestation projects in the nineteenth century; at the present time more than half the ridge is forested.
15 000	Tmp	From visual estimate by Google Map, approximately half of the inscribed property is part of Ohrid Lake.
147 000	Tr	An important Maya site set deep in the tropical forest of the Tierras Bajas of southern Mexico. Located within the Calakmul Biosphere Reserve.
3 500	Tmp	Three relevant ecological areas: an area of pinewood, a natural forest of various species (oak, pine, chestnut), and an area colonized by the forest tree species plus olives.
55 000	Tr	Mangrove forests and dry forests.
10 000	Sbt	Mediterranean woodland vegetation with forests of evergreen Balearic holm oak and riverine forest, with the additional presence of wooded pine groves.

1. Surface area is approximate, based on nomination file information and visual estimate from maps and/or Google Earth. This figure is indicative and serves to give the reader a sense of the relative size of the forested area within the property.
2. **Tmp** = Temperate, **Tr** = Tropical, **Sbt** = Subtropical

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Rapport sur la prévision et la gestion des effets du changement climatique sur le patrimoine mondial et Stratégie pour aider les États parties à mettre en œuvre des réactions de gestion adaptées
(In English and French) May 2007

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Enhancing our Heritage Toolkit
Assessing management effectiveness of natural World Heritage sites
(In English) May 2008; (In French) November 2008; (In Spanish) October 2009

World Heritage papers 24

L'art rupestre dans les Caraïbes
Vers une inscription transnationale en série sur la Liste du patrimoine mondial de l'UNESCO
Rock Art in the Caribbean
Towards a serial transnational nomination to the UNESCO World Heritage List
Arte Rupestre en el Caribe
Hacia una nominación transnacional seriada a la Lista del Patrimonio Mundial de la UNESCO
(In French, English and Spanish) June 2008

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World Heritage and Buffer Zones
Patrimoine mondial et zones tampons
(In English and French) April 2009

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World Heritage Cultural Landscapes
A Handbook for Conservation and Management
(In English) December 2009

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Managing Historic Cities
Gérer les villes historiques
(In English and French) September 2010

World Heritage papers 28

Navigating the Future of Marine World Heritage
Results from the first World Heritage Marine Site Managers Meeting
Honolulu, Hawaii, 1-3 December 2010
(In English) May 2011

World Heritage papers 29

Human Evolution: Adaptations, Dispersals and Social Developments (HEADS)
World Heritage Thematic Programme
Evolución Humana: Adaptaciones, Migraciones y Desarrollos Sociales
Programa Temático de Patrimonio Mundial
(In English and Spanish) June 2011

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