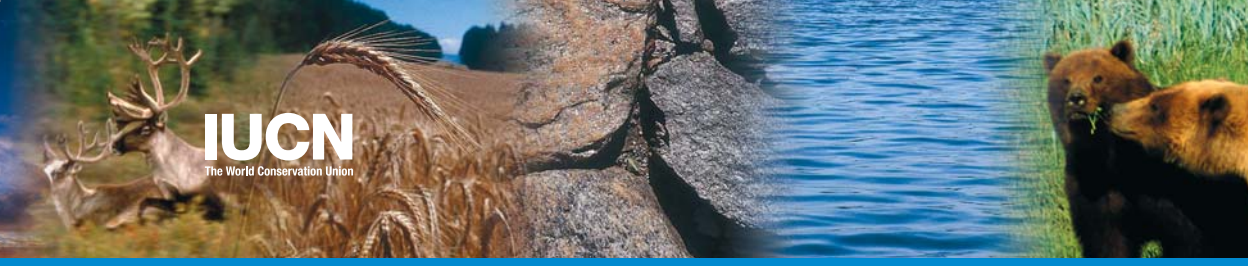
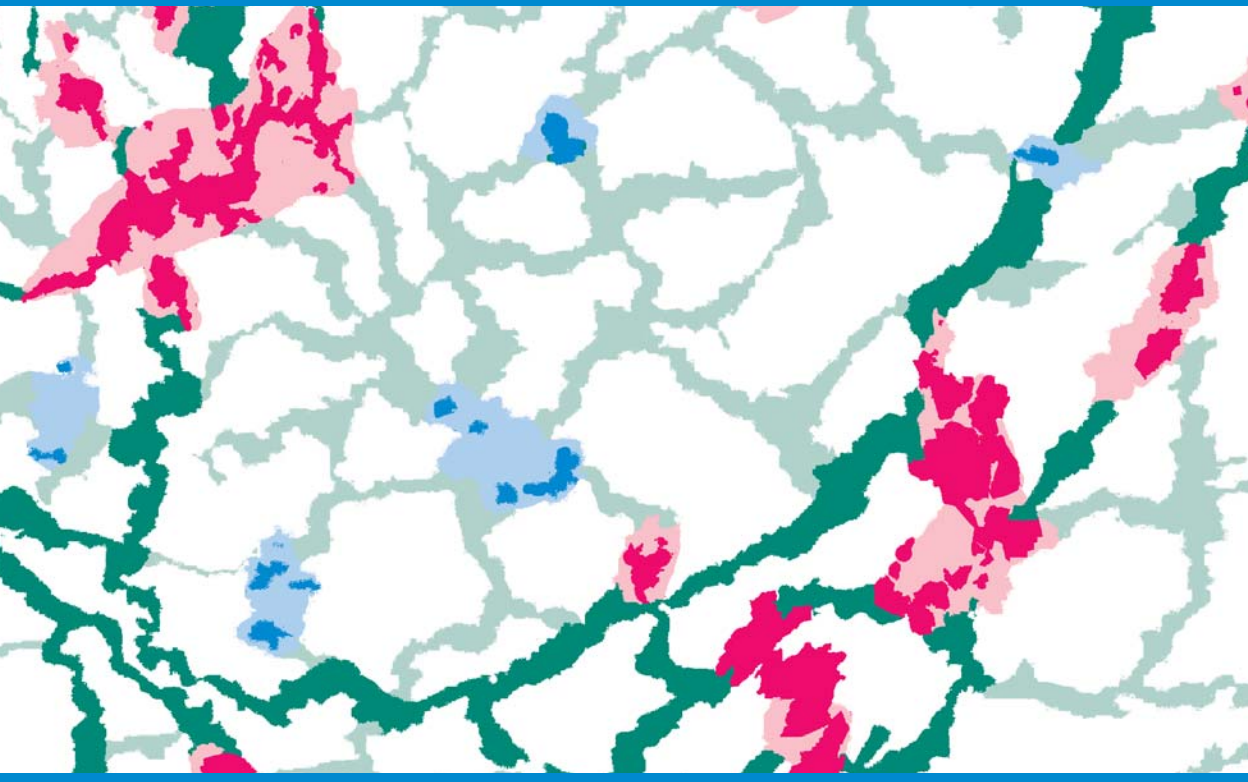


Integrating Biodiversity Conservation and Sustainable Use

Lessons Learned From Ecological Networks



Graham Bennett

Integrating Biodiversity Conservation and Sustainable Use

Lessons Learned From Ecological Networks

The designation of geographical entities in this book, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of IUCN concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The views expressed in this publication do not necessarily reflect those of IUCN.

This publication has been made possible by funding from the Ministry of Foreign Affairs and the Ministry of Agriculture, Nature and Food Quality, Netherlands.

Published by
IUCN, Gland, Switzerland, and Cambridge, UK, in collaboration with Syzygy, Netherlands

Citation
Graham Bennett. (2004). *Integrating Biodiversity Conservation and Sustainable Use: Lessons Learned From Ecological Networks.* IUCN, Gland, Switzerland, and Cambridge, UK. vi + 55 pp.

ISBN
2-8317-0765-X

Layout by
Marc Hegemans, Haarlem, Netherlands

Printed by
Albani drukkers BV, The Hague, Netherlands

Illustrations
The Baltic Ecological Networks: Arne Ader (photographs), IUCN Office for Central Europe (maps). **The Vilcabamba-Amboró Conservation Corridor:** Conservation International; **Tri-DOM:** Paul Scholte (photographs), UNDP-GEF (map); **The Far East Ecoregion:** WWF Russia; **Mesoamerican Biological Corridor:** the Mesoamerican Biological Corridor Coordination Office (maps), Rob Glastra (page 28 top, page 45 left), Juan Pablo Moreira (page 49 left); **Y2Y:** Yellowstone to Yukon Conservation Initiative, American Wildlands (map page 35); **The Terai Arc Landscape:** Esther Blom (page 36 top), Wim Blom (page 36 bottom), Bernadette Botman (page 37), WWF Nepal (map), Resources Himalaya (page 38); **The Green Wood:** Ministry of Agriculture, Nature and Food Quality, Netherlands (map page 40), M. Klijn (page 41 left and right, page 42), H. Smeding (page 41 centre), Province of North Brabant (maps pages 41 and 42).

Available from
IUCN Publications Services Unit
219c Huntingdon Road
Cambridge CB3 ODL
United Kingdom
Tel.: +44 1223 277894
Fax: +44 1223 277175
E-mail: books@.iucn.org
www.iucn.org/bookstore

A catalogue of IUCN publications is also available

IUCN
The World Conservation Union

Commission on Ecosystem Management

Syzygy

Integrating Biodiversity Conservation and Sustainable Use

Lessons Learned From Ecological Networks

Graham Bennett

IUCN – The World Conservation Union 2004

Contents

1 Foreword

4 Introduction: Defining Objectives, Applying Principles

11 The Baltic Ecological Networks: Estonia, Latvia and Lithuania

16 Peru and Bolivia: the Vilcabamba-Amboró Conservation Corridor

20 The Congo Basin: Tri-DOM

24 Russia: the Far East Ecoregion

28 Central America: The Mesoamerican Biological Corridor

32 North America: Y2Y

36 Nepal: the Terai Arc Landscape

40 The Netherlands: the Green Wood

44 Experience With Ecological Networks: Initial Lessons Learned

53 Further Reading

54 Acknowledgements

Foreword

Protected areas have long been one of the main strategies for safeguarding the world's biodiversity. But pressures on the environment caused by economic development and other human activities make it difficult to protect natural areas that are large enough to accommodate entire ecosystems. On the other hand ecosystems need to be treated with care, because they provide goods and services that are vitally important for human well-being.

This has been acknowledged by IUCN's World Commission on Protected Areas (WCPA) by integrating both sustainable use and conservation in IUCN's Protected Area classification system. This system identifies six categories of Protected Areas ranging from Category I, 'Strict Nature Reserve' that focus on protection, to Category VI, 'Managed Resource Protected Area' that allow for sustainable use of natural resources.

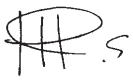
However, we have to look beyond boundaries. IUCN's Vth World Parks Congress in Durban, South Africa (September 2003) concluded that parks should not exist as unique islands, but need to be planned and managed as an integral part of the broader landscape. Ecological networks provide an operational model for conserving biodiversity that is based on ecological principles and allow a degree of human use of the landscape. This combination makes the concept of ecological networks a useful instrument for the implementation of the Convention of Biological Diversity and contributes to the intention of the World Summit on Sustainable Development held in Johannesburg in 2002.

This publication illustrates the development of several ecological networks around the world. It demonstrates the benefits of these networks, not only for conservation purposes, but also for sustainable development. Although the concept is relatively new and needs more time to fully crystallise, these examples indicate that investments in ecological networks yield benefits, not only because of the biodiversity they conserve but also because of the essential ecological services they provide to local communities, thereby contributing to poverty alleviation.

But how should these ecological networks be managed? The Ecosystem Approach, endorsed by the Parties to the Convention on Biological Diversity at its fifth meeting in Nairobi, Kenya (May 2000), is designed to balance conservation, sustainable use and equitable benefit sharing of genetic resources. It looks beyond the boundaries of Protected Areas and promotes inter-sectoral cooperation, while placing humans at the centre of conservation efforts. As such it is the ideal tool for designing and implementing effective ecological networks. IUCN's Commission on Ecosystem Management (CEM) has therefore dedicated its work to the promotion of the application of the Ecosystem Approach.

Because of the ever-increasing pressure on nature, habitat fragmentation will become more and more of a threat to sustainable development and biodiversity conservation. Ecological networks are an answer to successfully safeguard our natural treasures and contribute to human well-being.

Achim Steiner
Director General of IUCN –
The World Conservation Union



Hillary M. Masundire
Chair, IUCN Commission
on Ecosystem Management

Introduction

Defining Objectives, Applying Principles

This publication is a response to the widely expressed interest within the conservation and development communities for an evaluation of practical experience in applying models that aim to conserve ecosystem processes in human-exploited landscapes as a means of conserving biodiversity and securing the sustainable use of natural resources. The interest stems from the fact that this approach is being increasingly applied around the world in an ever-more diverse array of circumstances and often at an ambitious scale.

An Evolving International Consensus

The importance of strengthening ecological coherence and resilience as necessary conditions for both biodiversity conservation and sustainable development has attracted growing attention in recent years in a wide range of conservation and development fora. The World Summit on Sustainable Development, that was held in Johannesburg in September 2002, adopted the goal of securing by 2010 a significant reduction in the current rate of biodiversity loss. In setting out how this can be achieved within the context of sustainable development, the Johannesburg Plan of Implementation called for the promotion of 'national and regional ecological networks and corridors'.

The most important biodiversity conservation instrument, the Convention on Biological Diversity, also recognizes the value of ecological coherence as a means of achieving the Convention's three objectives – the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. Although the Convention itself does not specify the exact means by which these objectives are to be achieved, its implementing mechanism is working to promote the strengthening of ecological coherence. For example, in 2002 the Conference of the Parties to the Convention recommended that, in order to conserve forest biological diversity, 'ecological corridors' should be developed on a national and regional basis.

With regard to broader implementation approaches, in 2000 the Conference of the Parties identified the Ecosystem Approach as the primary framework for the implementation of the Convention and recommended the application of its principles. The Ecosystem Approach can be regarded as a strategy for the management of land, water and living resources that promotes conservation and sustainable use in an equitable way. At the heart of the approach is the awareness that, without the effective management of ecosystems, there can be no economic development that generates sustainable human and social welfare; equally,

without the full engagement of diverse sectors in the economy and society in the management of ecosystems, there can be no effective biodiversity conservation. In that sense, the Ecosystem Approach is a framework for holistic decision-making and action.

From Consensus to Action

The evolution of an international consensus on the most appropriate objectives and principles for securing biodiversity conservation and sustainable development marks a major step forward. However, applying the principles and achieving the objectives will only be feasible if a way can be found to translate these broad frameworks into appropriate actions on the ground. To what extent is practical experience offering useful lessons in how this can best be done?

Various operational models are providing useful lessons in implementing this broad approach. Six can be identified as most closely matching the Convention's objectives and the principles of the Ecosystem Approach and which are being widely applied in practice, namely Biosphere Reserves, ecological networks, reserve networks, bioregional planning, biological or conservation corridors and Ecoregion-Based Conservation.

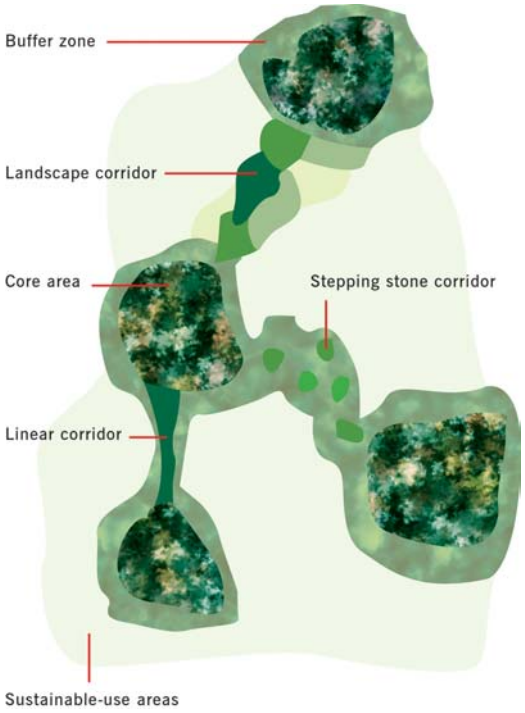
- **Biosphere Reserves** were launched by UNESCO's 1974 Man and Biosphere Programme which recognized the need to reconcile the conservation of areas that are host to valuable biodiversity with local land-use needs through the delineation of core areas, buffer areas and transition zones.
- **Ecological networks** were developed in several European countries in the 1970s and 1980s where a strong land-use planning tradition had created the institutional environment for allocating functions at the landscape scale and where, particularly in Western Europe, habitats were becoming severely fragmented by the high intensity of economic development.
- **Reserve networks** were developed in North America in the 1980s, primarily with the aim of conserving biodiversity at the regional scale, particularly in wilderness areas. They are, however, being increasingly applied to human-impacted landscapes.
- **Bioregional planning** has been developed primarily in the US and focuses on the process of planning and managing the protection of ecosystem services and biodiversity at the bioregional scale – that is, a geographic area that, on the basis of its ecology and community and government structure, forms an appropriate management unit.
- **Biological (or conservation) corridors** reflect a comparable approach that since the 1980s has been applied in developing regions.
- **Ecoregion-Based Conservation** is an approach developed by WWF in the late 1990s that is being applied to the task of conserving 'ecoregions' – that is, relatively large units of land or water that harbour a characteristic set of species, communities, dynamics and environmental conditions, of which WWF has identified 238 in its 'Global 200' programme.

Despite the differences in terminology, these approaches share a core vision on how best to integrate the conservation of biodiversity with sustainable development. That is, they all focus conservation action on those areas and on those species communities that harbour environmental values which are crucial to the maintenance of ecological functions and, in the long term, to human welfare. At the same time, they delineate human activities in such a way that they are both economically viable and ecologically sustainable. To a large extent the different terms represent variations in scope or emphasis rather than any essential differences in the basic approach. This common vision is reflected in the goal of applying a shared land-management model that can best be formulated as follows:

A coherent system of natural and/or semi-natural landscape elements that is configured and managed with the objective of maintaining or restoring ecological functions as a means to conserve biodiversity while also providing appropriate opportunities for the sustainable use of natural resources.

More importantly, the approaches also share a common understanding of how this model should be applied on the ground, namely through the allocation of specific functions to different areas, depending on their ecological value and their natural-resource potential. These functions are reflected in a coherent system of areal components:

- **core areas**, where the conservation of biodiversity takes primary importance, even if the area is not legally protected
- **corridors**, which serve to maintain vital ecological or environmental connections by providing physical (though not necessarily linear) linkages between the core areas
- **buffer zones**, which protect the network from potentially damaging external influences and which are essentially transitional areas characterized by compatible land uses.
- **sustainable-use areas**, where sufficient opportunities are provided within the landscape matrix for both the exploitation of natural resources and the maintenance of ecosystem functions.



This functional approach therefore maintains ecosystem processes by conserving a representative array of habitats, allowing species populations access to a sufficient area of habitat (for foraging, the dispersal of juveniles or the recolonization of other habitat patches), allowing seasonal migration, permitting genetic exchange between different local populations, allowing local populations to move away from a degrading habitat (caused, for example, by global warming) and securing the integrity of vital environmental processes (such as periodic flooding). In addition to this conservation dimension, the approaches identify appropriate opportunities within the landscape matrix for the exploitation of natural resources – agriculture, forestry, fishing, human settlement, recreation et al. If these activities are planned and managed in a sensitive way and at an appropriate scale, they offer the prospect of securing the sustainable use of natural resources.

Although where feasible this review will refer to specific examples by using their own preferred terminology, it will be necessary for practical purposes to use a generic term when referring to and discussing the common approach. In these circumstances, the term 'ecological network' will be used, which reflects the terminology used by IUCN, the Conference of the Parties to the Convention on Biological Diversity and the World Summit on Sustainable Development.

Ecological Networks and Protected Areas

A key issue that these developments raise are the implications of the Convention, the Ecosystem Approach and ecological networks for the central pillar of biodiversity conservation – the protected area. This is a matter that concerns not simply how conservation and development strategies should best be applied in territorial terms. It has far broader implications, such as for law, institutional structures, the allocation of funds, planning mechanisms, poverty alleviation, policy integration and the role of indigenous peoples. However, there are good reasons for arguing that the two approaches should be seen less as competitors than as allies that, in the longer term, will benefit from a substantial degree of synergy.

Two points are worth emphasizing here. First, it is clear that protected-area management itself has undergone a revolution over the past decades. Today there is a broad and growing awareness that the protection of individual biological elements – such as sites and threatened species – is in many cases not succeeding in arresting the decline in biodiversity. The traditional view that regards protected areas as islands of nature fenced off from a threatening world is already regarded as far too limited by a substantial proportion of the protected-

areas community. Second, in order to strengthen their role in conserving biodiversity, reserves are increasingly being designated and managed as systems of protected areas. That is to say, the thrust of protected-area policy in many countries or regions is moving towards the goal of ensuring the conservation of a representative array of characteristic habitats and species populations. The result of these two developments is that, within the protected-areas community, a broad awareness has arisen of the need to embrace the ecological, social, economic and cultural context within which protected areas function as a means of improving their effectiveness.

Reviewing Experience

Faced with the fast-changing context of biodiversity conservation and the pressing need for securing sustainable development, the question arises of what role the ecological network can play. With over 150 landscape-scale or regional networks under development around the world, it would seem a straightforward question to answer. However, despite the fast-growing number of ecological-network programmes, no comprehensive evaluation of the model's effectiveness has yet been published.

There are, in fact, very good reasons why such an evaluation has yet to appear. Most obviously, until a few years ago relatively few ecological networks had been developed, so in practice there was little to evaluate that could be of relevance to a broad audience. A second very apparent difficulty is that most ecological networks are being developed at a scale that invariably requires an implementing programme which extends over many years, if not decades. Such initiatives not only cover huge areas, they involve large numbers of stakeholders, making process management a major challenge. Demonstrable and testable results on the ground are therefore, anno 2004, few and far between.

But although it may still be too early for a comprehensive evaluation, the large number of ecological networks now under development offer the possibility of assessing a variety of examples and highlighting lessons from practice that can inform interested parties and may be of value in guiding further work. That is the purpose of this review.

Within this limited remit, it was clearly not feasible to carry out comparative analyses of different methodologies or to rigorously test the measured or claimed results of the initiatives. Rather, a group of ecological networks were selected that together represent as wide a range of operational circumstances as possible. These therefore serve as illustrations of the rich experience that is being gained in the large number of ecological-network programmes around the world.

The ecological networks selected for review

Ecological Network	Main Features
The Baltic ecological networks	The three national networks in Estonia, Latvia and Lithuania are of special interest for their institutionalization within the countries' land-use planning systems. It was in Estonia that the very first ecological network was developed.
The Vilcabamba-Amboró Conservation Corridor	Located in in the Tropical Andes Hotspot, the Corridor is being developed in one of the world's richest concentrations of biodiversity.
Tri-DOM	The Dja-Odzala-Minkébé ecological network is a tri-national programme in Africa's Congo Basin, a region in which a large tract of primary rainforest is under severe pressure from hunting and logging.
The Far East Ecoregion	Extending across four of Russia's southeastern provinces, this programme is attempting to develop an ecological network in a region that is in both transition and institutional crisis.
The Mesoamerican Biological Corridor	The programme is an ambitious eight-country initiative that grew out of an integrated multilateral vision for constructing a secure and sustainable future for the region.
Y2Y	The Yellowstone to Yukon Conservation Initiative is a visionary NGO-programme that aims to conserve the US and Canadian Rockies, North America's last remaining intact mountain ecosystem.
The Terai Arc Landscape	The programme is being developed in Nepal, an extremely poor region in which the promotion of community action is the key to biodiversity conservation and sustainable development.
The Green Wood	Located in the south of the Netherlands, the example illustrates how a national ecological network is being implemented at the local level in a densely populated industrialized country.

This sample of ecological networks has important implications for the lessons that can be drawn from practical experience. Most of the ecological networks that are in a relatively advanced stage of development and implementation are to be found in industrial countries and are shaped by the need to respond to a high level of ecological fragmentation. By contrast, all of the known initiatives in developing countries, including those included in this review, are still in an early phase of development. Moreover, they are being applied to large, relatively intact ecosystems that are coming under increasing pressure from expanding populations, underdevelopment and large-scale natural resource exploitation. This choice places certain limitations on the conclusions that can be drawn, but a review that focused only on the most advanced networks would inevitably be very restricted in the range of circumstances in which ecological networks are being developed and the challenges that are being faced.

The initial lessons that can be learned from these programmes are discussed in the final chapter. These observations concern not only the extent to which experience is justifying expectations with regard to conserving biodiversity on the ground, but also the progress that is being achieved in securing the sustainable use of natural resources, the process of reforming and strengthening institutions, the way in which the challenge of developing appropriate management processes is being met, the manner in which tensions between the need for urgent protection and poverty-alleviation actions and investing in longer-term objectives are being resolved, and the extent to which communities are becoming actively involved and committed to the programmes.

The Baltic Ecological Networks

Estonia, Latvia and Lithuania

Pioneering the Network Model Through Land-Use Planning

Ecological networks have a long history in the Baltic region. Indeed, it was through Estonia's 'Network of Ecologically Compensating Areas' that the ecological network concept was first developed over 30 years ago. Lithuania developed a comparable approach in the early 1980s with its 'Nature Frame' and Latvia followed in the 1990s with its 'Complex Territorial Scheme of Nature Protection'. Today, that work is the basis of a wide range of implementing actions, not only at the local level but also at the continental scale through the Pan-European Ecological Network.

Baltic Biodiversity

In comparison with Europe as a whole, biodiversity in the Baltic states is still rich. Characteristic habitats include raised bogs, wooded meadows, extensive wetlands and broad-leaved forests. The main reasons for this high level of habitat diversity are the long-standing traditional forms of land-use combined with the multiple environmental gradients that characterize the region, such as the long, relatively undisturbed coastline, the high soil differentiation, the varied topography and the various water regimes.

Estuary of the River Emajõgi

The wide range of habitats, many of which are still relatively undisturbed, means that various species that are threatened at the continental or global scale are still relatively abundant in the three countries. These include the wolf , the lynx, the otter, the beaver, the black stork, the corncrake, the lesser-spotted eagle and the crane. A wide range of amphibians can be found and also an exceptionally rich meadow flora – in Estonia almost 700 species, in Lithuania over 500 species.

The beaver

Economic Development

In European terms, population density in the Baltic states is low. This, combined with the relatively low level of economic development, has allowed an extensive system of protected areas to be built up and maintained. However, the independence of the

three Baltic states in 1991 and the initiation of political and institutional reforms marked the start of a long period of severe economic difficulties. One of the results of this transitionary phase is that agriculture has come under severe economic pressure, and this in turn is threatening many valuable semi-natural habitats which were managed through traditional agricultural practices. Forest habitats are also coming under increasing threat: almost half the forests are now privately owned, but illegal logging and the regulatory regimes to promote sustainable forms of forestry management are still lacking in effectiveness.

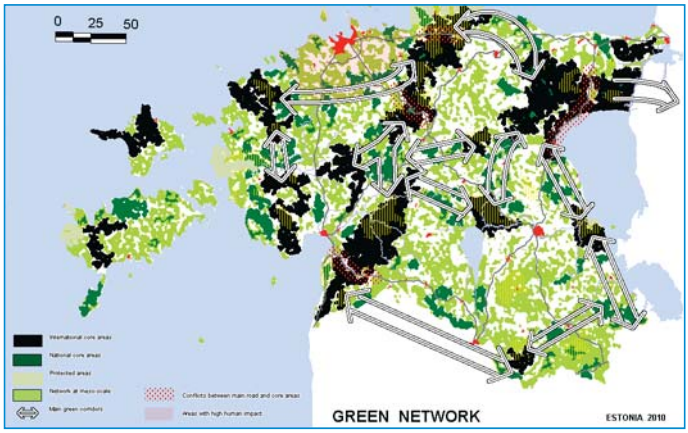
The Estonian Green Network

The disintegration of strong planning institutions and the long period of political reconstruction created enormous problems for the development and implementation of the national ecological networks. It was not until new legislation was adopted in the three states in the years following independence that serious work could be resumed. The Estonian 'Green Network', as it is now known, illustrates how these three ecological networks have survived the transition and are now being refined and realized on the ground.

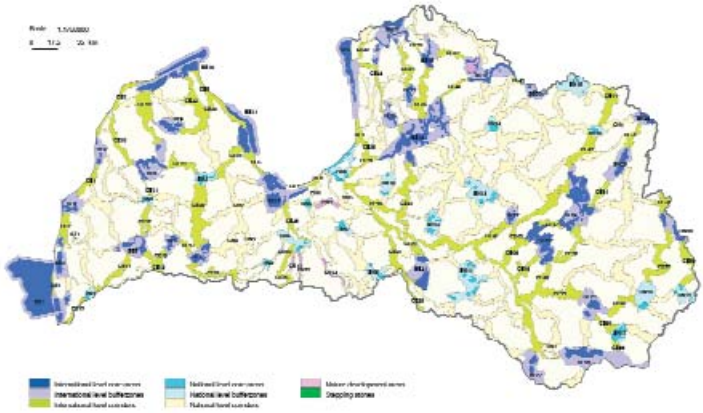
Given the long tradition of land-use planning and its strong institutions, the Green Network has been developed from its inception as a spatial-planning tool for the purpose of balancing and integrating land uses. The implementation strategy was interrupted by the events of the early 1990s, and it required a reform of Estonian political institions and legislation to be able to establish a new implementing framework. Since then, the network has been incorporated into new spatial planning and environmental legislation, mainly the 1995 Sustainable Development Act, the 1994 Protection of Natural Features Act and the 1995 Planning and Building Act. In addition, the network has been the subject of policy papers such as the National Environmental Strategy (which includes an indicative map of the Green Network), the Environmental Action Plan and Estonia – Vision 2010. The National Agri-Environmental Programme further provides for the development of ecological networks at the local level as a way of supporting extensive farming practices. Since 1995, the development of the Pan-European Ecological Network has further stimulated the process.

The three Baltic ecological networks

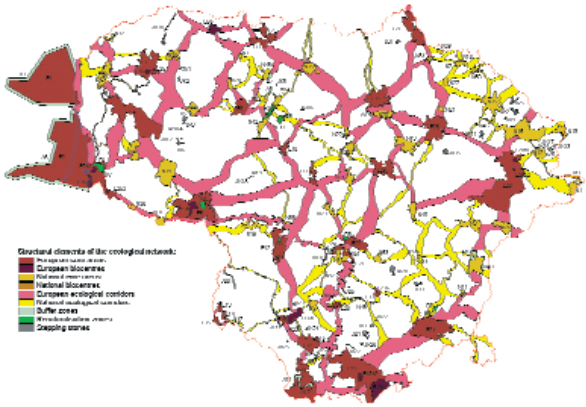
Estonia



Latvia



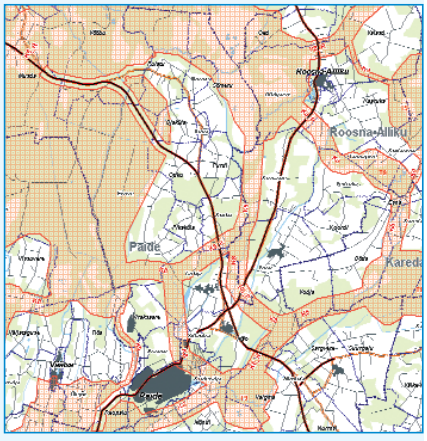
Lithuania



The Estonian ecological network, as it is currently delineated, covers about 50 per cent of the country's territory and is structured to achieve the following objectives:

- to shape the spatial structure of natural areas in order to meet ecological, environmental, economic and social goals
- to establish a fully functioning network of protected areas that are an integral part of a complete system with natural areas
- to protect valuable natural habitats and to preserve the migration routes of wild animals and valuable landscapes
- to mitigate human impacts on biodiversity and promote sustainable development
- to promote biodiversity-friendly management, lifestyles and recreation by ensuring access to natural areas
- to promote biodiversity conservation outside protected areas
- to use spatial planning as a means to minimize conflicts between different sectors
- to guide human settlement and land use
- to maintain the natural environment's self-regulatory capacity
- to promote international cooperation.

The network's national-scale core areas have been identified and delineated mainly on the basis of the size of the natural areas and their conservation value. Of these core areas, 12 are of international importance, each covering at least 100 square kilometres. Other core areas are at least 15 square kilometres in extent.



Järva County ecological network

A Local Example

The way in which the network is being implemented on the ground is best shown through an example of county planning. Järva County is situated in central Estonia and extends across three river basins – the Pärnu, the Põltsammaa and the Jägala. Every county is required by the end of 2003 to prepare a Green Network map at a scale of 1:50,000 as a framework for defining the conditions that are necessary to ensure sustainable development in their region. Four levels of core area are delineated together with interlinking corridors. These corridors are configured on the basis of data on the needs of species for dispersal and migration and the existence of natural linkages, including

'stepping stones' in the landscape. Public hearings on the configuration of the network are held to ensure that local views are incorporated into the plan, and account is also taken of the 1995 Protection of Marine and Freshwater Coasts, Shores and Banks Act that provides for corridors and buffer zones in relation to surface water.

By being part of the spatial planning process, the county network sets out the conditions that will apply to the regulation of land use in the development-planning process. This is particularly concerned with reducing conflicts between different land-use demands within the network, with the appropriate intensity of land uses and with how serious conflicts of interest – such as between a road and a wildlife corridor – should be resolved in a structural way. The specific measures adopted in the final plan for Järva County were approved by the national government in 2003, with the result that the plan now has the force of law.

Further information

- K. Sepp & A. Kaasik. 2002. *Development of National Ecological Networks in the Baltic Countries in the Framework of the Pan-European Ecological Network*. IUCN Regional Office for Central Europe, Warsaw
- M. Külvik. 2002. *Ecological Networks in Estonia – Concepts and Applications.* Tartu University Press, Tartu
- www.iucn-ce.org.pl

Peru and Bolivia

The Vilcabamba-Amboró Conservation Corridor

Conserving the Heart of the Tropical Andes

The Tropical Andes Hotspot has been called the 'global epicentre of biodiversity'. Encompassing an area of over a million square kilometres, the region runs from Venezuela through Colombia, Ecuador, Peru and Bolivia to northern Argentina. Bordered in the west by the 1000-metre altitude contour and in the east by the Amazonian lowlands, the region is a treasure trove of biological diversity.

The Vilcabamba-Amboro Forest Ecosystem

At the core of the hotspot, covering about a quarter of its area, is the Vilcabamba-Amboró Forest Ecosystem. This system extends from the Vilcabamba mountain range in south-central Peru southeast to Amboró National Park in central Bolivia. The vegetation of the region follows a gradient from lowland to the snow line – from tropical moist forests through cloud-forest formations to alpine grassland and scrubland. Other vegetation types, such as the unique dry *Polylepis* forests, are found at higher elevations. Species diversity is exceptional: in the 17,000-square-kilometre Manu National Park, over a thousand species of birds have been identified and in the Tambopata reserve about 1200 species of butterflies. The characteristic animal species include the vicuña, the spectacled bear, the mountain tapir, the jaguar, the black spider monkey, the giant river otter, the pink river dolphin, the condor, the harpy eagle and the black caiman – all now rare or endangered.

Land clearance in the tropical Andes

Human Pressures

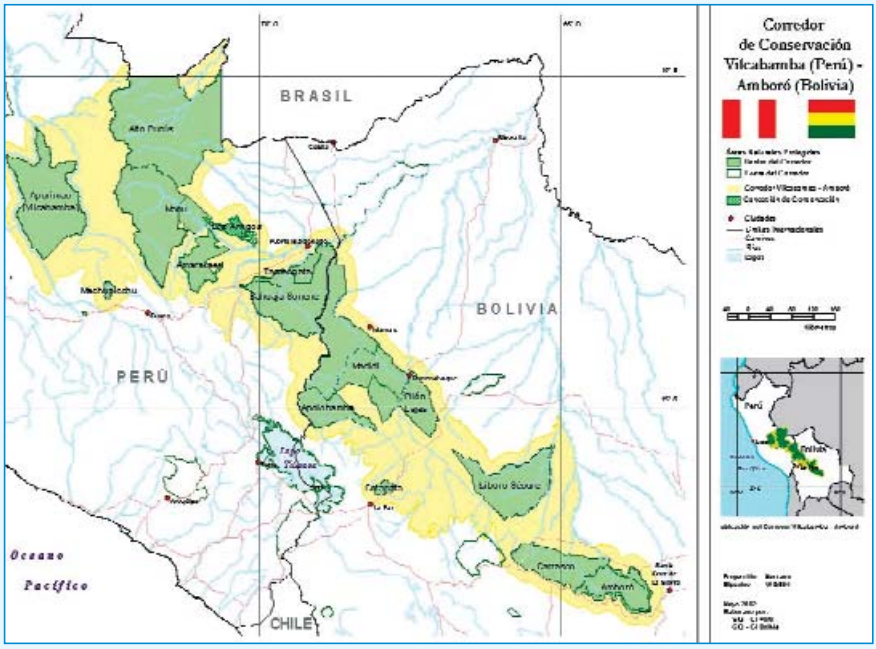
Outside of the major cities, this huge region is inhabited by less than two million people. Culturally, the population is made up of about 40 different ethnic groups that reflect a rich cultural diversity. They include uncontacted indigenous communities who wish to remain isolated.

Although the population is relatively small, human pressure is having a significant impact on the region's biodiversity. Direct threats include oil and gas exploitation, gold mining, logging, dam and road construction and the associated colonization (such as the Río Branco-Puerto Maldonado-Pacific Coast highway in Peru). Even the boundaries of protected areas are increasingly violated by expanding human settlements, economic activities and new roads. The forests themselves are becoming victim to illegal logging, overharvesting of heart of palms, commercial hunting and wildlife trafficking, land invasion and agricultural expansion – including illegal coca cultivation. The largest-known gas reserves in South America are located in Camisea, Peru, in the northern part of the region. Gold mining is poorly controlled, as is logging.

The Conservation Corridor

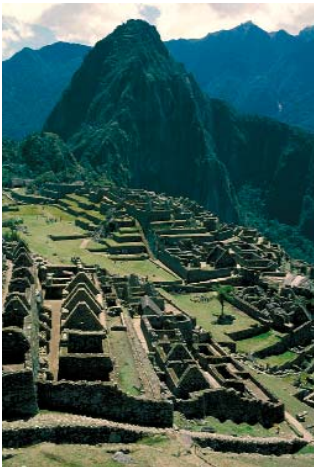
The first initiatives to address the destruction and fragmentation of habitats and restore ecological coherence in the southern part of the hotspot were launched in the mid-1990s when several large protected areas were established and a proposal was drawn up to create a transfrontier reserve. In 1998, the Organization of American States funded a proposal that involved the creation of a transboundary Biosphere Reserve which incorporated corridors and buffer zones into its configuration. These developments evolved into a more ambitious programme called the Vilcabamba-Amboró Conservation Corridor with the main funding provided by a range of international donors.

In developing the Vilcabamba-Amboró strategy, use was made of a wide range of technical resources, including GIS mapping, biological inventories, socio-economic analyses, environmental impact assessments, workshop facilitation, environmental education and media campaigns. The strategy itself extends far beyond biodiversity conservation, emphasizing the need to develop strong social and cultural cohesion between local groups and the source of their livelihoods. An essential aspect of the process is the active involvement of the traditional park services, the nature conservation departments and the land-use planning, land-reform and forestry agencies and local communities. Informal dialogues have been established with the mining and the oil and gas sectors.



The Vilcabamba-Amboró Conservation Corridor

The Conservation Corridor is built up around large protected-area complexes composed of protected areas, multiple-use areas and indigenous peoples' reserves. Protected-area coverage in the region has expanded from 59,000 square kilometers in early 1990 to around 150,000 square kilometers in 2001, in part due to the Corridor initiatives. There are now 16 protected areas, which can be considered as the core areas of the Conservation Corridor. Three of the protected areas are also indigenous reserves and six each cover over 10,000 square kilometres.
A number of adjacent protected areas comprise two unfragmented complexes of over 40,000 square kilometres each, and a series of Inca and pre-Inca archaeological sites are also located in the network, including the world-famous Machu Picchu.



Machu Picchu

Implementing Actions

The next phase in the development of the Vilcabamba-Amboró Conservation Corridor is the preparation of detailed action plans. However, this will first require further dissemination of the approach and securing greater involvement and commitment by the government departments responsible for economic development, by local administrations and communities, and also by the private sector. The first steps in this direction are already being taken through the programme's internal website and joint baseline monitoring.

A good example of actions that are now being taken in the field is the trans-national agreement that was signed in April 2002 by the directors of three protected areas to jointly coordinate and implement management efforts. The agreement includes joint patrols along the boundaries of the three areas, development of a master plan for two national parks, a training course on monitoring for park rangers and exchange of information on biodiversity threats. It also includes joint actions to directly benefit communities, such as an evaluation of ecotourism in two areas and socio-economic research on the catch of *paiche*, a commercially valuable fish species.

The key to successful implementation in the two countries will be the full participation of the protected areas and municipalities in a land-use planning process that integrates biodiversity conservation with sustainable development. Bolivia has provided some valuable experience in this respect with the participation of municipalities in protected-area management and support for municipal development plans that the protected areas are providing.

Further Information

- Critical Ecosystems Partnership Fund. 2000. *Ecosystem Profile: Vilcabamba-Amboró Forest Ecosystem of the Tropical Andes Biodiversity Hotspot. Peru and Bolivia.* Critical Ecosystem Partnership Fund, Washington DC
- N. Myers et al. 2000. 'Biodiversity Hotspots for Conservation Priorities'. Nature, 403, 853–858
- www.cepf.net; www.conservation.org
- www.biodiversityhotspots.org
- www.gefweb.org
- www.worldbank.org
- www.panda.org

The Congo Basin

Tri-DOM

Sustainable Rainforest Management in the Cameroon-Gabon-Congo Interzone

The region centred around the junction of Cameroon, Gabon and Congo harbours the largest tract of primary tropical rainforest in Africa. Extending over an area of 160,000 square kilometres across the Dja, Ivindo and Mambili river basins, the forest hosts biodiversity of global importance. However, despite the fact that about a fifth of the area is under protection, the rainforest is becoming seriously threatened by human activities. The creation of a transboundary ecological network in collaboration with local communities and the protected-area management authorities is offering the prospect of reconciling the conservation of the forest ecosystem with both natural-resource exploitation and the interests of the local people.

The interzone rainforest

Elephants in bai

The Biodiversity of the Interzone Rainforest

The interzone rainforest is home to a wide range of characteristic African mammals. These include the world's largest remaining populations of forest elephants, gorillas, chimpanzees and forest buffalo. The region's last population of lions also lives in the vicinity, as does the only known population of forest hyena.

Ba'aka hunting blue duiker

Ba'aka collecting medicinal plants

The forest's flora is also exceptionally rich. In the Dja region of Cameroon four major types of plant formations have been identified, including characteristic species of the Atlantic zone (such as coula and ozigo), species characteristic of semi-deciduous forests (such as obeche) and of Congolese forests (such as limbali). Interestingly, over 300 plants are used for medicinal purposes in the region and about 70 for human consumption. Of ecological importance throughout most of the region are sites known as *bais* – clearings, usually swampy, covered with herbaceous vegetation which is very attractive to forest elephants, gorillas and bongo.

Local Peoples and Threats

The local population comprises Ba'aka and Bakola pygmies who were formerly hunter-gatherers but are now becoming increasingly settled. There are a number of Bantu tribes with whom the pygmies have a complex, interdependent relationship. The Ba'aka inhabit the extreme north of Gabon, southern Cameroon and northwestern Congo; the Bakola inhabit northeastern Gabon and adjacent areas in Congo. Ba'aka and Bakola pygmies are heavily involved in bush-meat and ivory hunting and work on plantations for Bantu patrons. The Bantu also cultivate small plots of cocoa under shade, although the crop is highly dependent on world market prices. In addition, some slash-and-burn agriculture is still practised.

The most serious threats to the rainforest are hunting and logging. Commercial hunting is the cause of serious losses among the larger animals. Logging, although relatively underdeveloped in the region, is becoming more extensive as more and more forestry concessions are being granted. Together with the increase in logging comes the construction of access roads, which fragment the forest and increase the opportunities for hunting still further.

The Genesis of the Ecological Network

The current management of the forest is being secured mainly through several protected areas that have an aggregate area of 30,000 square kilometres – 19 per cent of the total extent of the forest. However, in all three countries severe limitations in institutional capacity are a major impediment to effective management. This results not only in inadequate patrolling and monitoring levels, but also in limited transboundary consultation and collaboration between the management agencies in the three countries and a failure to actively involve the most important stakeholders, particularly logging companies and hunters, in the management of the protected areas and the surrounding region.

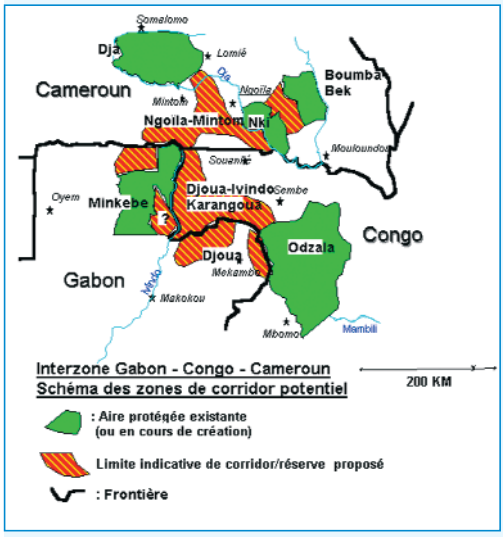
The urgent need to secure biodiversity conservation and sustainable development in this increasingly vulnerable forest persuaded various conservation NGOs in the mid-1990s to launch an initiative to establish an ecological network across the region that could provide the framework for effective, long-term management. The initiative was first discussed at the political level between the Water and Forestry Departments of the three countries at the meeting of Ecosystèmes Forestiers d'Afrique Centrale (ECOFAC) in Libreville in April 1997 and several follow-up meetings. These discussions resulted in March 1999 in the adoption by the three governments of the Yaoundé Declaration in which they formally committed themselves to:

- apply the principles of biodiversity conservation and sustainable management to the forest ecosystems in Central Africa
- accelerate the process of creating transboundary protected areas between the three countries
- reinforce sustainable management in the existing protected areas
- control large-scale poaching and any other unsustainable use of forest resources
- involve all stakeholders in these efforts.

The rainforest

Developing the Network

The Yaoundé Declaration objectives will be realized through the Tri-DOM ecological network. A new tri-lateral coordination unit is being established to facilitate cooperation between the agencies in the three countries. WWF and ECOFAC have been requested by the three governments to provide expert assistance in formulating and implementing the programme with financing through the Global Environment Facility and bilateral donors.



The Tri-DOM ecological network

The network is to be established over a period of 10 years. Plans provide for the establishment of a physical network of 40,000 square kilometres in extent together with a complementary management strategy that will apply to a total of 130,000 square kilometres. The immediate priority for action will be the areas that lie between the existing protected areas of Ngoïla-Mintom (Cameroon), Ivindo-Karangoua-Djoua (Congo) and the Djoua (Gabon), since these zones have a rich fauna, a sparse human population and a relatively low potential for logging – circumstances that offer a good opportunity for establishing linkages between the existing protected areas. The creation of buffer zones and the strengthening of the land-use planning system will take on a prominent role on the network development strategy. Parallel to these priority actions, the initiative will develop programmes to increase institutional capacity, improve trans-boundary coordination, encourage community participation and link the work to international developments (such as carbon sequestration programmes).

Further Information

- Kamdem Toham, A., et al. 2001. *Biological Priorities for Conservation in the Guinean-Congolian Forest and Freshwater Region. March 30–April 2, 2000. Libreville, Gabon.* WWF-US/CARPO, Washington, DC
- Kamdem Toham, A., et al. 2003. 'Forest Conservation in the Congo Basin'. Science, 299:346
- www.worldwildlife.org/ecoregions/

Russia

The Far East Ecoregion

Conserving the Home of the Amur Tiger on Russia's Pacific Rim

Across large tracts of Russia, habitat fragmentation is not yet the critical problem that it is in most Western countries. As a result, many ecosystems still exist in a more or less pristine state. However, the radical changes that have unfolded in the region over the past decade present new challenges for natural-resource management. One result is an increasing interest in ecological networks as a way of guiding land management, promoting sustainable development and conserving the region's biodiversity. This in turn persuaded WWF to initiate a programme to establish ecological networks in seven regions across Russia. The areas selected for the projects are all of high biodiversity value, but also represent a wide range of cultural diversity, including indigenous communities. One of these is the Far East Ecoregion, located in Russia's outermost southeastern provinces that are bounded by the Pacific Ocean to the east and by China to the south and west.

The Far East Ecoregion

The Far East Ecoregion

The Far East Ecoregion covers over 1.3 million square kilometres. Two-thirds of the region is mountainous – some peaks extending above 2000 metres – and it enjoys a monsoon climate which feeds the Amur river basin. The striking variation in landscapes and micro-climates has produced a high level of biological diversity in the region's prairies, mixed broadleaf forests, moraines, alpine tundra, intricate coastline and over 60,000 lakes.

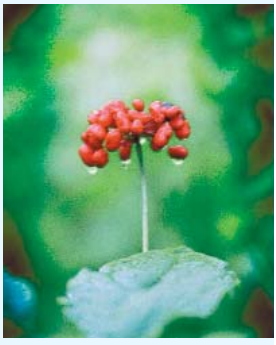
The region's temperate forests are among the richest in the world. Characteristic mammals include the Amur tiger, the Asiatic black bear, the brown bear, the Far Eastern leopard, the goral and the Amur wild cat. Of the 400 bird species found in the ecoregion, many are endangered, such as Blakiston's fish owl and the white-tailed sea eagle.

The Amur tiger

Population and Economic Development

Nearly five million people live in the Far East Eco-region. This is some five per cent less than ten years ago due to emigration to more prosperous parts of the country. Indigenous people make up about two per cent of the total population, most living in communities along the middle and upper reaches of the rivers and the northern mountain boreal areas where they depend mainly on hunting or mining.

Historically, the most important natural resources have been furs, agricultural land, precious metals, timber, fish and non-ferrous metals. Although fishing in the Amur river basin – mainly for salmon and sturgeon – was an important source of income, overfishing and pollution cut yields dramatically in the course of the twentieth century. More recently, the region has become an important transit route, with the Trans-Siberian and Amur-Baikal railways linking western Eurasia with the Pacific coast. Several large ports are located along the Amur river.



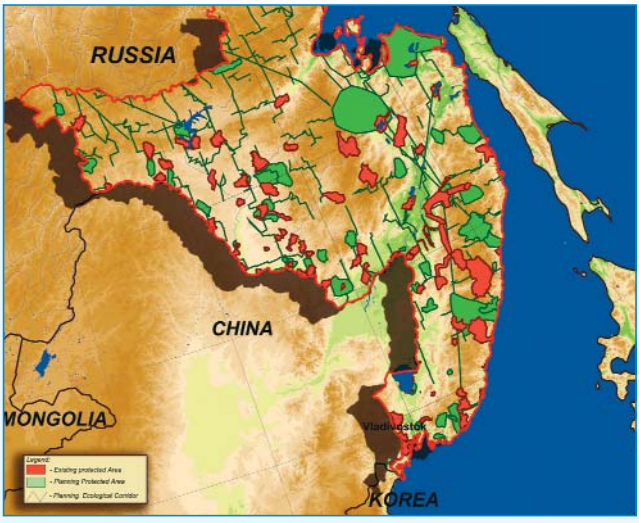
Ginseng

Currently, the main economic sectors are coal and non-ferrous metals production, although these are generally managed in a non-sustainable way and cause serious environmental impacts. The region's extensive forests are mostly production forests. However, the economic problems of recent years have resulted in a lower federal forestry budget which has forced the regional administrations to take on a greater responsibility for forest management. Hunting and illegal trafficking are poorly regulated, and as a consequence endangered species such as the tiger and the medicinal plant ginseng are coming under even greater pressure.

Developing the Conservation Action Plan

The development of the Far East Ecoregion ecological network was initiated in 1998 making use of WWF's Ecoregion-Based Conservation approach. A biodiversity assessment was prepared to identify the focal species and species of special concern, the key environmental processes and the priority areas for conservation action. A parallel socio-economic assessment identified the main threats to biodiversity, the priority actions required to mitigate human impacts and the roles of the various stakeholders. On the basis of these assessments, a biodiversity vision was drawn up to establish qualitative long-term conservation objectives for the region in collaboration with the main stakeholders – government bodies, NGOs, international organizations, research institutes, business and the media.

The results of the work were brought together in 2003 in a Conservation Action Plan, which sets out the strategies, the immediate actions, the short- and medium-term conservation targets and the responsible coordinating actors. In order to supervise the finalization and implementation of the plan, the Ecoregional Council for Sustainable Nature Use was established in May 2002. Participating in the Council are representatives of federal and provincial governments, scientists and NGOs. Although it was unrealistic to secure unanimous agreement on all the recommendations, most of the recommendations in the Action Plan enjoyed broad endorsement from the stakeholders.



The proposed Far East Ecoregion ecological network

The final strategic element of the Ecoregion-Based Conservation process is to delineate an ecological network for the ecoregion, which is identified as a short-term priority action by the Conservation Action Plan. A provisional ecological network has been developed and is currently under consideration by the Eco-regional Council. The network is projected to be fully implemented by 2020, with the main areas being under protection or appropriate management by 2010. The following medium-term targets have been defined:

- to protect 20 per cent of the temperate forests, 10 per cent of the boreal forests and 30 per cent of wetlands in a physical network that is protected by buffer zones
- the network should be capable of supporting full-scale assemblages of characteristic species and ecological processes
- sufficient forest areas are to be maintained so as to support viable populations of the Amur tiger and Far Eastern leopard
- three transboundary nature reserves along the Russian-Chinese border should function as a green corridor along the Amur river by 2012
- commercial forestry is economically viable, ecologically sound and in compliance with the FSC principles
- indigenous peoples and local communities should benefit from the sustainable use of the region's natural resources.

Much remains to be done if the Conservation Action Plan is to become reality. The central challenge is to persuade local communities and the key stakeholders in the natural-resource exploitation sectors that the vision of sustainable development set out in the action plan offers them a viable future. If this does become a shared vision, if institutional collaboration can be built on this basis, and if further external funding and new markets can be found, then the Far East Ecoregion can act as a pro-active force to shape a sustainable future for the region.

Further Information

- Y. Darman & L. Williams (eds.). 2003. *Conservation Action Plan for the Russian Far East Ecoregion Complex.* WWF Russia, Vladivostok
- Shestakov & V. Krever. 2003. *Ecological Networks in Russia: an Ecoregional Approach.* WWF Russia, Moscow
- www.wwf.ru

Central America

The Mesoamerican Biological Corridor

A Vision for Sustainable Development Across the Interamerican Land Bridge

Central America represents one of the world's richest concentrations of species and ecosystem diversity on a relatively small landmass. Over a period of many decades, however, this biological wealth has come under growing pressure through increasing population. The effects of these social pressures have been further exacerbated by the spread of inappropriate economic activities: extensive logging, the conversion of forests to coffee plantations and cattle ranching for beef exports, and the establishment of fast-growing timber, banana and oil-palm plantations. But with the ending of several armed conflicts in the region in the late 1980s, the opportunity arose to develop an integrated, regional approach to dealing with the region's social and environmental problems. The response was a visionary proposal for building a sustainable future – the Mesoamerican Biological Corridor.

Forest road, Costa Rica

Mesoamerican Biodiversity

Mesoamerica – the region encompassing Mexico's five southernmost states together with Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica and Panama – has a strategic position as a land bridge connecting the biotas of the two American continents. About 30 Mesoamerican ecoregions have been identified, an exceptionally large number for such a small landmass. These range from lowland rainforests through pine savannas, dry forests, high mountain forests and mangroves to grasslands and coastal ecosystems. Notably, the region is also one of the world's most important sources of agricultural crop species.

In terms of species richness, Mesoamerica hosts around 24,000 plant species, of which about 5000 are endemic. Vertebrate species include nearly 1200 birds, over 500 mammals, nearly 700 reptiles and well over 400 amphibians. About 40 per cent of these species are endemic. Many of these species are endangered, including the Caribbean manatee, the jaguar, Baird's tapir, the Central American spider monkey, the mantled howler monkey, the horned guan, the magnificent quetzal and Morelet's crocodile.

Morelet's crocodile

Culture, Population and a Vision for Sustainable Development

Historically, Mesoamerica has a long and rich cultural heritage, being home to the Olmec, Maya and Aztec empires. With a total population of 45 million people, population density is relatively high. About a quarter of the population are of indigenous origin and almost half the total population – and 71 per cent of the rural population – live below the poverty line, lacking access to basic health care, clean water and education. At the same time, the region's population growth is quite high at more than two per cent a year.

In 1994, the combination of the need for sustainable development and an unusually rich and threatened biodiversity persuaded the Wildlife Conservation Society and the Caribbean Conservation Corporation to launch the regional conservation project Paseo Pantera – Path of the Jaguar – that proposed linking existing protected areas along the Caribbean coast with wildlife corridors. This proposal was one of the topics discussed at an ecological summit of the Central American countries that took place the same year. Out of this summit came the ALIDES plan, which had as its objectives the promotion of peace, the strengthening of democracy and the protection of the Central American environment. These developments encouraged the Mexican government to join the initiative in 1995, and in 1997 what had now become known as the Mesoamerican Biological Corridor was formally endorsed by all eight heads of state as a framework for protecting biodiversity and maintaining ecosystem services, while at the same time improving the lives of Central Americans.

The Biological Corridor

A programme to implement the Corridor was officially launched in 1999. A regional coordinating unit to develop and monitor policies and actions was established in Managua, Nicaragua, working through national liaison offices in each country. The plan for establishing the Mesoamerican Biological Corridor distinguishes four kinds of zones: core areas, buffer zones, corridors and multiple-use areas, which at the regional level make up an indicative configuration for the Biological Corridor. Together they cover an area of 208,000 square kilometres, or 27 per cent of Mesoamerican territory. The basic elements of the Corridor are the region's 368 protected areas, 18 of which are larger than 1000 square kilometres. Within this area can be found 26 indigenous groups and all the major Maya sites, such as Tikal, Chichén Itza and Copán.

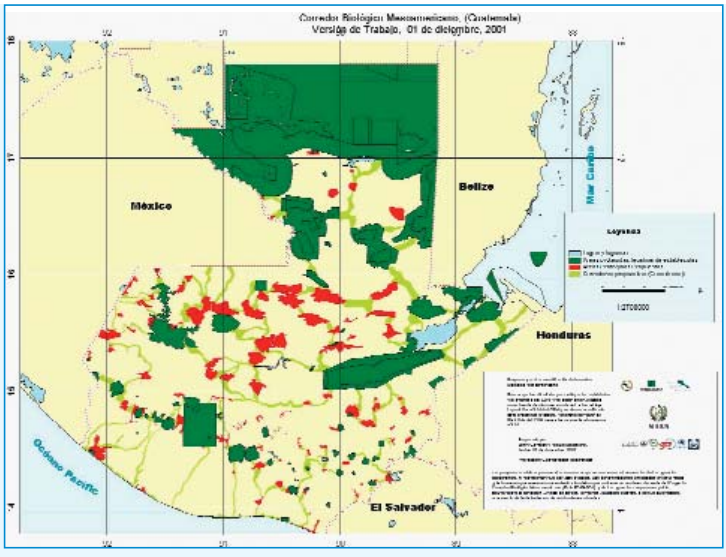
At the national level, programmes are being developed in order to elaborate the strategic plan for the Mesoamerican Biological Corridor. For example, projects in the buffer zones, corridors and multiple-use areas encourage land users to test and adopt management practices that are both biodiversity-friendly and economically viable, using incentives such as environmental service payments. These include the use of community concessions for harvesting non-timber forest products such as xate, wildberries and allspice in the Maya Forest and

layered-cropping farming and combinations of timber trees and shade coffee in Guatemala, Costa Rica and El Salvador. Local projects include the 1500-strong Small Farmers' Association of Talamanca in Costa Rica, which is now producing 20 per cent of the world's organic cocoa. At the same time, smallholders are being organized into producer associations that are capable of competing on the world market. Costa Rica is supporting management measures by private land owners whose land is located in corridors which have been delineated in the national ecological network.

The Mesoamerican Biological Corridor

The Mesoamerican Biological Corridor also aims to conserve the natural resources of the Mesoamerican Barrier Reef, which are of exceptional diversity but are threatened by inappropriate coastal development, unsustainable tourist development, overfishing and pollution. Recognizing these serious threats, the heads of state of Mexico, Honduras, Belize and Guatemala signed the Tulum Declaration in 1997 that provided for a single management system for the entire reef. The four countries are strengthening and coordinating their national policies, regulations and institutional arrangements for marine ecosystem conservation and sustainable use in order to facilitate the conservation and sustainable development of the reef.


The management area of the Mesoamerican Barrier Reef



The Guatemalan part of the biological corridor

Implementation Challenges

Despite the inspirational nature of the Mesoamerican Biological Corridor, many problems remain to be resolved. Some stakeholders and policy-makers remain to be convinced of the programme's benefits and are wary of its likely impact on their interests. Also, many projects are implemented in relative isolation. An evaluation in 2001 was broadly positive but identified eight key issues that the programme needs to address if it is to achieve its objectives, namely:

- reconciling stakeholder interests
- fostering democratic governance and enabling civil society participation
- catalyzing information for participatory decision-making
- clarifying the function of the land-use categories
- addressing property rights and land-tenure issues
- capturing benefits from ecosystem goods and services
- harmonizing institutional and legal frameworks and promoting intersectoral cooperation
- setting investment and management priorities.

The evaluation nevertheless concluded that the initiative had built a strong foundation through actively solliciting the support of a wide range of stakeholders and actors. Its involvement of local groups – farmers, organizations of indigenous peoples, municipalities and local companies – offers the main key to the initiative's success.

Further Information

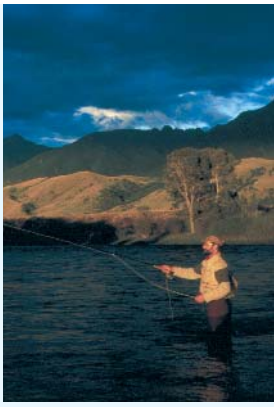
- Inter-American Development Bank and World Bank 2001. *The Mesoamerican Biological Corridor as a Vector for Sustainable Development in the Region: the Role of International Financing.* Analysis prepared for the IDB/World Bank seminar 'Sustainable Natural Resource Management at the Regional Level', Madrid
- K. Miller, E. Chang & N. Johnson. 2001. *Defining Common Ground for the Mesoamerican Biological Corridor.* World Resources Institute, Washington DC
- www.cepf.net
- www.conservation.org
- www.biodiversityhotspots.org
- www.gefweb.org
- www.worldbank.org
- www.panda.org
- www.mbrs.org.bz

North America

Y2Y

Maintaining the Integrity of North America's Last Intact Mountain Ecoregion

The Rocky Mountains represent an exceptionally rich natural and cultural heritage. The ecoregion itself stretches for 3200 kilometres south to north – from the Greater Yellowstone Ecosystem in Wyoming, across the Canadian border into Alberta and British Columbia and on to the Mackenzie Mountains in Yukon Territory, just crossing the Arctic Circle. This huge region of over a million square kilometres extends across three watersheds – the Atlantic, the Pacific and the Arctic – and six vegetation zones: alpine, subalpine, montane, the Great Plains, aspen parkland and boreal forest.



The Rocky Mountains

A native woman

Economic Transition

About 300 years ago the first white fur traders moved into the Rocky Mountains, drastically reducing the region's populations of beaver and bison. By the nineteenth century gold had been discovered in the Rocky Mountain West, and this led to a further influx of white traders and settlers and the expulsion of many native peoples from their traditional territories. Within a few decades, many tribes were forcibly restricted to reservations.

Today the region is inhabited by over four million people, including members of 31 Canadian First Nations and US Native American tribes. The main economic activities are mining, timber, agriculture, oil and gas. The oil and gas industry is expanding, and it is estimated that about 137,000 wells will have to be drilled over the next 15 years, which in turn will require an additional 440,000 kilometres of roads to be built. However, the highest growth rates in recent years have been in new technologies, information-based industries and tourism. In 1996, 78 million visitor days were recorded in the region's national and provincial forests – 30 per cent of which were devoted to hunting and fishing – and a further 37 million visitor days were recorded in the 10 national parks.

An important feature of the region's economy is the predominance of non-labour income in the form of returns from investment and pension payments. Together, these two sources not only account for almost three-quarters of all personal income, they are also the fastest growing sources of income. By contrast, less than five per cent of personal income is generated through mining, oil and gas, forestry and agriculture. The significance of this economic structure for the future management of the region is that inhabitants are increasingly in a position to live and work in the more scenic parts of the Rockies.

Biodiversity Under Threat

Significantly, the Rocky Mountains retain their full complement of native species, although local extinctions and endangered species are a serious cause for concern. Until a century ago, pumas, grizzly bears, wolverines and wolves were present throughout most of the region. Today, they only exist as potentially viable populations in the small number of protected areas in the northern Rockies. However, wolves require a huge territory and none of the existing national parks is large enough as a single unit to be able to support a viable population of these carnivores.

Puma

Moose

Falcon

Despite the protection offered by the 10 national parks and the dozens of state and provincial parks, wilderness areas and wildlife refuges, the effects of human activities are becoming increasingly apparent, particularly in the southern part of the region. It was these threats to the unique value of the Rocky Mountains that in 1993 inspired a group of scientists and conservationists to develop a 100-year conservation vision that applied the precepts of conservation biology to the Yellowstone-to-Yukon region – 'Y2Y'.

The Y2Y Vision

Y2Y strives to ensure that the Rocky Mountains continue to be capable of supporting all the region's natural and human communities. Sound science, sustainability and stewardship are key concepts in this vision, often expressed in the phrase 'co-existence in a healthy ecosystem'. Becoming operational in 1997, Y2Y is very much a grassroots initiative which now enjoys the support of 360 partners, about a half of which are organizations – primarily conservation NGOs, but also research institutes, First Nations and Native American tribes, companies and foundations. About 90 per cent of the funding has come from environmental foundations, with several substantial grants from government in the late 1990s.

The Y2Y ecoregion

To date, Y2Y has focused most of its resources on building a comprehensive and scientifically defensible 'Wildlife Network' (cores, corridors and buffers) for the ecoregion. This is being achieved through building and supporting a group of partners who can collaborate in maintaining and restoring the ecological integrity of the ecoregion and engaging directly in conservation activities in areas of primary ecological importance that are under high threat and which have the greatest potential to strengthen the local capacity for conservation work.

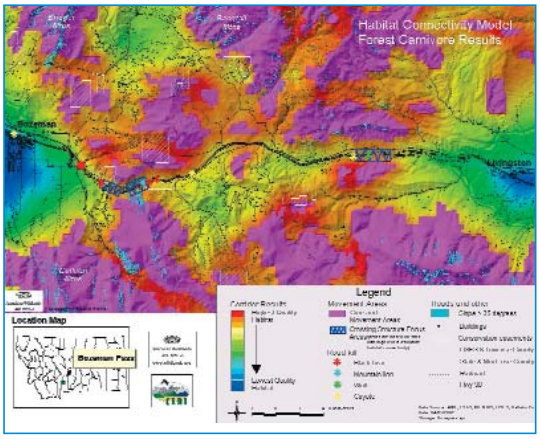
Although the Y2Y approach encourages collaboration among a wide array of constituencies, conservation NGOs have been the prime movers. As an umbrella organization, Y2Y provides vision, science research, conservation tools, organizational training and some financial support to the network, which in turn brings the vision to the communities and government agencies who in general control land use and planning at the local and regional levels.

Promoting Local Action

The way in which this approach operates in practice is illustrated by several projects that are being carried out in Bozeman Pass by American Wildlands, one of Y2Y's partners. Located in Montana, the Bozeman Pass is an important linkage for wildlife movement in and out of the northern end of the Greater Yellowstone Ecosystem. Through a scientific study, the Bozeman Pass Working Group identified the habitat needs of forest carnivores and open-space species, such as

the elk, the mule deer and the white-tailed deer. The group also surveyed the movements of individual animals, including the location and numbers of road kills. The results of this work formed the basis for initiating several projects with the aim of reducing the threats to wildlife movements in the Bozeman Pass. These included:

- negotiating conservation easements with private owners of priority wildlife habitat, such as the Bear Canyon area, using funds collected through the project's land trusts
- working within the Gallatin National Forest Travel Plan Revision process to reduce the impacts that roads are having on habitat connectivity
- initiating the Bozeman Pass Wildlife Channelization ITS project, in which the Western Transportation Institute and the Montana Department of Transportation are using additional fencing, changeable message signs and highway advisory radio



Map showing carnivore movement opportunities and barriers in the Bozeman Pass area

Although Y2Y is an independent initiative, it has already succeeded in mobilizing provincial governments to take conservation action that supports its objectives. For example, in 1997 Y2Y network members, participating in a British Columbia multi-stakeholder land-use round table, convinced the province to designate several new protected areas encompassing 16,000 square kilometres and surrounded by a single 28,000-square-kilometre special-management area that functions as a transition zone. Since then, working with First Nations and other stakeholders, members of the Y2Y network have succeeded in having several more protected areas set aside. In Alberta, the provincial government has designated a Wildland Park in the Bow Corridor, an important part of the network of valleys that permit the movement of wolves between the US and Canada. A similar approach has been followed in the Yukon, where the government's recent Protected Area Strategy is based on the core area/corridor model.

Further Information

- L. Willcox, B. Robinson & A. Harvey. 1998. *A Sense of Place: Issues, Attitudes and Resources in the Yellowstone to Yukon Ecoregion.* Yellowstone to Yukon Conservation Initiative, Canmore
- J. Gailus. 2000. *Bringing Conservation Home: Caring for Land, Economies and Communities in Western Canada.* Yellowstone to Yukon Conservation Initiative, Canmore
- www.y2y.net

Nepal

The Terai Arc Landscape

Developing an Ecological Network in a Poor, Densely Populated Region

Nepal is one of the least developed countries in the world. With less than 20 per cent of the working population employed in industry or trade and services, per capita income is only about $200 per annum. At the same time, Nepal's population of over 25 million is growing steadily. In such a region, the challenges involved in securing biodiversity conservation and sustainable development are enormous.

A Unique Natural Heritage

Despite the high human pressure, Nepal is still rich in unique landscapes and biological diversity. Seven of the world's 10 highest mountains are to be found in the country, including Mount Everest, as well as five major geomorphological zones that run east-west: the tropical lowland Terai, the sub-tropical Siwaliks along the lowest ridges of the Himalayas, the Middle Mountains, the High Mountains and the High Himal.

Terai grassland landscape

The Terai is a belt of land along the foothills of the Himalayas about 35 kilometres wide that stretches across southern Nepal and into India, Bhutan and Bangladesh. It has a remarkable landscape and harbours a rich diversity of flora and fauna. The dominant forms of vegetation are dense tropical monsoon Sal forests and exceptionally tall grasslands. Many mammal species are endangered, including the Indian rhinoceros, the Asian elephant and the royal Bengal tiger.

Taru minority woman

Human Poverty and Pressures

Almost half Nepal's population live in the Terai zone. The relations between the Nepalese and Indian parts of the Terai are strong and there is considerable transboundary employment. About 20 per cent of the Nepalese Terai population have no access to safe drinking water and 80 per cent have no access to

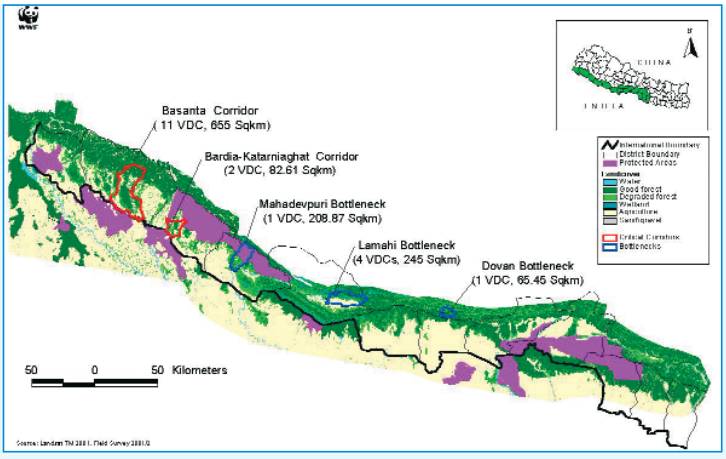
Indian rhinoceroses

health care. Nearly half the children are underweight and average life expectancy is relatively low at about 60 years for both men and women.

The high human pressure on the Terai region is causing serious impacts on the environment. The vegetation has become greatly degraded by deforestation and wood collection. About a third of all the forests have been cleared, with losses continuing at about four per cent a year. Surface waters are polluted by untreated waste water, and irrigation and hydroelectric projects are likely to threaten the ecological integrity of the river basins even further. Poaching is a major threat to the rhinoceros, the tiger and the elephant.

A Vision for Sustainability

In these circumstances, the Terai Arc Landscape Programme is an ambitious attempt to secure the twin goals of sustainable development and biodiversity conservation. Built on two established conservation projects, the programme has established broader goals that were formulated on the basis of a root-causes analysis workshop on the main causes of environmental degradation and loss of biodiversity in the Terai. Working within the framework of a long-term sustainable-development and conservation vision for the region, the programme aims within a timeframe of 10 years to strengthen the existing protected areas, conserve the remaining forests, restore degraded forests, establish community forests, introduce effective management practices in the buffer zones, create corridors between critical protected areas and introduce appropriate management practices in buffer zones.



The Terai Arc Landscape

In the Nepalese part of the Terai, four protected areas exist. However, it is clear that, with their restricted extent and the high human pressures, these are inadequate to secure the ecological integrity of the region. The Terai Arc Landscape has therefore focused on five priority areas in Nepal: two corridors – Basanta and Bardia-Katarniaghat – and three sites where serious barriers to ecological continuity exist – Mahadevpuri, Lamahi and Dovan. Additional corridors between seven protected areas in the adjacent Indian Terai are also planned, as are linkages with protected areas across the border with India, such as between the Royal Bardiya National Park in Nepal and the Katarniyaghat Wildlife Reserve in India. These projects are being supported by education courses for local livestock herders and awareness-raising programmes that are being developed by newly established Ecoclubs. To meet the increasing demand for tree seedlings, 13 multi-purpose tree nurseries have been established. Illicit hunting is being discouraged by 17 units that are stationed in the protected areas, while three new anti-poaching units are discouraging poaching in the corridors – the first community-based anti-poaching initiatives in Nepal.

Forest elephants

Implementation

Implementation the programme is being promoted through projects focusing on sustainable community development, awareness-raising and capacity-building. Support on the ground is facilitated through the establishment of a field office in the Royal Bardiya National Park that plans, implements and monitors all the field activities in the four protected areas. Starting in August 2002, the Forestry Office of Palpa District handed over five community forests to local communities in Dovan. Four community-forest coordination centres were formed to promote the participation of local people in the conservation activities and to assist collaboration with the community forest-user groups. These actions have contributed to the mobilization and institutional embedment of the local communities.

Community forests now enjoy a formal status under Nepalese law. In addition, the buffer-zone concept has been incorporated into the National Parks and Wildlife Conservation Act and the Buffer-Zone Development Council was established. The Council is entitled to receive 50 per cent of national park revenues for financing buffer-zone development projects, and as a result all four protected areas are now buttressed by buffer zones.

In the first year of the programme, a total of 536 hectares of degraded land were restored and a management plan and a tourism plan were drawn up for the Royal Bardiya National Park, both of which have since been endorsed by the Nepalese government. Cooperation with local communities enabled the District Forest Office to relocate over 10,000 families who had encroached onto forest areas in the Basanta corridor (although such programmes inevitably cause local tensions and require careful management if they are to secure the cooperation of both the peoples who are to be relocated and the population in the area to which they are moved).

Further Information

- J. MacKinnon (ed.). 1997. *Protected Areas Systems Review of the Indo-Malayan Realm.* Asian Bureau for Conservation Ltd, Hongkong/Canterbury
- World Wildlife Fund. 2000. *The Global 200 Ecoregions. A User's Guide.* WWF, Washington DC
- www.wwfnepal.org
- www.resourceshimalaya.org

The Netherlands

The Green Wood

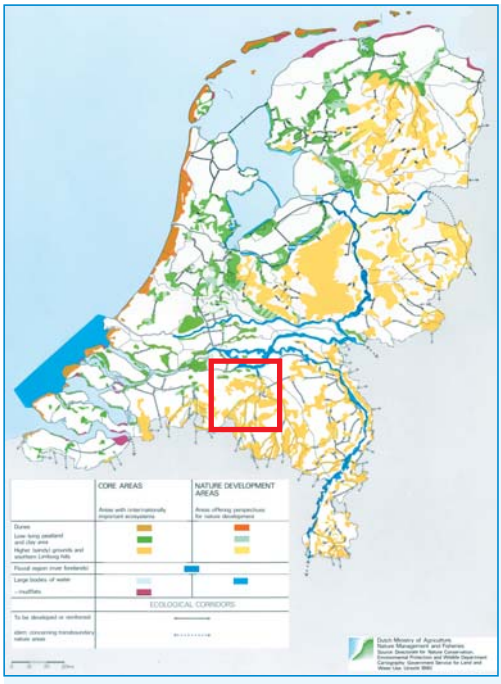
Implementing an Ecological Network at the Local Level

A small, densely populated and industrialized country, the Netherlands is a region where habitats and species populations are under extreme pressure. The ecological impacts are being exacerbated by exceptionally intensive agricultural practices – despite its small size, the Netherlands is one of the world's biggest exporters of agricultural produce – and the intricate road and rail network, which together are responsible for a high level of ecological fragmentation.

A National Ecological Network

Faced with the impossibility of conserving integral areas that would be large enough to ensure ecological integrity and support viable species communities, the Dutch government decided in 1990 to develop a National Ecological Network that could provide the basis for ecological sustainability throughout the country. Given the scale of the initiative, establishing the network is a long-term enterprise, with full implementation projected for 2018. In concert with the EU's 'Natura 2000' system of protected areas and the Pan-European Ecological Network, the Dutch ecological network is being developed as an integral element of a continent-wide bio-diversity conservation framework with full implementation projected for 2018.

The final network will total about 7000 square kilometres, or 17 per cent of Dutch territory. Three types of area are being designated in order to create the network of core areas, corridors and buffer zones: protected areas, areas managed for nature conservation purposes and nature restoration areas. The process of delineating the network is almost complete.



The Dutch National Ecological Network, showing the location of the Green Wood

Creating the Network: the Green Wood Example

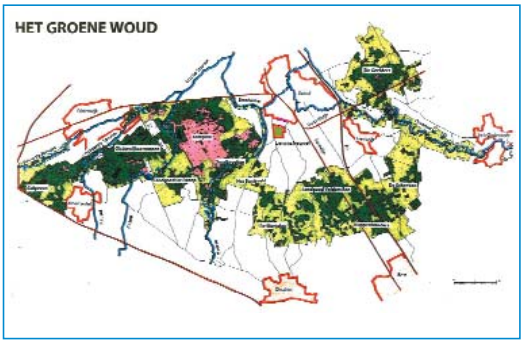
A good example of how this approach is being implemented is the area in the province of North Brabant known as the Green Wood. The Green Wood is located within the triangle formed by the cities of 's-Hertogenbosch, Eindhoven and Tilburg and extends across 13,000 hectares. The area is characterized by a high level of diversity that includes broad-leaved woodlands, country estates, heathland, brooks, meadows and hedgerows.



Views of the Green Wood

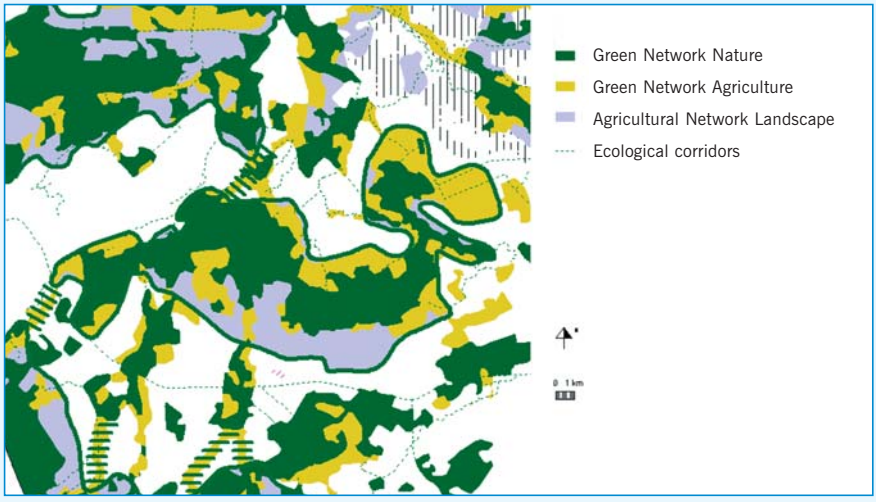
Because the Green Wood falls within the indicative map of the National Ecological Network, the province was obliged to delineate those areas that will formally be included in the network and to determine their management status. Realizing the ecological network on the ground requires the area's management to be appropriate to the objectives of the network. The instruments available to the province are to purchase the land, to use the spatial planning system or to sign management agreements with the respective land owners.

The Provincial Plan



The core areas of the Green Wood

Following the delineation of the ecological network, the province adapted its structure plan in 2002. The plan translated the management requirements of the ecological network into zoning instruments. This led to three different types of zone for the Green Wood: Green Network Nature (mainly the core areas of the ecological network – about 7500 hectares), Green Network Agriculture (mainly the adjacent areas that are currently farmed) and Agricultural Network Landscape (which indicated agricultural land that has high landscape value). The latter two zones together comprise a total of 5500 hectares which mostly function as a buffer zone. Although a structure plan does not provide direct protection to an area like the Green Wood, municipalities are obliged to ensure that their detailed development plans broadly comply with the provincial structure plan, which thereby shapes the main course of development in a region.



The zoning of the Green Wood area in the provincial structure plan

The most important instrument for establishing the National Ecological Network is public purchase of the land lying in the core areas. In addition, certain areas may be designated by the province as 'management area' where land owners may be persuaded to sign management agreements. In return for compensatory payments, the owners will apply certain nature-friendly agricultural or forestry practices. Currently, the priority areas for negotiating management agreements with private land owners are 'The Rosep' country estate – that lies within the core area of the ecological network – and the remaining agricultural areas that lie directly adjacent to the core area.

Action on the Ground

Restoring the Banisveld

A specific example of how this process operates can be seen in the Banisveld, a crucial link of just 90 hectares between the Kampina and the Mortelen in the centre of the Green Wood. The Kampina is an old heathland that was purchased in 1924 by the Natural Monuments Association – with nearly a million members, the largest private owner and manager of protected areas in the Netherlands. The Mortelen, an area of traditional small-scale agricultural land, is owned by another nature conservation organization, the North Brabant Landscape Foundation. The areas are particularly rich in characteristic flora and bird, butterfly and amphibian species.

The marsh gentian

Lying between these two areas, the Banisveld has for 40 years been an intensive dairy farm of low bio-diversity and landscape value and which acted as a barrier to the east-west ecological continuity of the Green Wood. Because of the importance of restoring the Banisveld as an ecological linkage within the National Ecological Network, the Nature Monuments Association was able, with funding from the national and provincial governments, to purchase the farm in 1996.

Following the purchase, a plan for the area was drawn up with the objective of restoring a semi-natural woodland landscape on the Banisveld and also the area's nutrient balance and surface-water systems. Achieving this involved the removal of 40 centimetres of nutrient-rich topsoil from the entire 90 hectares of the Banisveld in order to expose the original sandy soil. Although costly, the operation was financed completely by the sale of the soil. The newly exposed soil, despite being covered for decades, proved to contain an unexpectedly rich store of seeds. From this natural seed bank many rare plants emerged spontaneously, including several Red List species such as marsh gentian, bog club-moss, the royal fern and marsh St John's wort.

Further Information

- Provincie Noord-Brabant. 2002. *Streekplan Noord-Brabant: Brabant in Balans.* Provincie Noord-Brabant, 's Hertogenbosch
- R. Brinkhof & R. van Dijk. 2002. *Uitvoeringsprogramma Het Groene Woud.* Grontmij Eindhoven/ Provincie Noord-Brabant
- P.H.A.M. Dirks. 1997. *Natuurontwikkelingsvisie verbinding Kampina–de Mortelen.* Vereniging Natuurmonumenten, 's-Graveland
- www.HetGroeneWoud.com (in preparation)

Experiences with Ecological Networks

Initial Lessons Learned

From the start of the first pioneering programme over 30 years ago to today, when over 150 initiatives are under development, ecological networks are offering a new operational approach to meeting the twin challenges of biodiversity conservation and sustainable development. They are doing this in exceptionally diverse circumstances – not only in many different environments but also in a wide range of socio-economic, cultural and political conditions: from extremely poor to advanced industrial societies, from sparsely to densely populated regions, from large, intact ecosystems to highly fragmented landscapes. These programmes are generating a rich body of experience on the potential value of ecological networks and on the conditions that need to be met if they are to succeed in achieving their objectives.

Achieving Objectives

Given the scale, ambition and development phase of most ecological networks, it is clear that it will be many years, if not decades, before testable results can be achieved which demonstrate to what extent the programmes secure the conservation of biodiversity and the sustainable use of natural resources in a robust way and in a wide variety of conditions. That this cannot yet be done is not a failing of the network approach as such but an inevitable consequence of the nature of the challenge that has to be met.

The essential question that needs to be asked is to what extent current experience with ecological networks is justifying the claims of the approach and providing sufficient grounds for believing that the objectives can indeed be met. Answering this question requires, in the first place, an examination of the two key dimensions of ecological networks:

- Is there evidence that ecological networks are strengthening the conservation of biodiversity on the ground?
- Are the network programmes finding ways of offering sufficient opportunities for sustainable use?

Further, if ecological networks are to offer a feasible and cost-effective means of achieving these two objectives, they will have to find practical ways of meeting a variety of challenges that confront conservation and development on the ground. The most important are:

- adequate institutional support
- effective process management
- reconciling short-term and long-term priorities
- securing full community support and civil involvement.

What lessons are ecological networks teaching us about these key issues?



Conserving Biodiversity

The ecological model on which ecological networks are founded infers that supplementing an assemblage of core areas with functional linkages and buffering the resulting network from external pressures will establish conditions that promote the viability of many ecosystems and species populations. That this model applies to species that require access to very large areas or need to migrate across a landscape is obvious. But for most species, extensive linked and buffered systems of core areas are not, as such, immediately essential to their survival. For long-term viability, however, other factors become important for these species, such as the survival of a full complement of species and communities within an ecosystem, the ability to recolonize 'empty' habitat patches, the opportunity to move away from an existing area that comes under threat, and the occurrence of periodic natural disturbances that may require some form of linkage, such as flooding. The precise issue that needs to be addressed is therefore to what extent ecological networks are providing for the maintenance of these factors in such a way that they generate significant added conservation value on the ground.

The eight examples of ecological networks that are the subject of this review demonstrate in practice two classes of network design that operate at different levels and specificity. The first is a strategic configuration – the initial phase in all the examples – that is based on a broad understanding of ecosystem processes and which acts as a framework for further work. The second class comprises precisely delineated configurations that are intended to match the ecological requirements of a specific area and which are being implemented on the ground. Four of the network programmes have progressed to this second stage: the Estonian Green Network, the Mesoamerican Biological Corridor, Y2Y and the Green Wood (as part of the Dutch National Ecological Network).

The Estonian Green Network, for example, explicitly provides for connectivity for migratory species and wide-ranging species such as the wolf and the lynx, and also for an aquatic species such as the otter. Similarly, the Y2Y programme has developed detailed proposals in some of its implementation programmes, such as for the Bozeman Pass, and these proposals have been incorporated into local projects that aim to reduce the threats to wildlife movements. Of course,

none of the measures that have been implemented on the ground has been functional for a long enough period to be able to demonstrate that they have improved the viability of the respective species populations. The projects are, however, based on scientific assessments of the needs of species in relation to the threats to which they are currently exposed. They therefore explicitly aim to conserve ecosystem structure and functioning, a key principle of the Ecosystem Approach.

	Baltic Ecological Networks	Vilcabamba-Amboró Conservation Corridor	Tri-DOM
Geographical Region	Northern Central Europe	Western South America	Western Central Africa
Countries	Estonia, Latvia, Lithuania	Peru, Bolivia	Cameroon, Gabon, Congo
Scale and Areal Extent of Network	National, >50% of Estonian territory, 43% of Latvian territory, 25% of Lithuanian territory	Bi-national, 300,000 km^2	Tri-national, 130,000 km^2
Initiating Organizations	National governments, research institutes, international NGO	National governments, international NGOs	NGOs, national governments
Responsible Actors	National governments	National governments, international NGOs, international donors	National governments, international NGO, international donors
Implementing Instruments	Land-use planning, agri-environment measures	Land-use planning, education programmes, awareness-raising, protected areas, capacity-building, forest certification, support for sustainable enterprises and practices	Protected areas, management measures in corridors and buffer zones, land-use planning, capacity-building, Clean Development Mechanism
Forms of Local Involvement	Development planning, public hearings	Development planning, local NGOs, community-development projects	Development planning
Sources of Funding	Governments, international NGO	International donors, international NGOs, national governments	International donors, international NGO

Promoting Sustainable Use

The way in which the examples provide for the sustainable use of natural resources varies enormously. This diversity is to a large extent dictated by the widely varying circumstances in which the inititiatives have been launched. Thus, the opportunities and resources available for sustainable use in a locality in the Netherlands are in almost complete contrast to those available in a region such as Nepal's Terai Arc. Some broadly applicable lessons can nevertheless be drawn from the examples.

Far East Ecoregion	Mesoamerican Biological Corridor	Y2Y	Terai Arc Landscape	Green Wood*
East Asia	Mesoamerica	Northwestern North America	South Asia	Western Europe
Russian Federation	Mexico, Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica, Panama	Canada, USA	Nepal	Netherlands
Regional, >60,000 km^2	Multi-national, 208,000 km^2 (27% of Mesoamerican territory)	Bi-national, final network not yet delineated	Regional, final network not yet delineated	National, 7000 km^2 (17% of Dutch territory)
International NGO	International NGOs, national governments	NGO	International NGO, national government	National government
Federal and provincial governments, international NGO	National governments, international NGOs, international donors	NGOs	National government, international NGOs	National, provincial and local governments, NGOs
Protected areas, forest certification, capacity-building, awareness-raising, financial incentives, stakeholder dialogue	Protected areas, financial incentives, capacity-building, education programmes, awareness-raising, community concessions, support for producer associations, technical support, Joint Implementation	Awareness-raising, financial support and incentives, research, stakeholder dialogue	Protected areas, establishing community forests, management measures in corridors and buffer zones, education programmes, awareness-raising, capacity-building, restoration of degraded lands	Land purchase, financial incentives, land-use planning
Local research institutes and NGOs	Community-development projects	Local NGOs, individual members	Community-development projects, community forests	Development planning, local NGOs
International NGO, federal and provincial governments	International donors, international NGOs, national governments	Foundations, governments, partner organizations, individuals	International NGO	National government

* Data are for the Dutch National Ecological Network

The first and most important conclusion is that all the examples explicitly provide for operational means of promoting sustainable use. That may seem to be a lesson that is so obvious it is hardly worth mentioning. However, if we can discern one overriding failure of policies over the past decades, it has been our inability to find workable ways of integrating conservation and economic development. So to what extent are the various programmes succeeding in fostering development models that offer economic benefits to the communities and other stakeholders while still being ecologically sustainable?

The range of complementary land uses that are being promoted is certainly extremely wide, as is illustrated by some of the examples from the programmes: support for extensive farming practices (Estonia), the sustainable harvesting of non-timber forest products and the cultivation of organic cocoa (Mesoamerica), developing sustainable forestry in indigenous territories in Bolivia and evaluating ecotourism (Vilcabamba-Amboró), the establishment of tree nurseries (the Terai Arc) and planning for appropriate forms of agriculture in the buffer zones and promoting recreational opportunities (the Green Wood). In order to encourage these land uses, an exceptionally wide range of instruments are being applied by the programmes. These include legal protection, spatial planning, land reform, the establishment of community forests, buying up logging concessions, organizing smallholders into producer associations, forest certification, conducting awareness-raising campaigns and education programmes, offering training courses, strengthening institutional capacity, and negotiating voluntary agreements, environmental service payments and conservation easements with private land owners.

These measures will only prove effective in practice if they meet the perceived needs of local communities. Indeed, sustainable use in both senses of the term – environmentally appropriate and durable – requires their active involvement over and above the efforts of governments and NGOs. The experience with these kinds of participatory and adaptive management approaches – such as establishing community forests in the Terai Arc and organizing smallholders into producer associations in the Mesoamerican Biological Corridor – is therefore especially important.



Institutional Requirements

As an instrument, an ecological network is a planning tool that aims to optimize the balance between different objectives. However, because it is generally applied at the landscape or regional level, involves a long-term process, operates across an array of administrative units and embraces an exceptionally large number and wide range of stakeholders, the development and realization of an ecological network place high demands on the associated institutional framework. One obvious feature that is shared by examples such as the Far East Ecoregion, Vilcabamba-Amboró and the Terai Arc is the strong correlation between weak institutions and unsustainable resource use. At the same time – bearing in mind the principles of the Ecosystem Approach – the programmes have to find practical ways of ensuring that management is decentralized to the lowest appropriate level and that economic signals operate to promote biodiversity conservation and sustainable use.

The precise role of institutions varies depending on local circumstances – the Estonian Green Network is being implemented through a relatively centralized planning framework, Y2Y is founded to a far greater extent on non-governmental, civic processes – but a number of institutional characteristics are common to the needs of all the examples that are the subject of this review. Prominent among these are the rule of law, robust zoning arrangements, effective enforcement procedures, financial security for corporate stakeholders and clearly defined public and private ownership patterns.

In addition to these features, the long-term process that characterizes the development and implementation of an ecological network has important implications for the necessary degree of political stability. At the basic level, this concerns the robustness of government and basic political institutions such as parliaments. But at a higher level, it is also important that a particular vision of conservation and economic development be shared across the political spectrum and by successive governments. What is perhaps less obvious is the role that such programmes can play in promoting stability: one of the most important lessons from the examples is that the Mesoamerican Biological Corridor has been developed as an integral part of a broad political vision to promote peace, democracy and stability in the region.

Process Management

Any ambitious, broad-based initiative such as an ecological network brings with it enormous process-management challenges. Developing a comprehensive and coherent proposal that is appropriate to its setting and can meet strategic objectives, collecting and assessing a complex array of data, bringing together all relevant stakeholders, ensuring the commitment of local communities, attracting long-term funders, effectuating a programme of implementing actions – these tasks require a substantial investment in management resources and the adoption of an integrative approach.

As the examples demonstrate, by no means all the initiatives have yet found workable and effective solutions in practice. Most successful to date have been the Estonian and Dutch networks, since both countries have long experience of institutionalized planning processes and are using this experience to apply national ecological-network schemes in a systematic way. That both examples are working within established administrative frameworks and at a smaller scale than the other initiatives is clearly an advantage. Y2Y offers an interesting contrast in working method, where results are being achieved through active NGOs who focus on seizing opportunities to catalyze action at the local level within the framework of a coordinating regional vision. The Terai Arc is in some ways adopting a comparable approach to Y2Y in that efforts are being focused on initiating local projects that complement the programme's broad goals and principles rather than investing heavily in elaborating a sophisticated scheme for the entire region.

A particularly difficult issue that confronts all such initiatives is how to ensure that stakeholders can be persuaded to become fully involved in the programmes and committed to achieving their goals. Again, in the more developed countries institutional processes and instruments already exist to make this a manageable challenge. Serious difficulties arise in regions such as Vilcabamba-Amboró, Mesoamerica, the Congo Basin and the Far East Ecoregion where companies in the energy, mining and logging sectors have a vested interest in being able to continue their business. However, some local successes have already been booked by the programmes, such as in advancing sustainable forestry.

A striking lesson of the examples is that the initiation and management of the ecological-network programmes is not the sole prerogative of government. Indeed, in more than half the examples the process was initiated and is being driven by NGOs. An interesting consequence of this broad-based, integrative process is that it is proving in practice to offer an increasingly attractive vehicle to donors for directing development assistance. The programmes in Vilcabamba-Amboró, Mesoamerica and the Congo Basin are good examples of this feature.

Reconciling Urgent Needs With Long-Term Objectives

Conservation and development strategies have always been confronted with the challenge of finding ways to meet both short-term needs and long-term objectives. Dealing with pressing issues that demand immediate action, such as hunger, poverty and highly threatened habitats or species populations, has to be balanced against the necessity to invest in longer-term objectives in order to secure structural change. In that sense, this is not an issue that is exclusive to the debate on ecological networks. However, concerns have been expressed that ecological networks encourage too large a share of the available investment to be directed at the realization of long-term sustainable-use objectives at the cost of urgent protection and poverty-alleviation measures.

The experience of the examples shows evidence that more complex processes are at work. To be sure, all the ecological-network programmes require significant investment in analytical resources, process management and capacity-building. From the perspective of the programmes, it can be argued that this investment ensures that the actions to be taken are appropriately prioritized, programmed and supported so that they have maximum effect, both in relation to urgent priorities and to long-term objectives. The programmes would also argue that ecological networks need to build on and expand existing protected areas and to enhance their conservation value by strengthening the ecological coherence of the reserves.

But what the examples also suggest is that many initiatives are attracting a higher level of funding from a broader range of sources and over a longer period than would have been the case if the programmes had been limited to isolated conservation or development projects. The question of to what extent this additional funding represents an increase in the total funds that are being made available for biodiversity conservation and sustainable development rather than a reallocation of existing funding cannot be answered by this limited review. However, there are strong indications that this is the case in some of the examples, such as in Mesoamerica, Vilcabamba-Amboró, Y2Y and the Green Wood. Moreover, in underdeveloped regions or countries in transition, the examples indicate that an ecological network can work pro-actively to shape the development agenda towards an integrated approach to securing conservation and development, as in Mesoamerica and, potentially, the Far East Ecoregion.

Securing Community Support and Civil Involvement

No programme of the breadth and ambition of an ecological network can achieve results without the active support of local communities and key stakeholders. The special problem for many of the programmes discussed in this review is that they are being undertaken at a scale that hinders close cooperation with local communities and also that they might be perceived by local communities as irrelevant to meeting their needs. Only by demonstrating that an

integrated approach to biodiversity conservation and economic development at the regional scale offers benefits at the local level can these challenges be met.

It certainly cannot be claimed on the basis of the examples that broad local support has been gained for the initiatives and that it will be possible to transfer ownership of the programmes to local stakeholders in the near future. There is clearly a tension between the necessity to develop a coherent programme at the regional scale and the need to ensure that the main measures are driven by local needs and perceived as providing a solution to local problems. The appropriate balance has clearly not been found in all the programmes.

In fact, with the exception of instances where a clearly identifiable corridor or multiple-use buffer zone has been established, it can be concluded that an appreciation for what the model entails is generally limited to those stakeholders who are most actively involved in the programmes. Where local support has been secured, it is almost invariably through concrete projects that offer direct and tangible benefits – the establishment of community forests (the Terai Arc), providing recreation opportunities (the Green Wood), support for sustainable forms of agriculture (Mesoamerica) and the promotion of ecotourism (Vilcabamba-Amboró).

Adding Value to Conservation and Development

The examples that are the subject of this review represent but a small proportion of the total experience that ecological-network programmes around the world are generating. They are nevertheless demonstrating that progress is being made, albeit mainly with regard to the process architecture that is appropriate for securing action on the ground – programme design, stakeholder involvement, land-management models, capacity-building – rather than in testable conservation and development results. As already noted, however, the shortage of concrete results is to a large extent an inevitable consequence of the fact that most ecological-network programmes are still in an early phase of development.

But there are indications that the programmes are on course to meeting at least a significant proportion of their objectives: many are based on convincing scientific research, they are attracting substantial levels of funding from experienced donors, the older programmes still enjoy broad political support, conservation measures such as management plans and corridors are being realized, and the implementation of a wide range of sustainable-use projects is well advanced. Considerable work remains to be done. But the growing practical experience with developing and implementing ecological networks suggests that a synthesis is indeed emerging in which strategic objectives (the Convention on Biological Diversity), management principles (the Ecosystem Approach) and operational model (ecological networks) are coalescing to offer an effective and workable approach for integrating conservation and development.

Further Reading

International agreements and decisions that are of special relevance to biodiversity conservation, sustainable development and ecological networks include the following: Convention on Biological Diversity. 2000. *Decisions Adopted by the Conference of the Parties to the Convention on Biological Diversity at Its Fifth Meeting.* Nairobi, 15–26 May 2000; Convention on Biological Diversity. 2002. *Decisions Adopted by the Parties to the Convention on Biological Diversity at Its Sixth Meeting.* The Hague, 7–19 April 2002; World Summit on Sustainable Development. 2002. *Plan of Implementation.* Johannesburg, 4 September 2002. See also: Ministry of Agriculture, Nature and Food Quality, Netherlands, Ministry of Foreign Affairs, Netherlands, & Ministry of Science, Technology and the Environment, Malaysia. 2003. *Strategic Round Table on the Role of Ecological Networks in Biodiversity Policies.* Report of a meeting held on 5–6 June 2003. Ministry of Agriculture, Nature and Food Quality & Ministry of Foreign Affairs, The Hague.

General information on the ecological network model and 38 examples of its application can be found in G. Bennett & P. Wit. 2001. *The Development and Application of Ecological Networks: a Review of Proposals, Plans and Programmes.* AIDEnvironment, Amsterdam.

An authoritative analysis of developments over the past 40 years with respect to biodiversity conservation, protected areas and ecological networks was published by A. Phillips. 2003. 'Turning Ideas on Their Head – the New Paradigm for Protected Areas'. *The George Wright Forum,* 20 (2), 8–32.

A good overview of the Ecosystem Approach and its role in implementing the Convention on Biological Diversity is available in R.D. Smith & E. Maltby. 2003. *Using the Ecosystem Approach to Implement the Convention on Biological Diversity: Key Issues and Case Studies.* IUCN, Gland. See also: Convention on Biological Diversity. 2003. *Lessons Learned from Case Studies. Expert Meeting on the Ecosystem Approach,* Montreal, 7–11 July 2003.

Acknowledgements

This publication is the product of contributions and support from a wide range of sources. In the first place, the author is especially grateful to IUCN – The World Conservation Union for supporting the review as part of the work by its Commission on Ecosystem Management.

Overall supervision of the preparation of the review was the responsibility of Hillary Masundire (Chair of IUCN's Commission on Ecosystem Management), Alfred Oteng-Yeboah (Chair of the Convention on Biological Diversity's Subsidiary Body on Scientific, Technical and Technological Advice), Zenon Tederko (Director of IUCN's Regional Office for Central Europe), Willem Ferwerda (Director of the Netherlands Committee of IUCN), Simon Rietbergen (Acting Coordinator of IUCN's Ecosystem Management Programme), Chris Enthoven (Ministry of Foreign Affairs, Netherlands) and Peter Bos (Ministry of Agriculture, Nature and Food Quality, Netherlands). The author is grateful for their support, guidance and willingness to comment unreasonably promptly on considerably more drafts of the review than they had anticipated.

The following experts provided detailed information on some of the programmes and also commented on drafts of the review: Wim Bergmans, Netherlands Committee of IUCN (the Terai Arc); Rob Glastra, AIDEnvironment (the Meso-american Biological Corridor and the Vilcabamba-Amboró Conservation Corridor); Paul Scholte (Tri-DOM); Filiep Manger (the Green Wood).

In reviewing the examples, many experts associated with the various programmes were kind enough to provide information and to comment on several drafts. The author would particularly like to thank: Kalev Sepp (Estonian Institute of Environmental Protection); Henry Campero (WWF-Bolivia), Carlos Ponce (Conservation International-Peru), Eduardo Forno and Feddy Miranda (Conservation International-Bolivia); the WWF-Gabon team, in particular Pauwel de Wachter and André Kamdem Toham; Yuri Darman (WWF Russia, Far Eastern Branch), Alexander Shestakov and Vladimir Krever (both of WWF Russia); Sandra Ramirez (Mesoamerican Biological Corridor Coordination Office, Managua) and Florangel Villegas (IUCN's Regional Office for Mesoamerica); Bart Robinson and Rob Ament (both of the Yellowstone to Yukon Conservation Initiative); Chandra P. Gurung (WWF Nepal Programme Office); Robin van Dijk (Province of North Brabant), Frans Kapteijns and Kees Laarhoven (both of the Natural Monuments Association).

For further comments and suggestions the author is grateful to Piet Wit (Syzygy and Deputy Chair, IUCN's Commission on Ecosystem Management), Laurent Ntahuga (IUCN's East Africa Regional Office and Member of the Commission on Ecosystem Management), Angela Andrade (Regional Vice Chair, IUCN's Commission on Ecosystem Management), Ted Trzyna (California Institute of Public Affairs/InterEnvironment), Sagendra Tiwari (IUCN Nepal), Carleen Weebers (Ministry of Agriculture, Nature and Food Quality, Netherlands), Sander van Opstal (National Reference Centre for Agriculture, Nature and Food Quality, Netherlands) and Marieke Wit (IUCN's Ecosystem Management Programme).

Finally, the review would not have been possible without the financial support of the Ministries of Foreign Affairs and of Agriculture, Nature and Food Quality, Netherlands.

Integrating Biodiversity Conservation and Sustainable Use

Lessons Learned From Ecological Networks

Securing the conservation of biodiversity while at the same time promoting sustainable economic development is one of the greatest challenges of our time. Ways of achieving these twin goals are becoming the focus of increasing attention, particularly within the conservation and development communities.

Recent years have seen the development and application of management models that are designed to integrate biodiversity conservation and sustainable use. These models share a common approach in that they aim to conserve essential ecosystem functions while still allowing opportunities for the exploitation of natural resources and economic development. Known by various names – ecological networks, Biosphere Reserves, reserve networks, bioregional planning, biological or conservation corridors and Ecoregion-Based Conservation – the extent and scale at which these approaches are being applied suggest that a broad consensus is emerging on how best to integrate conservation and sustainable use.

The purpose of this publication is to assess experience with the model in practice. Eight programmes are reviewed, varying in scale from local to international, from developing regions to advanced industrialized countries, from the tropics to the Arctic Circle. Conclusions are drawn on the progress made to date together with initial lessons from the experience gained as a guide to further work.

IUCN – The World Conservation Union

Founded in 1948, The World Conservation Union brings together States, government agencies and a diverse range of non-governmental organizations in a unique world partnership: over 935 members in all, spread across some 138 countries.

As a Union, IUCN seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

The World Conservation Union builds on the strengths of its members, networks and partners to enhance their capacity and to support global alliances to safeguard natural resources at local, regional and global levels.

IUCN Ecosystem Management Programme
Rue Mauverney 28
CH-1196 Gland
Switzerland
Tel.: +41 22 99 90 215
Fax: +44 22 99 90 020
E-mail: ecosystems@iucn.org
www.iucn.org/themes/cem

IUCN Publications Services Unit
219C Huntingdon Road
Cambridge CB3 0DL
United Kingdom
Tel.: +44 1223 277 894
Fax: +44 1223 277 175
E-mail: books @iucn.org
www.iucn.org/bookstore

IUCN
The World Conservation Union

Commission on Ecosystem Management

Syzygy