Applying the Ecosystem Approach in Latin America

Ángela Andrade Pérez, Editor

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IUCN

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Preface

As the pressures on natural resources increase worldwide, it is recognized that the environmental and social tools that guide economic development are mainly reactive and have marginal effect. The negative implications of this are clear: loss of critical ecosystem services — on which human society depends — and rapid extinction of species. This, together with the growing probability of severe climate change, requires more proactive approaches to sustainable development to be adopted.

The Ecosystem Approach (EA) is a proactive strategy for integrated management of land, water and living resources that promotes equitable conservation and sustainable use. It places people and their natural resource management practices at the heart of decision-making. For this reason, it can be used to find an appropriate balance between conservation and use of biological diversity in areas where there are multiple users of important natural resources and values.

Nowadays, there are many examples of practical applications of the EA, but not at a scale significant enough to show a difference. It is necessary to provide information about these experiences in order to convince decision-makers of the benefits of its application at local and national levels.

As a global strategy adopted by the Convention on Biological Diversity (CBD), there is only one EA. It can be applied in many different ways, however. Its application must reflect and be oriented to the various ecological, social, cultural and political situations in specific geographical areas.

Latin America is a key region in which to demonstrate EA application. On the one hand, considerable efforts are being made to apply the EA by people committed not only to nature conservation but to the management of water resources, wetlands, lands and the development of Payment for Environmental Services (PES) schemes. On the other hand, the region is vast and there are still large intact expanses of land with high conservation values. Therefore, the adoption of a proactive natural resource management approach has the potential to contribute significantly to biodiversity conservation and sustainable development.

This is why the IUCN Commission on Ecosystem Management (CEM), the Alexander von Humboldt Institute (AvHI), the United Nations Environment Programme (UNEP) and the Tropenbos Foundation organized a workshop in June, 2007, in Villa de Leyva, Colombia. Its goal was to review the experiences acquired from the application of the EA in Latin America and summarize the lessons learned in order to allow more successful application of the approach in the future.

This publication gathers together some of the workshop's case studies and discussions, as well as other initiatives presented by IUCN members in the region, with the aim of sharing these experiences at the ninth meeting of the Conference of the Parties to the CBD — where review of the EA is one of the main topics on the agenda—and at the next IUCN World Conservation Congress (WCC), both in 2008.

The selected case studies represent EA application in different ecosystems, at different scales and in diverse social and cultural contexts. They include: The Chocó-Manabí conservation corridor between Colombia and Ecuador, and the Oak Forests conservation corridor in Santander, Colombia; the Mbaracayú Forest Biosphere Reserve in Paraguay; integrated water management in Latin America; sustainable management of wetlands — The Paraguay-Paraná Wetlands System and the Fúquene Wetlands Complex in the Colombian Andes; the Andean moorland ecosystem; and the creation and management of Marine and Coastal Protected Areas in Chile. At the institutional level, there is an account of the National Agro-ecological Zoning Programme in Panama, and three planning experiences from the Alexander von Humboldt Institute: the Regional Biodiversity Action Plan of the Orinoquia, planning of rural landscapes for biodiversity conservation, and use of biodiversity by local communities in the Andean mountains.

The conclusions of the Villa de Leyva's workshop and a series of recommendations addressed to governments, IUCN and the CBD are included with the aim of promoting research, and increasing the dissemination of experiences of applying EA at global and regional levels.

In this way, the Latin American region submits its contribution on the progress made in EA structuring to the CEM and IUCN, with the purpose of addressing its future actions toward improvement of the approach and achieving the CBD's objectives.

I hope this document will be useful.

Ángela Andrade Pérez, Editor

Introduction

Ángela Andrade Pérez

The fundamental objective of the ecosystem approach is the management of bio-physical resources by human societies within an ecological context. The approach covers a group of methods that examine the structure and the function of ecosystems and the way in which they respond to the actions of humans.[1] The ecosystem concept is the basis for understanding and analyzing the landscape, be it terrestrial or water-related. The ecosystem is seen as the articulation of the natural system and the socio-cultural system, the components of which are related and interactive.

Theoretically, the concepts of the Ecosystem Approach (EA) and Ecosystem Management arise from the confluence of several disciplines: ecosystem sciences (specifically ecosystem ecology, with an emphasis on its structure and function); systems theory (in the cause-and-effect relationship, and cybernetic and holistic concepts); and economics (in environmental externalities, resource location and landscape suitability, particularly with methods and techniques that allow ecological processes to establish linkages with the landscape).[2]

This confluence has largely been possible due to the predominance of systemic thought at the end of the 1960s and to the dissemination of the ecosystem concept as an organizing framework for understanding the development of people's activities on the landscape and its responses to change. Ecosystem management is intended to solve problems and it is supported by the basic concepts of ecosystem sciences and similar disciplines with the purpose of solving the problems related to people's adaptation to the landscape. Both the EA and ecosystem management imply an understanding of ecological and socio-cultural processes and they continue to be the object of research and a means of promoting sustainable development.[3]

The EA arose as a response to the pressure on the world's ecosystems, to the relevance they represent for human well-being and to the importance of bearing in mind the needs and aspirations of stakeholders and sectors involved.

One of the most outstanding aspects of EA is that it conceives of people, their society and their culture as central components of ecosystems, breaking down the prevalent conceptual and methodological separation between society and nature. People and their culture are considered dynamic agents and transformers of natural ecosystems, creating a wide diversity of cultural landscapes and a mosaic of ecosystems that range from those with little transformation, such as wilderness areas, to urban ecosystems with high levels of social complexity and whose operation depends on the appropriate management of the ecosystems that provide environmental services. Conventional ap-

proaches have favoured the specific use of resources — such as land, forests and water — to the extent of bringing about their degradation, and in many cases, their depletion. Understanding the relationship between the different components of an ecosystem, as well as its appropriate management, has tended to be reactive when situations of extreme deterioration are perceived, without effectively analyzing the underlying causes of its degradation or destruction. The EA offers an integral vision oriented to the continuous supply of environmental goods and services by maintaining the essential ecological processes and the active participation of the sectors involved in its management.

Table 1. Conventional approaches and the Ecosystem Approach[4]

Conventional approaches	Ecosystem Approach
• emphasis on conservation	• emphasis on adaptive management
• sectoral: management is focused on the extraction or use of a dominant good or service, in an isolated manner	• integral: takes into account all usable goods and services and optimizes the mixing of their benefits
• exclusively based on knowledge provided by western science	• involves other forms of knowledge including indigenous and local
• mainly environmentalist	• based on people, their society and their culture
• give priority to conservationist approaches to nature	• oriented to environmental and societal conservation
• top-down approach	• two-way approach, top-down and bottom-up
• short-term vision	• long-term vision
• give priority to production factors in an independent way	• considers goods and services as the product of a healthy ecosystem and not as ends in themselves

The EA recognizes that natural and transformed ecosystems are complex systems whose resilience (in other words, the function and capacity to respond to disturbances and changes) depends on the dynamic relationship between species and the environment, the society and its culture. It integrates the different sciences of the biophysical and socio-economic environment with traditional knowledge, including its corresponding disciplines, practices, methodologies and innovation systems. Human beings and their culture are an integral part of ecosystems and, therefore, management objectives are subject to social decision.

The EA was adopted by the fifth Conference of the Parties to the CBD, in 2000, (Decision V/6) as the main framework for action and to achieve its three objectives:

conservation, sustainable use, and fair and equal distribution of biodiversity goods and services, including among others, protected areas (PAs) and ecological networks. It was ratified again at COP 7, in 2004, and a review is on the agenda for COP 9, 2008. Some CBD decisions specifically refer to the application of the EA, such as the Programme of Work on PAs, which states that by 2015 all PAs will be "integrated into the wider land- and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity and the concept, where appropriate, of ecological networks."

In the CBD context, the EA is defined as a strategy for the integrated management and restoration of land, water and living resources.[5] It promotes conservation and sustainable use in an equal, participatory and decentralized manner; it integrates social, economic, ecological and cultural aspects in a geographical area defined by ecological limits. This conceptual framework establishes 12 principles for action that focus on the premises of sustainable development, ecosystem management and conservation. These should be applied in a flexible way to management in different social, economic, environmental and cultural contexts.

The EA's fundamental principles recognise ecosystems' structure and function and their direct relationship with the goods and services they provide to local communities, and to society in general, within an economic context. The structuring of ecosystems implies a set of specific activities such as research, ecosystem characterization, and ecological restoration. The latter is increasingly important as long as the number of remnant and fragmented habitats continues to grow, together with the supply of ecosystem services on which local populations depend. The EA contributes by applying appropriate scientific methodologies and following levels of biological organization that include essential processes, functions and interactions between organisms and their environment. It recognizes that people, with their cultural diversity, are a core component of ecosystems.

These are some of the EA's components:

- ecological services, which provide habitats to species with a high conservation value;
- essential ecological processes, such as water supply and water regulation, soil conservation and recreation or tourism; and
- cultural and sacred values.

Another important aspect is its adaptive management in the face of imminent ecosystem transformation caused by factors such as climate change.

The idea of an ecosystem approach and coordinated management of social and cultural systems provided the conceptual basis for the Millennium Ecosystem Assessment (MA), generating sustainability, governance, management and monitoring concepts.[6] The MA shows that human well-being and progress toward sustainable development depend on the effective management of ecosystems to guarantee their conservation and their sustainable use in light of the increase in demand for the services they provide and the decreasing capacity of many ecosystems to do so.

Until now, various global and regional initiatives have been developed, led by different organizations, with the purpose of establishing methodological guides and case studies on specific ecosystems. These were intended to show the effectiveness of such an approach and the possibilities of solving conflicts and making more appropriate decisions on the conservation and sustainable use of critical ecosystems. The EA is used by several disciplines, professionals and planners dedicated to the sustainable management of natural resources.

There are different options for structuring the EA. In the CBD context, it has been used for the formulation of National Biodiversity Strategies, environmental policies — including some sectoral ones — environmental management plans and some projects. Some organizations and governments have given special relevance to the EA in biodiversity conservation strategies and promotion of sustainable development through biosphere reserves or biodiversity conservation corridors.[7]

In some cases, initiatives have been introduced in the sectoral management environment, such as integrated management of water resources,[8,9] agriculture,[10] sustainable forest management[11] and fishing.[12]

An important part of the EA is its recognition of the relationship between the health of an ecosystem and the health of the humans who live in it. EA has been linked to the global development of ecology during the second half of the 20th century. This increasingly developing discipline establishes the relationship between ecosystem health and human well-being. It is a key component of sustainable development and relies on three basic criteria: participation, multidisciplinary collaboration and equity.[13]

At the 12th session of the CBD's Subsidiary Body on Scientific, Technical and Technological Advice, in 2007, it was concluded that useful experience had been acquired in applying the EA, mainly at a local scale, but it was necessary to disseminate this information at all levels. Access and awareness need to be improved by formulating clear and direct messages with the help of practical tools. More widespread adoption of the EA could contribute to the achievement of the Millennium Development Goals (MDGs). It was also stated that EA principles should be considered from the very first

stages of policy elaboration and planning at all levels related to natural resources and that they could be useful in developing poverty reduction strategies and cross-sectoral policies.

IUCN's Commission on Ecosystem Management (CEM) carried out a series of global case studies from 2003–2006; among these was the Bocas del Toro study in Panama, which demonstrated EA application mainly in the context of coastal-marine projects. It was based on the guide that synthesizes five steps for EA implementation:[14] planning, monitoring, ex-post analysis, assessment and establishment of the lessons learned. It provides a guideline for EA structuring, provided that people are willing to share power and knowledge and redesign management goals. It concluded that the EA should be translated into effective and democratic planning for the improvement of people's living conditions as a contribution to achieving the MDGs.[15]

The EA in Latin America

In the region, the EA has converged with other approaches to the management of natural resources at a landscape[16] scale such as biosphere reserves, model forests, management of water resources and watershed basins, and conservation corridors.[17] Various organizations have promoted its structuring and analysis, such as the United Nations Educational, Scientific and Cultural Organization (UNESCO),[18] IUCN through CEM [19] and WANI,[20] the Tropical Agriculture Center of Research and Education (*Centro Agronómico Tropical de Investigación y Enseñanza* or CATIE),[21] the University for International Cooperation-Latin American School of Protected Areas (*Universidad para la Cooperación Internacional-Escuela Latinoamericana de Áreas Protegidas* or UCI-ELAP) in Costa Rica,[22] and the Alexander von Humboldt Institute (AvHI) in Colombia.

Since 1997 the International Development Research Centre (IDRC) has been involved in activities in Latin America aimed at understanding the impacts on health of small-scale mining, agro-ecosystems and urban ecosystems. This approach is already being included in initiatives of the Pan-American Health Organization, and in the meetings of the ministers of health and environment of the region.[23]

CEM, together with AvHI, the United Nations Environment Programme (UNEP), and the Tropenbos Foundation, organized a meeting in Villa de Leyva, Colombia, to assess the experiences of applying EA in Latin America; contribute to its review and evaluation process at a global level; and propose activities to be developed in the region by governments, IUCN and CEM.

Case studies

This publication includes 12 case studies:

1. The Chocó-Manabí conservation corridor and applying the EA

The Chocó-Manabi conservation corridor is located in a biodiversity hotspot on the border of Colombia and Ecuador with an area of over 200 000 km^2. The EA has been applied both in the planning and structuring of most projects at local level. Indicators have been proposed to assess progress made in addressing the 12 EA principles, showing their contribution to biodiversity conservation, to the CBD's Programme of Work on PAs, and to the MDGs. Promotion of cultural diversity as an adaptive management strategy, and a greater commitment of governments and cooperation agencies in adopting the EA in their financial strategies is important. The promotion of the EA in other sectors, apart from the environment, and coordination with territorial zoning, is a challenge, especially at the local level.

2. The EA in ecoregion management, Chiquitano Forest in Bolivia and Paraguay

The Chiquitano Forest is located in Bolivia, Paraguay and Brazil and covers an area of 24 million hectares (ha). Strategies and initiatives for its conservation and sustainable development have been promoted for the past seven years. The main lessons learned have allowed adaptations to be made to those strategies, such as planning at multiple spatial and temporal scales, defining priorities in terms of ecological integrity, local participation in territorial and natural resource management, promoting decentralization of decision-making, integrating understanding and assessment of natural resources.

3. Oak Forests conservation corridor: an integrated strategy for biodiversity management and conservation in the framework of the EA

This corridor is located on the western slopes of the Eastern Mountain range in Colombia in the administrative districts of Boyacá and Santander. Its ecological importance is due to the presence of relicts of different types of ecosystems, among which the most outstanding are the oak forests that cover an area of 173 368 ha. White oak and black oak species and around 20 endemic species occupy highly degraded areas. It is one of the richest areas in vascular plants in the Andean region, with almost 1800 different plant species. It also harbours 50 species of mammals and more than 243 species of birds. The EA has been one of the main tools in the design and structure of a sustainable development strategy. Including the concept of cultural conservation objects for identifying landscape elements with cultural significance was particularly important. This reveals the close bond between natural processes and cultural processes. One of the biggest impacts of EA application has been the identification of a regional geographical unit that unifies criteria at the bio-geographic level. Local-scale actions are designed to affect adjacent ecosystems as well.

4. The Andean Moor Project: applying the EA at a regional landscape level

Moorland occurs above the forest line in the Andes and below the perpetual snow line in the Andes of the north, 3500–4700 m above sea level. The EA has allowed the social, ecological and geographical complexity and politics of these transborder landscapes to be better understood. The moors offer multiple benefits and involve the interests of many different stakeholders, with activities at different scales with different benefits. Many of the EA principles were easily understood by the local communities, given the holistic vision of Andean cultures. The success of this initiative was due to the research methodology, which included participatory action and adaptive management. There are continuing challenges with other sectors, however.

5. The Paraguay-Paraná Wetlands System: an initiative in progress

This initiative embraces six countries of the South Cone and seeks to bring together conservation and sustainable development in the region by applying the EA. The progress made to date shows that it is necessary to demonstrate the practical nature of the EA to confront the prevailing sectoral approaches to water resource management. The EA principles have been applied partially, with different degrees of intensity; their use as a complete and coordinated whole is still uncommon. There have been difficulties in harmonizing the work at different spatial and temporal scales, and in overcoming the political barriers implicit in working in six different countries. Indicators are needed to effectively apply the EA's principles and overcome its prevailing theoretical nature. This initiative demonstrates the effectiveness and convenience of coordinating conservation and sustainable use with effective participation mechanisms.

6. A connectivity strategy at Mbaracayú's Forest Biosphere Reserve and the EA

This initiative seeks to connect the 300 000-ha biosphere reserve with the 64 000-ha forest in a region inhabited by several indigenous cultures and by large and small producers. Applying the EA has brought environmental, social and economic results. Identifying local stakeholders and generating initiatives tailored to their requirements was important. The constant change of stakeholders makes it necessary to continually adapt. Donors' economic limitations and demands make it difficult to establish long-term goals.

7. The EA applied to water management: a Latin American perspective

This case study examines progress in sustainable water management in the region, supported by the EA and by integrated management of water resources and watershed basins. In practice, these approaches have not yet had a significant impact on the region, although the EA can enrich and supplement traditional approaches to water use. Application of the EA is hindered by the lack of coordination between interna-

tional and national agencies regarding holistic water management, and better coordination is needed between UNEP, the UN Food and Agriculture Organization (FAO), the Global Water Partnership (GWP) and IUCN.

8. To know is to respect: indigenous ecological-cultural principles and the EA in the Colombian Amazon

This case study shows the development of principles 11 and 12 of the EA, based on participatory research and the knowledge in Amazon indigenous communities. Support mechanisms have been promoted for research and co-research among indigenous communities. These mechanisms recognize and support ways of generating knowledge and promote a collaborative approach and a different way of action. Their goal is to ensure that conservation is understood as sharing and coexisting with other forms of life, thus avoiding disorder and guaranteeing a balance that avoids the degradation of the planet.

9. Contributions of the Alexander von Humboldt Institute to EA application in Colombia

The Alexander von Humboldt Institute (AvHI), which is part of the National Environmental System, only explicitly adopted the EA in its strategic plan for 2005–2010. Three projects have applied the principles of the EA in their implementation phases: formulation of the regional biodiversity action plan for the Orinoco basin; use of biodiversity by local communities in the Andean mountains; and landscape planning for biodiversity conservation in the coffee-growing area.

10. The EA in the management of Marine and Coastal Protected Areas (MCPAs) in Chile.

This Global Environment Facility (GEF) marine project aimed to balance conservation of coastal marine resources and economic development, based on the sustainable use of these resources and strengthening local governance. The EA offers a holistic vision beyond partial management plans. Although there have been difficulties in evaluating the marine environment, progress has been made in data production, work within the community, and in the elaboration of the management plan through public consultation.

11. Development of Panama's national agro-ecological zoning programme: an EA

This programme is a comprehensive planning tool for the agrarian sector. It considers ecological criteria for crop zoning according to the soil's agro-ecological suitability and the region's socio-economic capacity. It includes the development of land-use change scenarios, impact assessment of the production systems and their changes, and assessment of national and regional agricultural sustainability. Models for replication in similar agro-ecological areas are being developed.

12. The EA as a guide for action: the Fúquene Wetlands Complex in the eastern Andes of Colombia

These wetlands have a high conservation value due to the presence of a great number of species at a high risk of extinction. They also provide water for human consumption in local municipalities and support the dairy industry and local fisheries. Application of the EA has shown that sustainable management requires both efficient use of water for the dairy industry and making this use compatible with the ecosystem's multiple values and functions. The main challenge is to manage the lagoon's water, ecological and social systems so as to make compatible with the creation and administration of a PA based on the sustainable use of biological resources by local communities. This will benefit the population in general.

Lessons learned

The Villa de Leyva workshop drew out the lessons learned from the case studies, as well as the opportunities to and limitations of applying the EA in the region. Recommendations were also developed.

The EA has been applied in the region for some time, although in many cases in an ad hoc manner. In some situations its application is institutionalized. In most cases, it has occurred in the context of projects that are more oriented to conservation and sustainable use of biodiversity; it is necessary to engage other key sectors such as agriculture, fisheries and forestry. The EA's interpretations vary considerably according to the situation and the context. It is therefore important to establish follow-up indicators for each principle, as a guide and to ensure that the EA is applied appropriately. Adaptive management is a key aspect that will have the highest priority in the future given the challenges of climate change.

Limitations

Issues such as land boundaries and illiteracy among stakeholders make it challenging to achieve the participation of all parties in the application of EA. Participatory processes are very expensive and many projects are not willing to finance them. When they do occur, they can raise expectations that may be very difficult to meet, since the projects are often very short-term. There is not enough emphasis on the generation and dissemination of knowledge and information.

Opportunities

New projects that address strategic issues such as climate change and ecosystem services are starting to gain momentum in the region. Systematization and analysis of existing studies will allow better organization of knowledge and will orient actions in the planning and decision-making sectors. Dialogue with ethnic groups over their

vision of the universe and their adaptive way of life is essential. The issue of human health opens up new areas of research and new challenges for EA application.

Recommendations

The EA is a fundamental part of the solution of ecosystem management problems and sustainable development management in general. It is becoming necessary to look beyond the environmental sector to land-use planning and land zoning and to public policies outside the environmental sector and in the private sector to ensure that governments commit themselves in a definite manner.

It is also essential for regional cooperation and management organizations to adopt EA in their agendas. This includes MERCOSUR (*Mercado Común del Sur* — the common market of the south, encompassing Argentina, Brazil, Paraguay and Uruguay); GEF; the Amazon Cooperation Treaty Organization; the Community of Andean Nations (*Comunidad Andina de Naciones* or CAN); and the Andean Development Corporation as well as bilateral and multilateral cooperation organizations. The EA can also be a viable tool to solve conflicts during war and natural disasters.

It is imperative to develop strategies to provide information and training aimed at all stakeholders, including decision-makers, and to look for ways to link them to environmental education programmes. It is important to find ways of facilitating information exchanges between stakeholders of different cultures and views, especially native and Afro-descendant populations.

The development of indicators for the principles offers the possibility of objectively evaluating progress. Indicators can only be a guide, however, since their application will vary by case and by the level of detail.

The conceptual framework should emphasise the development of monitoring instruments and more thoroughly applying concepts such as adaptive management and ecosystem services, the valuation of environmental liabilities, people's effects on their environment and cumulative effects on ecosystems.

Case study 1

The Chocó-Manabí Conservation Corridor and applying the Ecosystem Approach

Ángela Andrade Pérez[24]

Summary

Important progress is being made in Latin America in the application of the Ecosystem Approach (EA) in conservation corridors and other similar initiatives. These experiences contribute to the achievement of the CBD objectives, and to the 2010 goal of reducing the rate of biodiversity loss.

In addition to the directives proposed by the CBD, initiatives have been developed in the region — with the participation of academics, scientists, decision-makers, planners and regional experts — to make the EA more operational in practice and to make effective progress in its application. Attributes, indicators and assessment criteria that were used in the Chocó-Manabí Conservation Corridor have been proposed with the aim of contributing to methodological development.

Introduction

The concepts of "corridor for the conservation of biodiversity," "biological corridor" and "ecological network" are increasingly being referred to around the world in response to the main causes of biodiversity loss: the fragmentation of natural ecosystems and changes in land use.[25] According to the CBD,[26] 200 projects relate to such corridors globally and 482 biosphere reserves exist in 102 countries. These initiatives are beginning to be seen as appropriate instruments to reach the goals and commitments of the CBD[27] for 2010 and to achieve some of the MDGs.

Initiatives oriented to the promotion of biological or conservation corridors have also started to be included in the Latin American environmental agenda. The corridors have several main objectives:

- to consolidate a network of PAs;
- to address conservation needs and economic development;
- to prevent the loss of any biodiversity components; and
- to ensure the perpetuation of ecological and evolutionary processes.

Conservation corridors are made up of a system of PAs, a connectivity network, a group of compatible uses of land[28] and networks of stakeholders. The EA adopted by the CBD[29] contributes to corridor management and to the CBD Programme of

Work on Protected Areas, which includes the establishment of networks and ecological corridors. The Programme of Work states that by 2015, all PAs will be "integrated into the wider land- and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity and the concept, where appropriate, of ecological networks."

Methodology

A wide range of projects in South America address the construction of corridors, at different scales and with different objectives. In a first attempt at classification and organization, the IUCN Regional Office for South America (UICN-Sur), with the support of the CEM, identified 82 projects, including three corridors that touch on more than three countries, 15 bi-national and tri-national and one marine network.[30]

Conceptual and methodological progress

Experience and analyses in the region have been oriented toward EA principles, which has hindered comparisons and assessment of their effectiveness. There is an increasing need to formulate attributes and analysis indicators that are easily measurable and will allow effective progress in the development of the EA.[31]

A comparative assessment was carried out on eight case studies that applied the EA's principles and the directives proposed by the CBD for transboundary projects relating to water resources. It found that comparisons were quite subjective due to the lack of specific assessment indicators and measuring instruments. These results revealed, however, that the EA is becoming better positioned as a conceptual framework in projects oriented to comply with the CBD's mandate.[32] Other efforts and initiatives have been undertaken to achieve better application of the EA in the region.[33]

Social, economic and cultural principles

One of the EA's contributions is the recognition of human beings and of social and cultural systems as intrinsic components of ecosystems. Its principles 1, 2, 4, 10, 11 and 12 relate to the promotion of cultural diversity. This includes knowledge, institutions, adaptive patterns and visions of the future, which are key elements for the harmonious development of society. Understanding the application of the principles requires a comprehensive assessment of these components.

Ecological and biological principles

Principles 3, 5, 6, 7, 8 and 9 focus on ecological and biological aspects. They are oriented to the spatial and functional relationships between adjacent ecosystems, the structure and function of ecosystems, and adaptive management in the dynamic and evolutionary context of ecosystems.

Results

The EA in the Chocó Manabí Corridor

The Chocó Manabí conservation corridor (*Corredor de Conservación Chocó Manabí* or CCCM) initiative was developed by Conservation International in 2001 with the support of the Critical Ecosystem Partnership Fund (CEPF).[34] It takes up approximately 48.3 percent of the total area of the Tumbes Chocó Magdalena hotspot[35] (which has a total area of 274 597 km^2). It is in a transition zone between two high-priority terrestrial ecoregions — Tropical Andes and Tumbes Chocó Magdalena — and is fundamental for the survival of the tropical rainforest and the very humid premontano forest. It harbours around 9,000 species of vascular plants, 25 percent of which are endemic, and is the most floristically diverse region in the neotropics. There are 830 bird species (10 percent endemic); 235 mammal species (25 percent endemic); 350 amphibian species (60 percent endemic); and 210 reptiles (30 percent endemic). There are 79 municipalities in the corridor in Colombia and 42 in Ecuador, with 3 726 000 inhabitants made up of Afro-descendant, half caste and indigenous populations: 80 percent of the population lives in extreme poverty; 78 percent of the corridor's total area is under special management.

These are the main threats to the corridor:

- deforestation and ecosystem fragmentation from expansion of agricultural land, roads and international frontiers;
- over-exploitation of valuable wild fauna and flora species;
- low ecosystem representation in the national system of PAs;
- unsustainable production practices;
- insufficient alternatives to stop the deterioration of the natural heritage;
- challenges from globalization (TLC, infrastructure works and the expansion of the biofuel agro-industry);
- an increase in armed conflict; and
- expansion of illegal crops.

The long-term vision for the corridor is for it to be managed for ten years as a biodiversity corridor that reconnects natural habitats, consolidates PAs and maintains cultural integrity from Chocó to Manabí and fosters and establishes sustainable development practices among stakeholders. The goal is a well designed and sustainable network of PAs, covering 767 929 ha, established by 2015 in the 10.7 million ha of the CCCM.

Strategic directions include establishing and strengthening local and regional mechanisms to promote conservation; enhancing management of PAs and threatened and endemic species; and identifying and promoting sustainable development practices among communities living near PAs.

The EA has been applied in two contexts: as the corridor's overall work plan and as a reference for project development. In the first case it was taken into account when defining strategic plans of action and as a conceptual and methodological framework for coordination management. In the second case a methodological guide was elaborated for the partners and collective follow-up meetings were carried out.

Table 2. Actions carried out according to Ecosystem Approach principles

Principle 1. The objectives of management of land, water and living resources are a matter of societal choice		
attributes	**indicators**	**work developed in CCCM**
• existing and desirable participation mechanisms in decision-making related to ecosystem and PA management	• actors and sectors with impact on ecosystem and PA management, characterized by their level of importance, influence and decision-making power • number of participation and social self-management mechanisms created or empowered, oriented toward ecosystem and PA management	• map of local actors developed and characterized and a social network established • opportunities for dialogue created with ethnic groups and with local communities Establishment of action principles: transparency, trust, respect for autonomy and commitment • invigoration of local processes: support for activities developed by ethnic groups • new civil society associations created, such as Asocorredor[36]
• social control of local actors in the definition of goals and objectives for ecosystem and PA management	• degree of representativeness of the groups of actors involved • Level and decision-making power of each social stakeholder in the formulation and prioritization of the objectives of ecosystem and PA management	• more than five sectors and ten organizations putting together a strategic VISION for the corridor • community groups convened and in process

Principle 2. Management should be decentralized to the lowest appropriate level		
• the regulatory scheme and the decision-making structure promote the decentralization of ecosystem management and conservation	• Level of decision-making power over critical aspects of ecosystem function and PA management	• not enough participation mechanisms • no juridical clarity on the level of competence of community authorities in environmental management
• administrative levels involved, public and private, in ecosystem and PA management	• number and type of administrative levels involved in the process	• more than 40 municipalities with corridor objectives incorporated into their land-use plans • four regional environmental authorities assign resources • protected area management plans related to the corridor
• empowerment and organization of local communities	• number and type of organizations • number of projects implemented by local communities	• community organizations involved and empowered: indigenous reserves and territories of Colombia and Ecuador, and community councils of Afro-descendant communities in Colombia • more than 15 projects developed by local communities
Principle 3. Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems		
• adjacent ecosystems with spatial and functional relationships with PAs identified	• ecological processes beyond PA limits • PA watershed basins • ecosystems shared among administrative units, PAs and strategic ecosystems	• spatial analysis and modelling indicating PA presence in different municipalities, basins, etc. • identification of high-priority ecosystems that require action outside the corridor limits
• socio-economic and ecological processes that impact on ecosystems adjacent to PAs	• migratory flow of people from and to high-priority ecosystems and PAs • key species that move within PAs or are found in adjacent ecosystems	• preliminary evaluation of population displacements in the region
• shared promoted ecosystem management mechanisms	• agreements for shared ecosystem management • activities geared toward the management of shared ecosystems	• preliminary action plans in identified shared ecosystems

Principle 4. Recognizing potential gains from management, it is necessary to understand and manage the ecosystem in an economic context.		
• policies and laws take into account economic aspects in biodiversity conservation and in ecosystem and PA management	• number and type of policies, laws, programmes and projects that favour or limit ecosystem management and conservation in the production of sustainable goods and services • variation in resources invested in ecosystem conservation and management • socio-economic characterization of the region	• new laws, for example the forest law and investment plans in infrastructure affect conservation management in the region • strategy of designed financial sustainability, based on economic instruments • factors that affect the region's sustainability and its trends, identified • characterization of the region's social and economic context and baseline definition
• current and potential use of ecosystems including goods and services	• Land-use zones, Territorial Classification Plans, current use and classification of aptitudes, agreed and developed in different scales	• revision of current plans and territorial classification schemes Most are just beginning and information is limited
• certification processes and marketing of local products, with added value for biodiversity conservation	• number and type of promoted experiences • number of people involved • additional economic benefit	• 91 miners with "green gold" certification schemes • concept of conservation coffee developed; it integrates the effort of more than 500 families in four municipalities, achieving a 40% increase in income
• assessment and PES initiatives that contribute to biodiversity maintenance or restoration	• number of initiatives ongoing • restored areas	• two PES initiatives developed: Munchique Pinche corridor and Chachi Reserve • 2000 ha of reestablished riparian forest recovered and more than 20 plots in the process of being restored by the mining industry

Principle 5. Conservation of ecosystem structure and functioning, to maintain ecosystem services, should be a priority target of the approach		
• current uses of land and biodiversity assessed and their impact established	• changes in ecosystem goods and services identified and assessed	• maps of land change and coverage with satellite images for different periods
• PA management plans and conservation actions oriented toward maintaining ecosystem structure and functioning	• priorities for the conservation of ecosystems, species and ecosystem services identified • strengthened existing PAs • new PAs proposed • ecological restoration activities ongoing	• new PAs identified: Playona, Unguía and Marriaga marsh; Atrato wetlands complex; higher and lower San Juan; mangrove areas • support to management plans of more than ten PAs in Ecuador • establishment of new public, private and community PAs: in Colombia 39 340 ha and in Ecuador 34 200 ha, in collective, community and private territories • 25 restoration plots with similar forestry model in extractive mining areas • 2000 ha of riparian forest under restoration in the *Munchique Pinche* corridor
Principle 6. Ecosystems must be managed within the limits of their functioning		
• ecosystem disturbance factors due to the actions of man and natural processes	• type and impact of the effect on established and mapped ecosystems	• high-priority affected sectors of identified ecosystems under mapping modelling
• ecological integrity of ecosystems	• degree of fragmentation of natural ecosystems • mechanisms and connectivity options identified • identification of high-priority indicator species • spatial distribution models of threatened and endemic species	• established fragmentation indexes at landscape and fragment levels • relationships between fragmentation and species composition changes are established (Darién)[37] • high-priority micro-corridors identified[38] • 20 species are identified with high level of community participation • maps of potential distribution of endemic and threatened species: 150 maps using the Mahalanobis model: 36 amphibians, 106 birds, 105 mammals, 54 butterflies and 82 plants

Principle 7. The EA should be undertaken at the appropriate spatial and temporal scales		
• working scales established to meet the objectives of ecosystem and PA management	• degree of representativeness at different scales in management structure or initiative • information protocols developed for each management level	• appropriate working scale based on conservation objectives established • protocols agreed to with the partners indicating scales and information requirements • mapping generation agreements based on the projects: 1:50,000–1:25,000 and general mapping 1:750,000, 1:500,000 and 1:250,000
Principle 8. Given the varying temporal scales and lag-effects that characterize ecosystem processes, long-term objectives should be set for ecosystem management		
• PA and ecosystem long-term management objectives established and agreed at the different management levels, including public or private areas	• policies, strategies and favourable measures for ecosystem management and protection formulated and developed in a participatory manner with a long-term vision • PA management plans with long-term objectives • Long-term initiatives involved in the plans of private organizations and communities	• Long-term vision and goals for the corridor agreed and established by consensus with communities and actors • revision of policies and plans at multiple levels • PA management plans with long-term objectives • actions in the region's strategic plans and resources assigned: four regional environmental authorities in Colombia; PNN management plans in Colombia; PA management plans in Ecuador
Principle 9. Management must recognize that change is inevitable		
• changes in social, political and economic patterns involved in ecosystem management practices and PA management • changes in the nature of ecosystems due to natural processes or induced by man, considered in ecosystem management and PA management	• demographic changes by age, sex groups and ethnic groups • variation in poverty indexes • variation in the population's well-being levels • variation in development policies and actions that include ecosystem management principles • identification of processes and assessment of their impact on ecosystem integrity • vulnerability of ecosystems to climate change, risks and established natural threats • mitigation measures and conservation actions identified and adopted to mitigate climate change	• population change models developed, with poverty indicators, population composition and distribution • changes in social and economic patterns and impact on PAs • conceptual models showing the variables and where they will affect the habitats of endemic and threatened species in the next ten years, indicating the number of ha • ten models are elaborated to estimate the area that can be subjected to anthropic pressure • vulnerability to climate change and other processes and mitigation and adaptation actions defined • identification and implementation of conservation actions in the territories of indigenous and Afro-descendant peoples

Principle 10. The EA should seek an appropriate balance between, and integration of, conservation and use of biological diversity.		
• coordination between conservation and development in land-use plans and sectoral plans	• degree of correspondence between land-use suitability and uses assigned in the land classification plans and sectoral plans • identified high-priority conservation areas — biodiversity and cultural — and included in land classification and sectoral plans • connectivity between conservation areas identified and involved in land classification and sectoral plans	• revision of maps and documents for land-use suitability, classification and development of activities on the land • models of distribution of threatened and endemic species • representativeness of ecosystems in PA systems • revision of land classification and plans according to function of conservation areas and identification of priorities
• adequate standard of living of the population	• change in the UNDP Human Development Index (HDI)	• monitoring system that includes social, economic, ecological and process criteria, agreed among organizations; monitoring changes in the HDI, quality of services and use of the land
• utilization and sustainable use of biodiversity goods and services	• factors that affect sustainability in identified sectorial activities • changes in the quantity and quality of ecosystem services • agendas with productive sectors established and ongoing	• sectors, policies and programmes that generate high negative impact in the ecosystems identified: large-scale mining, palm cultivation, shrimp cultures, infrastructure development • establishment of follow-up indicators on quality of ecosystem services • work agendas with proposed productive sectors
Principle 11. All relevant information should be considered, including scientific and indigenous and local knowledge, innovations and practices		
• practices and traditional and scientific knowledge involved in ecosystem management processes and PA management	• number and type of actions developed by individuals, organizations or institutions based on scientific knowledge and traditional practices • number of initiatives to promote traditional knowledge • number of regulations, guidelines and formal and non-formal education programmes elaborated based on consistent and validated traditional and scientific knowledge	• summary of actions or projects developed • revision of the content of such actions based on local knowledge • promotion of projects oriented toward the articulation of western scientific knowledge and traditional knowledge systems such as the environmental and cultural code of the Awa territory

• mechanisms to exchange information between scientific entities and traditional and local organizations for conservation, sustainable use of biodiversity and PA management	• organizations involved in the production of basic and applied information operating as a network • number of alliances established between research institutes and organizations	• identification of public and private community organizations • alliances with scientific research institutes and organizations to share information and to establish information and monitoring system • basic and thematic mapping information system is available and easy to use
Principle 12. The EA should involve all relevant sectors of society and scientific disciplines.		
• intersectoral and interdisciplinary teams established for ecosystem and PA management	• knowledge sectors and disciplines identified and working in ecosystem management processes • establishment of linked interdisciplinary teams	• sectors involved and working on the process • knowledge areas involved
• intersectoral, interdisciplinary and multidisciplinary coordination mechanisms in operation	• ecosystem and PA management agreements with the various scientific sectors and organizations in place and functioning	• alliances for information management among partners, research institutes and NGOs • processes for the integration of vision, perspectives and priorities of stakeholders • corridor communications strategy designed and in operation

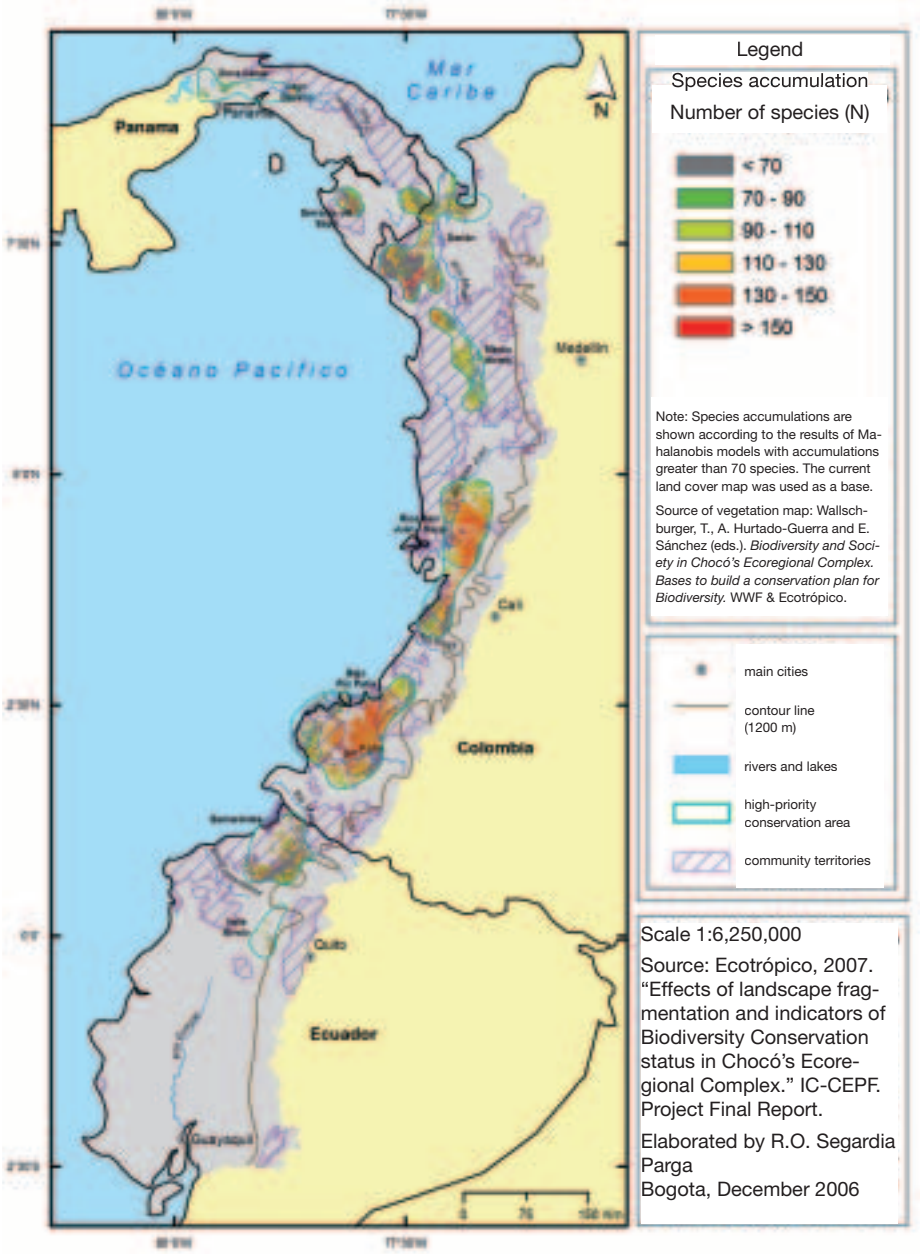
Modified from Ballesteros and Vides (2005).[39]

Conclusions for EA application in corridors

- The EA contributes to achieving the objectives of the CBD's Programme of Work for PAs and reducing biodiversity loss, especially through conservation corridors or biological corridors. Its application should be further promoted.
- Conservation of biological diversity is as important as that of cultural diversity.
- Conservation objectives should be integrated with spiritual and cultural values.
- More work needs to be done in the development of adaptive management strategies to deal with cultural and environmental changes.
- A greater political commitment to the EA is required from governments, cooperation agencies and donors to prove its relevance in the execution of the MDGs and other global commitments.
- It is important to develop operational tools — including attributes and indicators for each principle, appraisal methods and monitoring and assessment systems — to be better able to demonstrate the EA's potential contribution.

- It is necessary to promote the EA in other agendas and sectors, in land-use planning and to highlight its contribution to fulfilling the MDGs and meeting the 2010 target.
- More training and capacity building is needed on the scope of the EA, especially at planning and decision-making levels.

Map 1. indigenous and communal areas: High-priority zones for conservation



Case study 2

The value of the Ecosystem Approach in the ecoregional management of the Chiquitano Forest in Bolivia and Paraguay

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Summary

The Dry Chiquitano Forest ecoregion (*Bosque Seco Chiquitano* or BSCh) extends through Bolivia, Paraguay and Brazil, occupying an area of approximately 24 million ha. For more than seven years, strategies and initiatives have focused on conservation and sustainable development, using the EA as a framework. The main lessons learned from its application have allowed for adaptive adjustments of these strategies, such as planning at multiple spatial and temporary scales, defining priorities in terms of ecological integrity, local participation in territory and natural resources management, decentralizing decision-making, integration of knowledge and evaluation of natural resources. The experience generated at this ecoregional scale shows the EA's usefulness in creating more integrated and effective conservation processes.

Introduction

Dry, tropical forests are complex and fragile ecosystems and their biodiversity and ecological function are not very well understood (Sánchez-Azofeifa et al. 2005). Around 97 percent of the remnants of these forests worldwide are at risk from various threats, including fragmentation, fire, land conversion for cultivation and raising livestock and global climate change (Miles et al. 2006).

BSCh is the largest and best preserved forest in South America. It originally extended through the west of Brazil, east of Bolivia and north of Paraguay, covering an area of 24.7 million ha (Dinerstein et al. 1995; Vides et al. 2005). Most of it is in Bolivia — 16.5 million ha — and it has the greatest representativeness and best conservation condition in the region. It contains a number of ecosystems, including a complex mix of cerrado and flood-plain savannas. Paraguay has the next largest area, while in Brazil less than ten percent of its original cover remains (Killeen et al. 1998; Navarro and Maldonado 2002; Ibisch et al. 2002; Vides et al. 2005).

The greatest threat to BSCh is deforestation, mainly due to the expansion of agricultural land for soybean, sorghum and sunflowers, the expansion of animal husbandry (encouraged by Chiquitania as having been free of hoof-and-mouth disease since 2003) and climate changes that show local trends of reduced rainfall and an increase

in temperatures. Loss of connectivity has been identified as a threat that could threaten BSCh's functional landscape maintenance in the long term.

The case study posed the following questions: How can conservation strategies be developed at an ecoregional scale? How can these strategies be put into practice, considering the complexity and the size of the ecoregions? How can an acceptable balance between conservation and use of biodiversity be maintained? The EA provides a reference framework for decision-making with effective participation by all those who are jointly responsible for environmental management and with planning at multiple spatial and temporal scales (Shepherd 2006).

It is important to clarify what is understood by the term "multi-scale planning." It means establishing management perspectives at different spatial levels — farm, landscape, ecosystem, watershed basin, ecoregion, etc. — and defining strategic objectives over different time periods, taking into account that "long term" should be measured in ecological-evolutionary terms. Thinking in multi-spatial terms implies organizing the territory in a way that allows for multiple uses at a regional scale and restricted uses at a unit or site scale. Gradations between these areas are critical for biodiversity conservation.

Ecosystem limits are elastic and change over time. Ecosystem managers should take this into account when planning and managing, and therefore think and act at multiple scales. The EA has helped improve biodiversity conservation strategies and initiatives at the landscape scale in the BSCh.

Methodology

Planning scale

The EA was significant to BSCh management at the ecoregional level. The conservation and sustainable development plan of Dry Chiquitano Forest in Bolivia (Ibisch et al. 2003), developed and promoted by the Chiquitano Forest Conservation Foundation (FCBC), began with the participatory design of an action plan for an area of 7.7 million ha containing of a number of ecosystems, but mainly dry tropical forests. The plan outlined the main challenges aimed at finding a fair and effective balance between conservation and socio-economic development.

Work began based on key plans of action such as sustainable forest management (SFM), land use and biodiversity conservation in PAs. After a critical analysis of the conservation and sustainable development strategic plan, however, the need was identified to more thoroughly study the application of the 12 EA principles, in order to achieve success in conservation terms (Margoluis and Salafsky 1998).

In a joint effort with The Nature Conservancy (TNC), the FCBC started an ecoregional planning process, mainly putting into practice Principles 5 and 10, which emphasise the need to preserve ecological integrity at multiple spatial and temporal scales, to manage ecosystems within their functional limits, to look for support in adaptive management and in the search for a balance between the conservation and use of biodiversity, among other relevant aspects. The resulting ecoregional plan (Vides et al. 2005) allowed not only the FCBC but the entire ecoregion to define new strategies and actions based on biodiversity conservation.

Assessment of the EA's application

Five years after applying the EA to the BSCh ecoregion, its impact in achieving the CBD objectives was assessed (Shepherd 2006; Lobo 2006. By conducting semi-structured interviews with a team of key stakeholders in the region, the degree of application of the EA 12 principles was assessed using a set of standard criteria and indicators.

Considering the importance of land use for natural resource conservation, the survey differentiated between municipalities that already had territorial management tools, such as a municipal land use plan (*Plan Municipal de Ordenamiento Territorial* or PMOT), in effect for two or three years and those that did not. Key actors assigned values according to their perception on a scale from 1 to 5 — minimal or null application up to excellent or optimal application — for each of the EA principles (Lobo 2006). The assessment also led to the definition of a base line for EA application in the BSCh.

Results

Specific examples of EA application

Applying the EA to ecoregional planning allowed a conservation portfolio to be developed that identified the places of greatest interest for biodiversity protection and ecological integrity maintenance in the ecoregion. The proposed conservation portfolio includes the identification of key biodiversity conservation areas (0.2 million ha), very important areas (1.6 million ha) and seven critical biological corridors and eight key corridors to maintain ecological connectivity and functionality (4.6 million ha). A series of short, medium and long-term goals were proposed in the different BSCh sectors, in Bolivia and Paraguay in particular.

Although the EA should be applied in a comprehensive manner — in other words, it is not valid to apply some principles and not others — in practice it is necessary to strengthen those principles that are already being used and promote those that have not yet been applied. Local conditions may mean that some principles are more eas-

ily applied than others. In the BSCh, for example, Principle 1 (selection of natural resource management objectives should remain in the hands of society) is easier to apply due to the legal mechanisms for public participation that already exist in Bolivia. These mechanisms enable full public participation in the definition of land use, and in the use and occupation of land according to its socio-economic development potential, limitations and interests.

More specific territorial management instruments, such as PMOTs, foreseen in Bolivian law, have also been used in the BSCh in the framework of Principles 7 and 8. On the other hand, managing ecosystems within the limits of their function (Principle 6), reveals a gap in knowledge about what those limits are. There is not enough information for the limits for ecosystem use to be recommended with certainty, but the existing information base and an adaptive management approach (Principle 9), will help deal with this uncertainty.

On the other hand, the reasonable application of Principle 2 (management should be decentralized to the lowest appropriate level) has led the FCBC to promote, in conjunction with government officials and local communities, the establishment and management of PAs. Various management initiatives and mechanisms for municipal and district PAs have been generated in this manner (Vides and Reichle 2003). A management plan for one PA, Tucavaca Reserve, was designed with active local participation, as per Principle 1, through the integration of empirical and scientific knowledge (Principles 11 and 12).

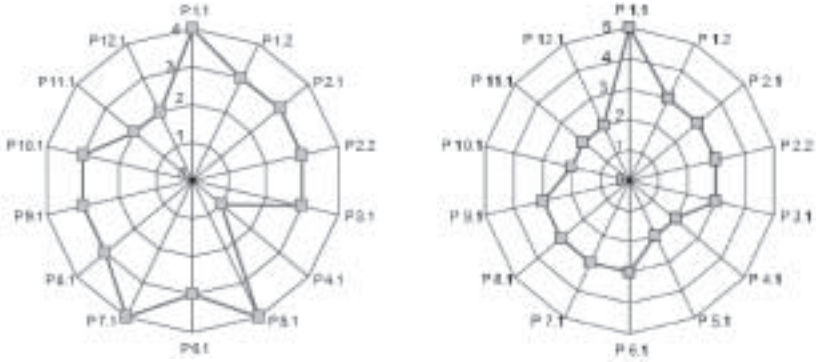
Assessment of EA application

Approximately 63 percent of the key stakeholders interviewed assigned grades of 4 and 5 to Principle 1 and its corresponding criteria, which correspond to public participation in decision-making on natural resource management. This demonstrates a positive situation in the region. On the other hand, 74 percent and 97 percent of respondents assigned scores of 1 and 2, respectively, to Principle 4 (understand and manage the ecosystem in an economic context) and Principle 11 (knowledge integration). In other words, these are the principles least frequently applied (Figure 1).

Principle 4 has not been thoroughly analyzed because natural resource users don't take into account those indicators that show ecosystem management in an economic context, such as opportunity costs, economic appraisal of natural resources, and the costs and benefits of adequate management. This could be attributed to a public perception that natural resources, given their large extent and good conservation condition, are "endless," since the level of deterioration is still low and changes in land use are still imperceptible in some sectors. Although the difference is not statistically significant, higher scores were obtained from respondents such as forest concessions and some

local social groups in sectors that are legally entitled to use forest resources. These people and groups have and apply management plans, receive better economic returns, are positioning themselves in national and international markets and are trying to guarantee long-term use of the resource. The low score for Principle 11 could be attributed to the loss or neglect of certain traditional practices that are environmentally responsible and economically efficient.

Figure 1. Mean values of key stakeholders' perceptions of EA application in the ecoregion of the Dry Chiquitano Forest



1a: municipalities with PMOT 1b: municipalities without PMOT

A score of 3 was given to nine of the 12 principles, which shows a certain degree of awareness of the existence of norms and the recognition of negative repercussions, among other indicators. Although actions oriented to the structuring of these parameters are just beginning, a growing awareness is evident in local stakeholders about better ways to use natural resources, consistent with EA application. No significant differences were detected between municipalities with and without land-use instruments, probably because these processes are still relatively new in the region (Figure 1).

Conclusions

Strategic level

The EA made several contributions:

- developing a common and holistic vision of a set of ecosystems that share processes and biological diversity as a functional entity (an ecoregion);
- defining priorities at multiple spatial and temporal scales, intended to maintain ecological integrity in the ecoregion;
- catalyzing public participation through legitimate mechanisms so that the choice of management objectives for the land and natural resources remains in the hands of society;

- establishing concurrent investment synergies among a wide range of public, private, local, regional, national and international sectors, oriented to conservation and sustainable development; and
- governance of municipalities linked to the ecoregion through land-planning processes that contribute to the integration of social and economic sector interests, with conservation and the sustainable use of biodiversity.

Land-planning level

At the land-planning level at a municipal scale, the EA made several contributions:

- having a conservation and sustainable development plan in place with a geographical scope wider than administrative-political limits (e.g., municipalities) where work is done in socio-economic planning;
- considering ecological more than political limits, for example at an ecoregion level, landscapes, basins, etc.; and
- directing work in jurisdictional blocks that reflect ecological planning limits.

At financial and operational levels, it gave more credibility to the search for effective actions to achieve the CBD's objectives, the assessment of natural resources (tropical forests) by society and poverty reduction in Bolivia and Paraguay.

At a technical-scientific level the EA provided support to political decision-making through the integration of scientific knowledge and established a baseline of ecological, social and economic conditions that allows for medium- and long-term assessment of the effects of global changes such as climate change.

Barriers and difficulties

A number of obstacles hinder the EA's effective deployment as a conservation and sustainable development method. First, and paradoxically, the extent of the EA's application area has been a problem. Even though it is considered appropriate in ecosystem management terms, the logistics and interactions between juridical-administrative and political bodies — municipalities, districts, countries — and local organizations, mainly indigenous ones, are complex. Nevertheless, this drives creativity and adaptive management.

In addition, there is insufficient knowledge about and acceptance of the EA concept in society in general. The concept needs to be taken up not via theoretical definitions but through tangible processes such as the structuring of land use or the development of sustainable production activities. Third, rapid changes in social and political scenarios at national, district and municipal levels generate difficulties (but also provide new opportunities to test EA).

Working at the scale of municipal communities makes planning and land management processes viable in a holistic and compatible manner —through, for example, watershed basins and biological corridors — in ecological, political-jurisdictional, cultural and socio-economic terms. Conservation and socio-economic development objectives should be incorporated into the integrated management of the territory through formal planning instruments such as PMOTs. A number of specific resource management issues in the region, such as forest use, tourism, water use, biodiversity and soil conservation, also need to be addressed.

Challenges to be faced

The main challenge in ecological terms is establishing connectivity corridors that are coherent with land-use plans at municipal, private and community levels in order to consolidate critical conservation areas. Another challenge is carrying out "intelligent deforestation" in such a way that changes to land use are feasible — economically and ecologically — while the ecological processes and ecosystem integrity of the BSCh are maintained to a large extent, and establishing effective monitoring systems of those processes by using "landscape species" (Wildlife Conservation Society).

Adaptive management mechanisms are needed to deal with changes at the political, social, economic and geographic scale, underlining the role of the EA in the mitigation of these changes. Other key challenges will be the application of Principle 4 (understanding and managing the ecosystem in an economic context) so as to acknowledge the important economic, social and environmental benefits provided by forests, by the different actors and sectors of society, both in communities, in local and national governments, and in private business related to forest use and agricultural production.

Principle 11 should be put into practice more thoroughly, taking into account all the types of relevant information, including the knowledge, innovations and practices of indigenous, local and scientific communities. Relevant information should be generated and integrated to develop effective ecosystem management strategies that allow for sustainable use of timber and non-timber resources and the long-term maintenance of the area's ecological integrity.

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Case study 3

Oak Forests Conservation Corridor: An integrated strategy for biodiversity management and conservation

Clara Solano[44]

Introduction

The mountainous forests of the Eastern Mountain Range of Colombia are a worldwide and countrywide conservation priority. They are part of a number of critical sites identified by the World Wildlife Fund (WWF 1997;[45] Myers 1998[46]) for the rich diversity patterns of the northern Andes and for the threats to their natural ecosystems. The northern ecoregional complex includes more than 1500 bird species that constitute 37 percent of South American birds, 10 percent of the world's frogs, a wide diversity of butterflies, palm trees, orchids and an important number of endemic fauna and flora species. This diversity reflects the zone's variation in altitude and ecosystems.

For several decades the Andes region has been threatened by human activities, with a high level of permanent disturbance. It has suffered great diversity loss and dramatic transformation of its natural landscape.[47] Less than 10 percent of the original Andean forest remains (Henderson 1991, quoted by Rodríguez et al. 2004).[48]

The *Corredor de Conservación de Robles Guantiva-La Rusia-Iguaque* (Oak Forests conservation corridor Guantiva-La Rusia-Iguaque) is located in the Eastern Mountain Range, a region of great bio-geographical and cultural interest. The Colombian Natura Foundation coordinated and facilitated a planning process for biodiversity conservation and sustainable development there with 24 institutions, 20 local communities (350 people) and six town halls.[49] They discussed development options for the communities in the region, based on its natural resources, its conservation and management for long-term sustainability. The planning process was developed using strategies identified through projects and programmes also carried out by the Natura Foundation.

The EA has been one of the main tools in the development of sustainable development strategies, particularly in their structure, because it places the local people, their daily practices, their needs and their means of subsistence at the heart of conservation and sustainable development actions.

Location

The Guantiva-La Rusia-Iguaque conservation corridor includes 67 municipalities and occupies an area of approximately 1 073 000 ha. Its limits are defined by the water-

shed basins of the Chicamocha and Suárez rivers, on the western and eastern slopes, respectively, with an altitude that ranges between 350 m and 4100 m above sea level. The corridor is made up of an almost continuous expanse of natural moorland and Andean forests, where natural and transformed habitats interact, with the Guantiva, La Rusia and Iguaque[50] massif as its central axis.

Its ecological importance lies in the presence of relicts of different types of ecosystems such as dry forests, sub-Andean forests, Andean forests and moors, among which oak forests occupy an area of approximately 173 368 ha, the country's most extensive continuous oak forest zone. The White oak *(Quercus humboldt)*, Black oak *(Colombobalanus exelsa)* and approximately 20 endemic species that occupy highly degraded lands are found there. This is one of the richest areas in vascular plants in the Andean region, with close to 1800 different plant species. It's also home to 50 mammal species —12 of which are in danger of extinction — and more than 243 bird species.

Beneficiaries

The conservation strategy has different types of beneficiaries. Institutionally the regional environmental authorities (*Corporaciones autónomas regionales* or CARs) — Corpoboyacá and CAS — included programmes in their triennial plans which supported conservation activities in the corridor by allocating resources and carrying out practical activities; this also made their presence apparent in the region. Likewise, municipal authorities were able to incorporate into their development plans the conservation objectives and strategies related to the delimitation of areas that regulate water resources, and zones assigned for forest resource conservation and management.

The environmental organizations that participated in the process have been developing conservation and sustainable production projects in different parts of the corridor, mainly in moorland regions and Andean oak tree forests. Specific environmental agendas are being organized for both Boyacá and Santander.

The plan has benefited local farmers by taking into consideration their interests, visions and circumstances. Local inhabitants were given an opportunity to have an input into the design of the strategies and high-priority actions for the region. In addition, 60 families are benefiting from the projects through which the Natura Foundation developed its strategy.

Objectives, methodology, work plan and resources

Plan development was intended to be a regional process that would allow an action plan to be established. This would allow for the sustainable development of the Oak Forests conservation corridor.

Objectives and strategies were generated from this process to maintain the conservation objectives identified in the long term, reducing the impact of anthropic threats and strengthening existing conservation and sustainable development activities in the region.

The environmental objectives of the conservation corridor over the next ten years are to maintain existing natural systems, restore connectivity between natural forest relicts, reduce fragmentation and stop the expansion of agriculture into key sites.

Several main strategies were identified to fulfill these objectives:

- promoting sustainable production through agro-forestry systems, including forestry and grazing systems;
- developing economic incentives for conservation;
- promoting habitat restoration;
- strengthening research on natural resource management; and
- strengthening the regional and local system of PAs, both public and private.

These strategies should be reinforced with education, public participation programmes and rural communication processes.

Methodology

This plan was developed between February and September 2004. During this time the permanent technical support team was set up, and training in the methodology was carried out, including five workshops with local communities in different municipalities, three workshops with all the participating institutions, ten meetings with experts and eight management meetings with the regional environmental authorities.

The 5-S Framework for Conservation Area Planning, developed by The Nature Conservancy[51] was used for identifying conservation objects and high priority cultural objects in the corridor, and the most important threats and threat sources to these objects.

Including cultural conservation objects in a methodology specifically designed to identify a portfolio of biodiversity conservation sites is worth noting; identifying landscape elements with cultural significance shows the tight link between natural and cultural processes in the area.

From that point on, strategies were designed, in an agreed and participatory manner, to guarantee the conservation and use of corridor resources. The results of the process became guidelines for the different municipal and regional authorities and institu-

tions, for use in the conservation, land classification and sustainable development of the Guantiva-La Rusia-Iguaque conservation corridor.[52]

Besides the conservation strategies, a communications strategy was designed to publicize the planning process and its results at national, regional and local levels.

The planning work was co-financed by the MacArthur Foundation, TNC, USAID and the Natura Foundation.

Results and impacts

The main output of the planning process was a sustainable development strategy for the Guantiva-La Rusia-Iguaque conservation corridor.[53] This created a regional perspective and vision that transcended the municipal dynamics that traditionally operated in the region.

The strategy facilitated cooperation between public, private and third-sector entities at national, regional and local levels. It helped generate important medium- and long-term impacts in the zone and allowed state institutions, civil organizations and local communities to articulated their interests regarding the region's development possibilities.

Using the strategy as a starting point, a number of programmes and projects for the corridor have been implemented under the coordination of the Technical Secretariat set up by the Natura Foundation.

The planning process achieved several specific results:

- compilation of information and documentation about the region (for information, see www.corredordeconservacion.org). Virtual technical discussion fora have been created on the threats to forest resources and the possibilities for intervention;
- development of the first international symposium on oak trees and other associated ecosystems;
- creation of environmental agendas for oak trees and water involving various local entities; these are autonomous processes financed by the European Union, Ecofondo, Planeta Paz and WWF-Colombia;
- an inter-institutional agreement to develop conservation actions in the corridor, allowing for collabouration between local and regional administrative entities and uniform criteria.
- selection of the corridor for debt-swap investment and international cooperation to develop the strategy.[53]

Strategy implementation

Development of good agricultural practices

Through the Rainforest Alliance, a programme to improve the environmental and social conditions on coffee plantations was designed and is being implemented. It aims to address socio-environmental management, natural resource conservation, social welfare and integrated farm management. The programme started out with 275 ha on 21 farms. It has an average annual growth of more than 350 percent; in 2005 and 2006 growth exceeded 400 percent. Its achievements are as follows:

- restoring shade on coffee plantations, thereby improving the quality of the final product and the plantation's biological connectivity;[55]
- using native species for shading the coffee plants, assuring conservation of the corridor's biodiversity and natural habitats; and
- increasing the producers' income by around 10–15 percent.

Economic incentives for forest conservation

All forests in the corridor are privately owned by farmers with small and medium-sized livestock farms who have mostly left untouched the forests in the steeper areas. This has allowed a stable area of forest to be maintained, whose cleared area has not changed significantly in the last 25 years.

The possibility of using PES to compensate the forest owners by a certain percentage for their contribution to forest conservation, led the Natura Foundation to negotiate and organize property tax exemption incentives in Onzaga, Encino and Coromoro. These municipalities own a representative forest area within the corridor.

The negotiations led to the development of a methodology for creating a geographical property information system, identifying payment flows for property tax, setting up a working group with the municipal council and negotiating exemption percentages with the municipal government.

During 2005, 94 of the 190 owners in the selected zone benefitted. In this phase, 3396 ha of forest (43 percent of the total) were covered under the pilot scheme. In 2006, 84 properties, covering 2938 forest ha, were linked to the initiative. That same year an agreement was reached with the Coromoro and Onzaga municipalities, and in 2007 the initiative began, with a potential 320 beneficiaries.

Converting conventional livestock systems to forestry and grazing

One of the main criteria for the corridor's participatory planning was the recognition of the productive and economic context of the communities settled in the region. The

strategy to mitigate the threat to oak forests and moors by livestock production was structured in a way that would foster greater productivity in the areas currently used for keeping sheep. This encouraged the removal of livestock from moorland ecosystems and a productive and protective recovery process leading to greater connectivity between the main oak-forest areas.

Several accomplishments made in the Guanentá[56] Fauna and Flora Sanctuary buffer areas, where 26 families were involved on 860 ha of livestock-producing landscape mosaics:

- the standardization of a property planning method;
- the formulation and application of tools for forest conservation on private land through conservation production agreements;
- a model for converting high-impact intensive conventional animal husbandry systems to highly productive and efficient forestry and grazing systems; and
- a productive and protective restoration strategy applied to micro-basins that supply rural water systems.

Conclusions

The EA in corridor management

- The corridor's regional planning process led people to identify their main conservation values in the area and develop the management required to maintain and improve natural resources.
- Although the process cannot yet be described as decentralized management, it incorporates the opinions and desires of a group of people who live in and support themselves from the richness of the region and it was carried out with the participation of a wide sector of society.
- Actions are developed with the participation of each of the owners, producers or groups (for high-priority sites) where they make decisions in an individual and collective manner.
- One of the major impacts of the exercise has been the identification of a regional geographic unit that standardizes criteria at a bio-geographical level. Locally developed actions are designed to have an impact on adjacent ecosystems.
- The planning exercise has been recognized as a regional planning model both nationally and internationally. It has been replicated in similar locations with similar conditions.
- Up-to-date information on the area has been made available for evaluation by the various decision-makers (regional and local) and for private and public schools, universities and other educational entities in the region.

- As a result of the discussions generated on oak tree conservation in Colombia, the Ministry of Environment, Housing and Territorial Development[57] reversed the statute that regulates the use of oak wood in the country, allowing for resource conservation and enforcing a proposal for its management.
- Different sectors of society participated, including environmental authorities, national parks, municipalities, organized local groups, trade union producer groups, non-government environmental organizations, research centres and individuals. Various economic, social and biological disciplines were incorporated.
- Processes have been negotiated that seek to compensate the corridor's communities for their conservation efforts by means of incentives that promote biodiversity use and conservation to achieve its long-term sustainability.
- Actions to preserve, use and protect are intended to directly benefit the diversity user.

Case study 4

The Andean Paramo Project: Applying the Ecosystem Approach at a regional landscape level

Robert Hofstede[57]

Introduction

A moor is the type of ecosystem found above the line of the Andean forests and below the perpetual snow in the northern Andes, between 3500 and 4700 m above sea level (Luteyn 1999). The moors form an uninterrupted corridor between the Mérida mountain range in Venezuela up to the Huancabamba depression in north Peru, with two more separate complexes, the moors in Costa Rica and the Sierra Nevada de Santa Marta in Colombia and continuing to the south, the Peruvian *jalca* (Andean zone). The moors are known for their great biological, cultural and landscape diversity. They have the greatest biodiversity of the high mountain non-forest ecosystems (Smith and Cleef 1988).

Even though large expanses of moors have no human presence, in some areas diverse indigenous and other groups use them for raising cattle and growing potatoes. Hofstede et al. (2002) believe that less than one-third of the moors are not used by humans in any significant way, with the remaining area modified by its inhabitants.

There are many different interests in the moors because of their rich biodiversity, their importance as water regulators, their trans-border location and the presence of many inhabitants; therefore, a single conservation objective cannot be adopted. This makes the moors ideal examples for the ecosystem approach.

Moorland conservation and the need for integrated management

In every country, the direct decision-makers on the moors — who for a long time have not been taken into consideration — are the small-holder farmers. They make up the largest group of inhabitants and have the greatest and most direct influence on the ecosystem. Effective conservation of the moors requires an understanding of the trends that determine land use in the high mountains in the long term. Unfortunately, at present the local people do not have alternative land-use opportunities, which is why agricultural land continues to encroach on the remaining conservation areas.

Several conservation efforts have been made in the last decades that have lowered the rate of land transformation. The projects are generally local and do not have a cross-sectoral vision. Most of them have little impact at national and regional levels, because

they do not include the social, historic, political, economic or bio-geographic aspects of conservation. In addition, there are different circumstances for each moor, which makes it difficult to coordinate efforts.

As a result, the conservation of moorland — with its function as an international corridor and its importance as a water regulator for many major basins, including those of the Amazon and the Orinoco — continues to be threatened because of the lack of an integral and international vision. After analyzing the lessons learned from conservation projects in different countries, Hofstede (2001) concluded that it is best to take an integrated participatory management approach instead of opting for the total protection of large areas. There would be no support from the local community for total protection since people need the moor for their livelihoods. Management of the moor must include the habitats around the moor because it is such a fragile ecosystem.

In Ecuador, participatory integrated management of the moor was applied between 1998 and 2002 in a project financed by the Dutch government. Several important lessons learned from the project are being used as the basis for current management (Mena 2002):

- the basis for successful integrated management of the moors is good management of knowledge;
- different groups of actors must be included;
- demonstrating success is essential in order to change attitudes;
- communication is the key to learning; and
- a positive institutional and political framework is crucial.

The Andean Paramo Project (APP)

Based on the experiences of Ecuador in 2003, the four South American countries with moorland, along with NGOs and universities, agreed on a regional strategy for conservation of the moors using the ecosystem approach at the landscape level. This initiative, the Andean Paramo Project (APP), is receiving a large amount of international investment from GEF through UNEP for just one moorland conservation project. The project acknowledges that the major threats to the diversity of the moor come from the people who live there and use its natural resources, and from the external demand for its goods and services. It also acknowledges that effective conservation of the moor's biodiversity is difficult because of the underlying causes that relate to other levels and sectors.

These causes are diverse and include dependency on traditional agriculture, disarticulation of planning and implementation efforts at local, national and regional levels, a

shortage of inter-sectoral policies to promote integrated ecosystem management, the lack of policies and policy instruments at all levels, the lack of an effective international conservation strategy for ecosystems and trans-border basins, limited experience and capacity at all levels, underestimation and loss of knowledge and ancestral practices, lack of public awareness of the ecosystem and a lack of adequate information to support effective decision-making.

To manage these underlying causes, APP is applying the ecosystem approach in a well-planned manner to the integrated management of the moorland ecosystem at a regional level and at the level of all the high Andean landscapes (Hofstede 2006). It is too early for an exhaustive evaluation of the application of EA principles, but initial observations on the first years of the project can be made.

Principle 1: People are an integral part of the ecosystem and its management is a societal decision.

It is impossible to preserve an ecosystem with so much human presence and history without considering its inhabitants as an integral part, who intervene and will continue to intervene. The fact that its population is one of the poorest in the region makes it ethically important to find alternatives that will create human well-being alongside conservation. This means that its management is a social decision: no other way would be accepted or acceptable. This principle comes close to the model of decision-making in indigenous Andean towns where any decision on the use of the land is based on social consensus.

Principle 2: Decentralization

Since conservation of the moor is related to water, and since the management of water is decentralized in every country covered by the moor, this principle is very appropriate. In a decentralized environment, it is easier to base conservation objectives on societal choice, since local governments are closer to the inhabitants. Local people are socially excluded and have no access to decisions made at higher government levels. In many cases they choose to work at the most decentralized level, since the higher the level of centralization, the greater the lack of trust felt by rural inhabitants.

Principles 3 and 7: Effects on other ecosystems and temporal and spatial connectivity.

The moor now comprises an archipelago of large and small areas, previously surrounded by cloud forest, most of which has disappeared and been replaced by crops and pasture. The justification for good management of the moor is its importance for water. Neighbouring ecosystems can have an effect: it is important to know if a natural area or one that has been transformed by human intervention is next to the moor. The historical context is key to understanding the capacity of the ecosystem and

the social system to react to changes in management. It has been observed that two areas with the same social and ecological context but different history of use can require very different management models (Recharte and Gearheard 2001).

Principle 4: Economic context.

Ecosystem evaluation, both in terms of opportunities for the development of its inhabitants and for its conservation, can demonstrate the benefits of effective management. PES and management systems, especially for water, scenic value and carbon storage are important factors. There is resistance to the PES concept, however, especially in areas with many indigenous groups, because it places the right to environmental services in a market framework.

Principles 5 and 6: Structure, function and limits.

The project considers the entire ecosystem a moor, including all of its landscape, and associated ecosystems, such as dwarf forests and wetlands. A conflict arises in the application of this principle: although work continues at demonstration sites and it is expected that the lessons learned will be replicated and extended to other areas, experience shows that the set of conditions is so variable that no two areas of moor have the same context. This is why replication is not possible, but the application of positive lessons from one area to another is.

Principles 8 and 10: Long-term integrated objective

The objective of the project is to preserve biodiversity, manage water resources and find opportunities to improve the well-being of the moor's inhabitants. This is a long-term task that looks for a balance between the ecosystem, inhabitants and functions.

Principle 9: Acknowledge the dynamics

Although some observers consider the moor a cultural landscape (Suárez 2002), it is unrealistic to think that it can be preserved in its original state. Since the objective is integrated biodiversity, water and local development goals, work must be done to balance the three and achieve a positive dynamic between the use of the land, the capacity for water regulation and biodiversity. Acknowledging this dynamic is fundamental to establishing that an adaptive approach is the most appropriate form of management. At demonstration sites, communities apply their own plans for local management through research and participatory action. Stakeholders can observe the effects of their actions and by assessing the results can adjust them continually. This concept can also be applied to local government policies that must create support for the management of the moor under their jurisdiction.

Principle 11: Use all available knowledge

Even though the moor is a well-studied ecosystem, there is a need to increase the base of knowledge. This is fundamental for conflict management. It is also necessary to understand the diversity of the conditions of the moor. To this end, an information system on the moor, open to the public, is being designed and is connected to the facilitation initiatives such as clearing-house mechanisms that countries are developing as part of their commitment to the CBD.

Principle 12: Institutionalization in different sectors

One of the big problems in previous efforts to conserve the moorland was their concentration on the environmental sector. This project takes into account the direct impact of sectors that are traditionally not related to conservation, such as infrastructure, defence and mining. The Moor Group has been able to bring together different actors from all the local, national and regional sectors (Hofstede and Mujica 2002). The main lesson learned from this experience was that, although such a diverse group will probably not reach a consensus, the ongoing debate, the exchange of views and the simple fact of being in contact with each other are important achievements in themselves.

Conclusions

After several years of integrated management of the moorland at local and national levels and management planning at the regional level, it can be concluded that understanding the complexity of the geographical, ecological, social and political situation of a trans-border landscape is essential. Taking into account the multiple benefits and the different interests in moorland on the part of diverse groups of people — with an approach that connects management activities to different scales and that includes direct beneficiaries in the management of the ecosystem — is necessary to find a means of achieving conservation and to provide the local population with a sustainable base for its well-being.

Applying the ecosystem approach on an Andean trans-border landscape showed that many EA principles correspond well to the holistic vision of the Andean cultures. This made its acceptance relatively easy. A critical element in the integrated management of such a complex ecosystem was the inability to achieve replication, because of the individual situation found on each individual moor. The basis for success is the research methodology — participatory action and adaptive management. Greater difficulties exist with the continuity of management and with including conservation issues without connecting them to environmental and social sectors. What was learned on the moor can be a model for other ecosystems in similar conditions.

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Case study 5

The Paraguay-Paraná Wetland System: An initiative in progress

Julieta Peteán[59]

Introduction

The EA provides the framework for the Paraguay-Paraná Wetland System initiative. It seeks a balance between conservation, sustainable use of biological diversity and the needs of users who depend on the system, taking into account that participation is key to decision-making on the use of natural resources in a fair and equal manner.

For more than a decade, a group of civil-society organizations, together with some government sectors of the basin countries, supported the development of a shared vision in the management of the Paraguay-Paraná Wetland System. From the Ríos Vivos Coalition launched in the 1990s to the Pantanal Network in Brazil, Redepesca in Argentina and the South Cone, and a wider proposal from System Alliance, a network of activities along the corridor has been built.

Map 2. Paraguay-Paraná river system

Source: PROTEGER Foundation.

Step A. Determining the main stakeholders and defining the ecosystem area

(Principles 1, 7, 11 and 12)

The wetland system located in the central plain of the Plata Basin, from the Pantanal and the Paraguay rivers to the medium and lower alluvial valley of the Paraná and La Plata rivers, is considered the largest freshwater wetland corridor in the world. With more than 3400 km of rivers free of dams, this wetlands macro-system has a defined ecological area. The operating area has been defined by the relevant stakeholders, most of whom have been identified and are participating at different levels, obtaining skills to work in the management of the increasing pressures exerted on the system and their possible solutions.

The initiative includes the development of skills among the various stakeholders, mainly the primary participants, to establish priorities and management strategies and develop the appropriate fora to allow participation and debate with the secondary and tertiary stakeholders, mainly governmental.

Analysis of the area

The Paraguay-Paraná Wetland System is an ecological and cultural unit. It occupies a central place in the Plata Basin, the second largest in South America. The management area is subdivided according to scientific criteria on wetland systems; the size of the subdivisions is determined by existing management capacities, knowledge and experience. Training the civil-society organizations that lead the initiative is key. Administrative and legal limits are also taken into account, not as barriers but as main elements to be considered in this shared basin.

This is possible thanks to the increasing participation of local and national governments through the Ministries of the Environment and the Ministries of Foreign Affairs of the five countries, who signed the *Poconé Act* in 2005. The Act defines, together with civil society and the local communities, the strategies and guidelines of a programme to strengthen the group of stakeholders in their dialogue with governments, financial institutions and decision-makers, integrating the existing sustainable programmes in the basin and building an agenda for cooperation. Subsequent regional meetings held in Buenos Aires in September 2006 and July 2007 with representatives of the government, NGOs, and communities also led to some progress.

The area chosen for long-term objectives is the entire Paraguay-Paraná Wetlands System. The short-term effective management units will be established by committed users, who define the management of the ecosystems through the uses of biodiversity and the landscape. The users make decisions jointly with the local and regional managers of the resources.

The various stakeholders who are trying to find the most appropriate management measures for the system or its resources have different interests, which in some cases are opposed. In this way, ecosystems are defined according to the interests of the users; ecosystem limits can generally be better identified as can those persons, groups or institutions who need to interact in the negotiation and decision-making relevant to their management. The result is a mosaic of areas — different in size and in some cases overlapping — that is defined by landscapes, ecosystems or the distribution of the resources managed by the stakeholders involved.

The leading organizations of this initiative are building long-term goals and vision, and are working with local stakeholders to define priorities from the bottom up. At the Jaaukanigás Ramsar site, for example, an alluvial valley of Paraná in Argentina covering 492 000 ha, the main stakeholders (artisanal, commercial and sport fishermen, tourism operators, the technical and scientific sector, academics, NGOs, social groups, legislators, local, provincial and national governments) have signed a Letter of Intent. They agree on the basic guidelines and the commitments of all parties interested in the conservation of fishing resources, and have formed a committee to promote sustainable and participatory management of fisheries in the region. This has become a vehicle for negotiation and formulation of proposals to establish management rules for fishing in the river.

Map 3. La Plata River watershed

Source: PROTEGER Foundation

Step B. Structure and function of the ecosystem, and management

(Principles 2, 5, 6 and 10)

The Paraguay-Paraná Wetlands System is one of the biggest freshwater and biodiversity reserves in the world, extending into Argentina, Brazil, Bolivia, Paraguay and Uruguay. This macro-system is the center of a region with extraordinary ecological, social and economic values, with exceptional biodiversity and climate variety, soils and water resources and a unique cultural heritage due to its rich complexity and singularity. It fulfills irreplaceable functions such as flood and drought mitigation, recharging large aquifers, maintaining fish breeding areas and supplying abundant high-quality water.

The system's extraordinary biodiversity is due to the great South American environments that converge there: from Amazonia, El Cerrado and Gran Chaco to the Mata Atlántica, the plains and the wet Pampa. Sustainable management is fundamental for maintaining the natural cycles, the conservation of biodiversity, the prevention of disasters and the long life of ecosystems and communities.

Along the corridor are areas designated as Ramsar sites and areas acknowledged by the World Heritage Convention, and by UNESCO's Man and the Biosphere (MAB) Programme as biosphere reserves. The importance of the system has been awakening a growing international interest, reflected in the resolutions of the second and third IUCN WCC and the Ramsar Convention and the support of donors.

The renewed coordination of the communities, NGOs, academics, institutions and governments is manifested in the continuous work in local communities to preserve the characteristics, structure and functions of the ecosystems that supply goods and crucial services for more than 20 million people and for the ecological sustainability of the system as a complex unit.

Riparian populations depend on the resources of the wetlands; these form the basis of vital economic and social activities. A range of traditional uses, including artisanal and commercial fishing, sustainable community tourism and family agriculture, are compatible with conservation of the system. The reinforcement of wetland resources through capacity building and systematization of adequate environmental practices opens the way to increasing family incomes and reducing poverty.

Anthropic pressures have negative consequences for the system, its hydrological cycles and its population, however. The most significant of these are encroachment of agriculture through slash-and-burn techniques (mainly because of the soybean boom), contamination from agricultural toxins and effluents, soil erosion, dredging for waterways, and large infrastructure projects. It is fundamental to having adequate

knowledge and the tools to determine when an ecosystem is threatened because it is being overused.

To this end, tools are being developed for joint mapping, on-land verification, participatory resource assessment and monitoring activities on behalf of the users. Initially, knowledge is inevitably incomplete, but it increases over time, especially when the groundwork is laid for coordinated activities among the communities and close relations with the scientific and academic sectors. It is crucial to build skills, exchange experiences and lessons learned among all the stakeholders and sectors involved, and standardize realistic management objectives. Besides being basic elements for management, they constitute a two-way flow of knowledge and trust.

The balance between conservation and the use of biodiversity is achieved through joint decision-making and management agreements. Management at the lowest appropriate level for a macro-system such as this assumes complex interactions, since many decision-makers from different levels are involved, from local governments to foreign affairs ministries. A mosaic of superimposed management is created which includes local people, community groups, civil-society organizations, governments at different levels and international organizations. This management mosaic deals with legal and administrative issues and concerns and must continue to be monitored by the group — NGOs and governments — that promoted the initiative.

Step C. Important economic issues (Principle 4)

During ten or more years working on the system, the main impacts on the basin and its wetlands have been identified. These correspond to the economic interests that affect the ecosystem and its inhabitants and therefore have an influence on management decision-making. A distortion in the market that affects biodiversity is the exaggeration — mainly by the governments and some private companies — of the utility and benefits of the megaproject *Hidrovía Paraguay-Paraná* (the Paraguay-Paraná Waterway), a regional infrastructure proposal related to exports (mainly soy and minerals) from the countries of the basin.

Overfishing also has a great impact on biodiversity and on the communities that depend on natural resources. This has been aggravated in recent years by the large scale of exports from Argentina of a few species such as *Prochilodus lineatus*.

The reduction of market distortions and development of incentives to promote the conservation of the wetlands system — and the sustainable use of its resources — require greater knowledge and interest by the governments and international development organizations and a vision of sustainability and equity.

The initiative strives to strengthen regional initiatives and new forms of sustainable integration. The basin approach and that of the system as a whole is essential for classification and management, with active participation from local communities as well as from political stakeholders, according to an integrated and adaptive management that includes local, provincial and state governments. Incentives for better use include greater knowledge and the ability to influence decision-making at local, national and international levels.

Civil-society organizations are looking for ways to quantify the economic benefits that result from better management of ecosystems. In the Paraguay-Paraná Wetlands System one of the main challenges is the internalization of costs and benefits. There is a strong rural exodus of local and indigenous communities being displaced by new settlements and land uses. In the case of overfishing, local communities have no access to the resources that are the source of their sustenance.

These situations generate serious economic, social and democratic governance problems in the region. This presents a political challenge. Awareness raising and capacity building are urgently required so that the main stakeholders can be the ones who intervene in decision-making. The demands of various users for natural resources should help to model sustainable use and management in the basin.

It is necessary to achieve consensus in socio-economic policies in order to reverse the current situation, where traditional and indigenous communities face social exclusion, dispersal, impoverishment and deterioration of resources and access to those resources.

Step D. Impact of the ecosystem on adjacent ecosystems: Adaptive management in space

(Principles 3 and 7)

Sustainable and participatory management plans need to be elaborated and implemented for the Ramsar sites, biosphere reserves and other PAs in the system. Work is being done in some of them under the concept of integrated and adaptive management. One of the objectives of these plans is to promote better management of adjacent or associated ecosystems.

It is key to actively involve all the stakeholders in decision-making processes in an informed and binding manner, recognizing that participatory and democratic management is essential to social, ecological and economic sustainability.

Step E. Long-term goals: Adaptive management in time

The long-term objective is to achieve sustainability in order to reduce degradation of the wetlands and its negative impacts. These include the growing level of poverty

and loss of quality of life of the riparian communities and populations, including the medium and large cities that depend on the health of the system.

Long-term integrated management, sustainable use and conservation of ecosystems are being sought. These must consider the needs of society and take into account that sustainability in the provision of goods and environmental services depends on the appropriate biological, physical and anthropic conditions.

Several flexible mechanisms have been proposed to achieve this long-term goal, with short-term objectives and tools that are regularly reviewed and updated. In the proposal for fisheries management, for example, monitoring is carried out by fishing communities in order to identify indicators for potential problems in time to adjust management measures.

Conclusions

Lessons learned: Advantages, difficulties and challenges in the application of the EA

Working within the EA framework encompasses the system's ecological, economic, social and cultural connectivity, and allows the proposal to be coordinated with other initiatives and strategies for conservation, planning and territorial classification. The EA surpasses other methodologies, techniques and management tools and has enormous potential to enrich the management of basins, complementing traditional approaches.

The solid conceptual framework of the EA enables conservation and sustainable use initiatives to be established within a long-term management scheme, building institutionalism and contributing to governance through integration processes. Ownership and participation of the stakeholders involved — not just consultation or information on decisions made by sectors —and the reconciliation of their biological, political, social and economic needs, is possible. The EA promotes communication mechanisms to share information on methods, activities and results, including all forms of knowledge and practices.

Adaptive management also allows ongoing responses to new situations. It tries to make compatibility between development and conservation more tangible and allows sustainable productive alternatives to generate direct benefits for the communities, organizations and the private sector. The EA introduces sustainable use within a conservation strategy and its core component is to satisfy the needs of the people.

At the same time, the EA's general concept and 12 principles become the main arguments for protection of watershed basins and their associated systems. It is necessary, however, to continue to spread the concept of EA and its relationship to various

conservation options, obtaining public participation through legitimate mechanisms intended to leave the choice of resource management objectives in the hands of society.

It is essential to show the practical applicability of the EA in specific cases, in order to confront the sectoral management approaches that have dominated and continue to prevail, with their uncoordinated and fragmented development of the environment and its resources.

It is common for EA principles to be applied only partially, in varying degrees of intensity; it is still unusual to see them used as a complete and articulated group. To the local communities and Latin American people in general, the approach seems very close to their overall perception of their environment, resulting in something "natural" being created. This means an opportunity for progress in the region.

One of the main difficulties is working at different scales, both spatial and temporal. The challenge is to be more creative to achieve the objectives, overcoming the legal, administrative and logistical barriers thrown up by the rapid changes in social and political scenarios in the countries of the basin.

The EA can be used as a work tool but it is also an analytical tool. It is necessary to develop indicators to accurately evaluate the application of the principles. This set of indicators and attributes — which can be adapted to different contexts — will allow objective comparative analysis and overcome what is at times the excessively theoretical nature of the concept and principles.

There is still a lack of knowledge and ownership of the EA concept through tangible processes. Tools and examples of successful cases are needed to show that the change in land use is ecologically, economically and socially feasible while maintaining ecological processes. Another challenge is to show how conservation can be compatible with sustainable use, developing effective adaptive and participatory management mechanisms.

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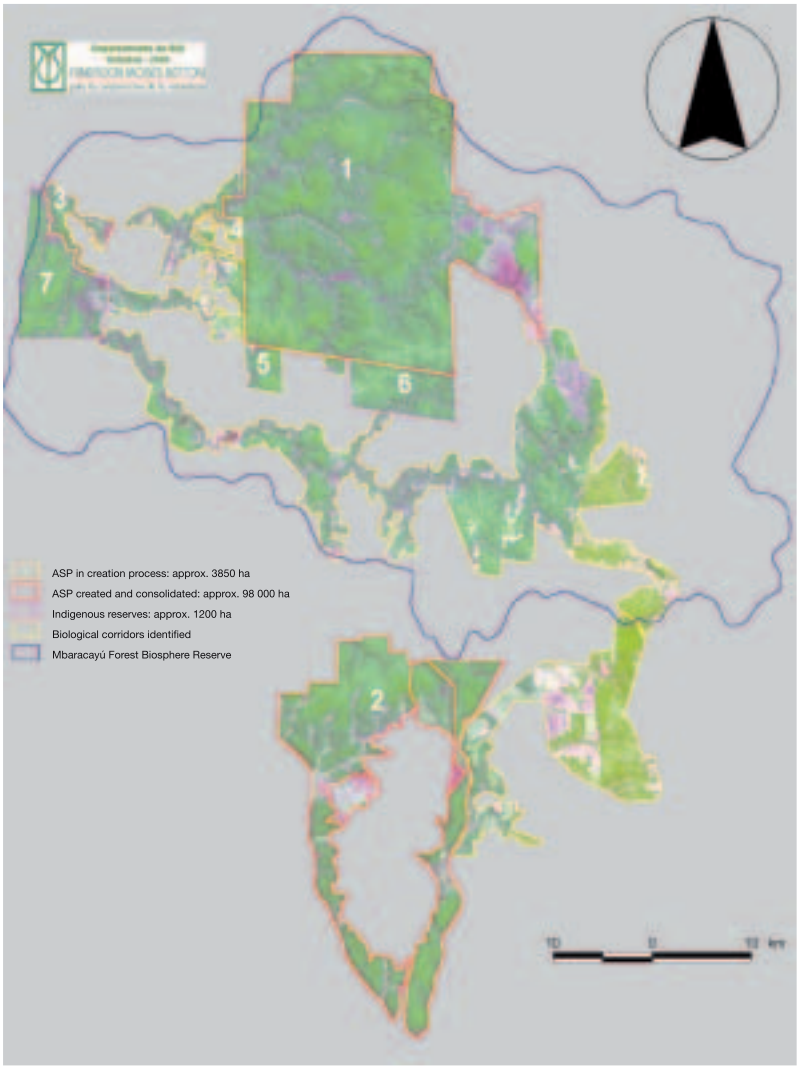
Case study 6

A Connectivity Strategy for the Mbaracayú Forest Biosphere Reserve and the Ecosystem Approach

Danilo A. Salas Dueñas and Edgar García[60]

A connectivity strategy is being privately developed in the Mbaracayú Forest Biosphere Reserve (MFBR) in Paraguay. It incorporates social, environmental and economic aspects drawn from EA principles. The strategy generates benefits at various levels.

Map 4. Ecosystem focus and connectivity strategy for the Mbaracayu Reserve



Introduction

Paraguay's Mbaracayú Forest Natural Reserve, with an area of 64 000 ha, was created by Law 112/91. Since its creation, it has been managed by the Moisés Bertoni Foundation (MBF), a non-profit organization that has also carried out a number of development and conservation activities. In 2000, MBF successfully negotiated for the reserve and the area of the Jejuí River high basin to be designated the Mbaracayú Forest Biosphere Reserve (MFBR), with a total area of 300 000 ha.

The MFBR is a mosaic of cultures where 3,000 people of Paraguayan and Brazilian origin and Guaraníes and Aché natives coexist, along with small-, medium- and large-scale producers. It has some of the lowest human development rates in the country; at the same time, it has one of the country's highest rates of agricultural development. It also has one of the highest rates of population growth in Paraguay.

The area has great biodiversity, containing forest remnants of more than 10 000 ha each. This makes it an exceptional area in spite of historically high levels of deforestation, accelerated by its proximity to Brazil and, recently, by a high demand for agricultural land.

A connectivity strategy has been developed by WWF based on the Biodiversity Vision for the Interior Atlantic Forest. Two remaining forests were identified, each more than 10 000 ha: one belongs to the Chupa Pou indigenous community, west of the biosphere reserve; the other to the Morombi Private Natural Reserve, south of MFBR.

Since 2003, MBF's institutional programme, "Private Conservation Initiatives Support," has engaged in activities with the large land-owners in the MFBR. Although there are relatively few of them, they have a great impact on the landscape due to the size of their properties.

This is why a connectivity strategy was structured in a way that will include results for the three elements considered fundamental for sustainable development: environmental, economic and social. This closely corresponds to the 12 EA principles, where the same elements are key to developing and aligning the activities undertaken.

Characteristics of the strategy

The institutional strategy covers three areas, which have achieved different results. Although institutional work has been carried out for more than 16 years, a systematic process of connectivity construction has only recently begun.

These have been the main social results to date:

- the generation of employment for indigenous and peasant communities;
- establishing nursery training programmes, especially with young people, as a way of preventing migration;
- mass-media communication campaigns, especially in Guaraní;
- renovation of schools, streets and squares by the local communities, with strong support and participation from various local authorities;
- achieving greater environmental awareness by making the communities themselves demand that the state comply with its own environmental laws; and
- the creation and consolidation of a management committee as a way for communities and local authorities to exercise self-management, decentralization and participatory principles with fairness.

Important environmental results have been achieved:

- the use of at least 16 native species in reforestation;
- completion of a thesis on pioneer forest species that are not commercially developed but are an important component of reforestation or landscape restoration;
- development of seed bank research as a way of obtaining basic information;
- installation of permanent monitoring plots;
- monitoring forest initiatives as a way of following up on developed actions;
- enriching the forest by planting maté (*Yerba mate*, a form of South American holly), which allows land-owners to contribute to forest conservation by protecting water flows and stabilizing slopes.

Important economic benefits have also been achieved:

- significant increases in income for some peasant and indigenous families from jobs related to reforestation, forest restoration and enrichment;
- an increase in economic resources in the zone as a result of the communities' selling services, goods and materials;
- creation of additional sources of employment; and
- water is now seen as a capital good by some large land-owners after the advantages of forest conservation actions and the services they generated were better understood.

Application criteria

In order to achieve results, criteria have been incorporated that determine which actions and activities will be developed. These are part of a flexible framework that allows for adjustments when needed.

Using GIS, high-priority reforestation areas have been identified. These areas can be used as practical ways of establishing connectivity corridors between the main forest remnants. Information management systems have been generated that can track both the behaviour of large-property owners (with respect to the management of their land) and the possibility of developing activities with them.

A spatial model was generated that incorporated diverse variables as a part of better decision-making. An important criterion has been the use of native species, especially fruits, pioneer species and species that adapt easily to a range of soil conditions. In all reforestation processes, responsibility is shared; the land-owner and the foundation jointly assume the costs of the activities as set out in individually negotiated agreements.

Another criterion is the application of environmental rules to differentiate between the support given to those land-owners who operate within the law and that given to those who currently do not, but have expressed a desire to; in this way priority has been given to the protection of the forest remnants and watershed basins. The criteria described are only a small sample of the criteria developed.

Practices

The connectivity strategy examines three practices:

- green corridors;
- establishment of private conservation units; and
- restoring forest landscapes through shared responsibility,

Green corridors

Areas associated with water flows have been identified, where the surrounding vegetation needs to be protected in order to achieve connectivity with remaining forests and to facilitate the movement of animals. The corridor is considered a matrix of soil use and not a rigidly defined area of land. The biological corridor demarcation strategy includes the coordinated establishment of various human activities in harmony with habitat conservation as an alternative to the threats arising from timber extraction, cattle-raising and monocultures, which have caused severe habitat fragmentation. These alternate activities include reforestation, organic agriculture, and soil and water

management. Consolidating the economic growth of adjacent communities is considered very important in order to reduce pressure on natural resources.

The MBF has a professional team that develops rural extension tasks. These are |intended to combine economic development with maintenance of environmental quality in rural settlements, some of which are located in the connectivity corridors. These activities benefit at least 500 indigenous and peasant families, many of whom have voluntarily joined a mutual microcredit project.

As a strategy to protect the remaining forests, there is a plan to establish a value for them by including them in the family economy, starting by using timber and non-timber forest products (NTFPs), allowing production of environmental goods and services. A pilot scheme for forest cover maintenance, currently in development, seeks to secure the maintenance of forest cover in 100 ha of sites with springs and riparian forests.

Establishment of private conservation units

Private conservation units will be established in biologically important areas that require higher levels of protection due to their strategic location relative to the forest remnants. Two forms of private conservation will be possible according to the characteristics of the properties, the willingness of the owners and their biological richness: private conservation contracts and natural private reserves.

Private conservation contracts

This type of contract will be put in place for the Rama III farm. The contract will be executed through a private conservation contract signed between MBF and the landowners and will be registered at the Public Registry of Property as an integral part of the farm's property title.

Natural private reserves

Once approved by the state, these reserves will form an integral part of the National System of Wild Protected Areas of Paraguay. The Felicidad farm is located at the end of the corridor that links the MFBR core area with the Chupa Pou indigenous community. It has 2000 conservation ha within a 3000-ha property. The Don Marcelo farm, which is approximately 1800 ha, protects important springs that contribute to the basin's hydrological balance. Management plans will be developed in these private reserves to ensure the protection of natural resources in the framework of a joint vision.

At both farms, work is being done to establish mate scrub under the forest canopy, with the aim of establishing organic production models. The projects are financed by land-owners using labour from an indigenous community that, with the support of the private sector, has developed the skills to grow and process this product.

Restoring forest landscape through shared responsibility

Reforestation work is being done in three mixed farms previously dedicated to intensive livestock production and agricultural monoculture, processes that place great pressure on soil and water resources. The project is a 50-ha reforestation pilot scheme at each farm, which could be extended to a larger area after evaluation by the parties.

Reforestation will use 16 native species, including fruits, pioneer species and species that easily adapt to a range of soil conditions. Special attention has been paid to species used by fruit-eating animals and to indigenous fast-growing species, based on these criteria and on the availability of changes in commercial nurseries or the production viability of these species in a short period of time.

The shared-responsibility reforestation project starts with co-financing tasks. Based on the characteristics of each farm and on the vision, objectives and degree of commitment of their land-owners and administrators, individual models are adopted. Land-owners must maintain the forested areas after the reforestation process is completed; trees cannot be harvested for timber, but can be exploited for NTFPs, such as forage, firewood and fruits.

Three different types of land-owners were selected:

a) *Felicidad* farm is a livestock farm with 1,500 head of cattle whose owner is an established settler in the area who has managed his property for more than 30 years without making any significant changes to the forest cover or to his cattle-raising system.
b) *Don Marcelo* farm is a medium-sized farm with some 2,000 cattle and around 1500 ha dedicated to livestock. Farm management is still done by the family but with staff responsible for both livestock and agriculture production. This is a farm where a strong and constant increase in investment is observed.
c) *Nueva Esperanza* farm is an agricultural-livestock complex with some 45 000 ha of land given over to mechanized agriculture and around 8,000 cattle on a 12 000-ha area.

In all cases hiring local labour is a high priority, so that the land-owners' investment will help to integrate the community into the restoration process.

Conclusions

- The incorporation of an ecosystem vision brings environmental, social and economic results.
- Predetermined but flexible criteria bring spatial and temporal results that are complementary, from small areas to thousands of ha and short-, medium- and long-term results.
- Local actors need to be identified and incentives developed that correspond to their individual requirements.
- The model becomes more complex as it develops and responds to circumstances and demands.
- The existence of various stakeholders, with their own requirements, forces constant innovation.
- Resource limitations and demands by some donors for short-term results are a major complication.
- The absence of the state can be an opportunity but can also be a problem to overcome.
- The fact that this type of biodiversity is of little interest to some donors is an obstacle to the development of this type of project in Paraguay.

Case study 7

The Ecosystem Approach and water management: A Latin American perspective

Eduardo Guerrero Forero[61]

Introduction

Latin America has one of the most abundant freshwater supplies on the planet: around 28 000 m^3/habitant/year (FAO 2003a; 2007). With such a high level of availability, countries shouldn't find it difficult to guarantee universal access to drinking water and basic sanitation to their populations. There are limitations and risks related to the spatial distribution of water and the fragility of many of the contributing basins, however. Although water is abundant at a regional scale, there are severe shortages in some densely populated areas and arid zones (UNEP 2003; FAO 2003a; 2007).

In addition, a lack of social equity limits the access of large sectors of the population to drinking water and sanitation, even in those countries in the region with acceptable human development rates. It is clear that all countries need to work harder to reach the Millennium Development Goals by 2015.

Beyond each country's specific needs, Latin America as a whole requires more integrated management of its water resources that will strengthen them as a development factor and assure their long-term sustainability. It's necessary to better coordinate the development of policies and legislation, economic tools and infrastructure with the management of contributing basins and ecosystems.

The issue of water is increasingly being found on the agendas of the Andean community countries, MERCOSUR and the Central American Integration System, among other requests for integration and cooperation. This interest translates into more integrated and effective actions with respect to water resource management, with concrete benefits in terms of quality of life and development.

Towards truly integrated water management

In addition to political will, strategies and tools are needed to bring about truly integrated management of water resources. Integrated basin management, integrated water management and the ecosystem approach offer useful platforms. During the last few years, numerous pilot schemes have been undertaken in Latin America. For example, the last Latin American Congress presented several examples of projects and initiatives for watershed basin management that are worth analyzing (FAO 2003b).

Likewise, the Global Water Partnership (GWP) has provided valuable experiences in their Latin American Water Management magazine, which has been in circulation since 2004. IUCN and UNEP have been systemizing and analyzing experiences relative to water management from the ecosystem approach perspective (Guerrero et al. 2006). Thanks to the accumulated volume of experiences and the maturity of regional debate, now is a good time to review lessons learned, translate them into actions and move forward (UNEP 2003 and 2007; FAO 2003a and 2007).

There are several conceptual consistencies in the different approaches:

- Integrated Basin Management through public participation has been widely accepted as the approach to assure effective sustainable management of natural resources and a better economy for highland and low-basin inhabitants (FAO 2005).
- Integrated Water Resources Management (IWRM) is a process that promotes coordinated development and management of water, soil and related resources to maximize fairly economic results and social welfare, without compromising the sustainability of vital ecosystems (Global Water Partnership 2000).
- The Ecosystem Approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (UNEP-CBD 2000; 2004).

These approaches have been thoroughly reviewed with the aim of improving them and applying them more effectively (FAO 2005; Dourojeanni 2005; Kosten and Guerrero 2005). Rather than competing against each other, these strategies can supplement and reinforce themselves. This makes it more likely to achieve progress in making integrated and systemic practices regular elements in dominant development models.

EA and water management

People, water and nature are part of a system. Any policy related to water must incorporate an integral and systemic vision; with this issue, more than any other, isolated sectoral approaches are too risky in terms of socio-economic efficiency and sustainability. Water basins offer multiple ecosystem services. Although water supply, flow regulation and water purification are fundamental, other benefits and ecological, cultural, social and economic values should also be considered.

Just as the Millennium Ecosystem Assessment notes, at a global scale ecosystems' capacity to provide fresh water and other associated services is being negatively affected (Millennium Ecosystem Assessment 2005). The ecosystem approach offers a strategy based on a set of principles that integrate social, economic and ecosystem dimensions in natural resource management and can be very useful in halting that worrying tendency.

Along with other regions of the world, Latin America has contributed to the conceptual construction of the ecosystem approach. In the region the take-up process has generated constructive debates related to guidelines and tools for its application, which need to be adapted to the contexts of Latin American countries. In the specific case of water management, the region has been progressing in adapting the basis and guidelines of the ecosystem approach to the local context (Andrade and Navarrete 2004; Kosten and Guerrero 2005).

Case studies assessment

With the aim of assessing the explicit or implicit application of the ecosystem approach in the management of water resources and watershed basins, IUCN, with support from UNEP, conducted an analysis of eight case studies (Table 3) in Latin American countries (Guerrero et al. 2006; Andrade 2006). This initiative contributed to an understanding of how the ecosystem approach is being implemented and provides lessons learned and recommendations relevant to its application.

When analyzing the case studies, it became apparent that, in general, not all the EA principles were being applied at the same time (Table 4). Only one of the case studies incorporated all 12 principles, although the case study that applied the fewest number of principles did incorporate at least six of them (Andrade 2006).

Table 3. Case studies, application of the EA

case study	country
Guaraní Aquiferous System	Argentina, Uruguay, Brazil and Paraguay
Coastal River Wetlands Corridor	Argentina
Lake Titicaca Basin	Bolivia and Peru
Pastaza River Basin	Ecuador and Peru
Ubaté River Valley Wetlands Complex	Colombia
Barra de Santiago Watershed Complex – El Imposible – Ahuachapán	El Salvador
Basins associated with the Tacaná Volcano	Mexico and Guatamala
Three high-priority ecoregions: La Montaña in Guerrero State, Los Tuxtlas in Veracruz State and la Chinantla in Oaxaca State	Mexico

These case studies were analyzed with the participation of IUCN's Regional Office for South America and Mesoamerica, IUCN's Water and Nature Initiative, IUCN CEM and the UNEP Regional Office for Latin America and the Caribbean (UNEP-ROLAC).[62]

Table 4. Principles applied in Latin American case studies

most frequently applied	least frequently applied
Principle 1: Management objectives in the hands of society Principle 2: Decentralized management Principle 7: Appropriate spatial and temporal scales Principle 10: Balance between conservation and use	Principle 4: Management in an economic context Principle 6: Management within the ecosystem functional limits

These were some of the more relevant lessons learned from the analysis:

- Adopting an ecosystem approach for water management addresses technical, and political and institutional goals, because it creates objectives that take into account the multiple functions and social values of watershed basins and other ecosystems. In practice, this requires the resolution of conflicts of interest between stakeholders.
- Initiatives solely focused on biodiversity protection do not seem to offer direct community benefits. When objectives combine water management and biodiversity, stakeholders get more directly involved. In terms of alleviating poverty, the population will always value short-term concrete benefits, while the environmental action emphasizes long-term general benefits. Truly effective projects achieve both.
- It's not enough to focus management on ecosystem health to maximize the provision and regulation of services. It is essential to honour the EA principles related to the participation of local stakeholders in decision-making.
- In a multicultural context such as that in most Latin American countries, it is essential to balance scientific criteria with the visions and knowledge of various social groups.

Conclusions

Conceptually, there have been great advances in the development of integrated approaches to sustainable water management in Latin America. By means of pilot schemes, a great deal of experience has been acquired in the field, through strategies such as integrated watershed basin management and IWRM. This provides a good basis for moving forward toward sustainable development models of water management. In practice, however, these approaches have still not been applied at a scale that has a significant effect on environmental indexes and human development.

The ecosystem approach has the potential to complement and reinforce integrated water management. In particular, it can enrich traditional integrated basin management and complement traditional approaches, such as IWRM. To do so, it is necessary to promote ownership by all stakeholders.

The case studies reviewed followed the general philosophy of the ecosystem approach more than its specific principles. This has influenced the conceptual framework of the projects. It is common for the principles to be applied in an implicit and partial form, with different degrees of intensity. Their use as a complete and comprehensive group is still not widespread.

There is little coordination between national and international agencies with respect to integrated water management approaches. It is very important that the different networks, agencies and international entities — UNEP, FAO, GWP and IUCN, among others — better coordinate their efforts to create synergies between these approaches.

In the context of Latin America the ecosystem approach has much to offer and should focus on the integrated management of basins and strategic water supply ecosystems, equitable water distribution and on stimulating economic activities compatible with the MDGs.

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Case study 8

To know is to respect: indigenous ecological-cultural principles and the Ecosystem Approach in the Colombian Amazon

Carlos Alberto Rodríguez,[63] María Clara van der Hammen[64] and Mónica Gruezmacher[65]

The nature-society relationship and ecological principles

The nature-society interactions in many cultures contain symbolic concepts that regulate nature conservation. These concepts can be considered ecological principles but are challenging to quantify. Such an interaction has been demonstrated by modeling the relationship among indigenous populations of the Amazon and the surrounding tropical rainforest, which has enhanced the continuity of the vegetative layer in the forest.

This study analyzes the ecological and cultural principles of the indigenous populations of the middle and lower Caquetá River in the Colombian Amazon. It also discusses the coincidences, complementary nature, contradictions and potential use of the 12 EA principles, based on work on participatory research being carried out in the region by Tropenbos International Colombia (TBI-Col), and the documents previously published on this issue by TBI-Col, such as van der Hammen (1992), Rodríguez and van der Hammen (2000), van der Hammen (2003), Rodríguez and van der Hammen (2003) and Persoon et al. (2004).

Ecological-cultural principles of Amazon Indians

For more than a decade, joint work has been carried out with several indigenous communities of the middle Caquetá River on the use of the Amazon in order to define guidelines for its management. The work followed the methodology designed by TBI-Col, which includes symbolic concepts, understanding of resources, rituals, restrictions, consumption and standards for the overall management of the territory both from a shamanist point of view and from a quantitative follow-up of consumption at the level of family units.

Issues examined included the use of resources in different parts of the landscape, the use of vegetation and wild fauna (including hunting and fishing) and the establishment of agricultural areas or *chagras*. During the process, a large amount of information on the domestic consumption of forest products was obtained from daily records on domestic family units. These records include information on species, the magnitude of their capture or use, capture areas, capture techniques, and some records on the biology of the resources such as size, age, sex and stomach contents. The final destination of the products was also recorded.

Joint quantitative and qualitative analyses of the resulting data were performed. One of the most relevant analyses for the indigenous peoples related to the symbolic and shamanist interpretations that govern why some forest species may or may not be used and the implications that misuse could have for human beings.

Through collective discussions and individual work with experts, certain basic principles were defined that rule the relationship between indigenous peoples and nature:

1. There is a limit to the amount of "vital energy" available to all the creatures of nature.
2. Everything in nature has a "spiritual owner" and nothing can be used without his or her permission.
3. All the "spiritual owners" control misuse of nature through their weapons that cause illnesses.
4. The land is a multi-ethnic space, where each group has its own origin or birth, that must be maintained and well cared for.
5. Each ethnic group has its own ritual tasks that must be performed to assure harmony or balance in the territory.
6. The *maloca* or community house is the basic unit for interaction with nature.
7. The shaman is in charge of establishing a balanced and harmonious relationship with nature and its spiritual owners, through symbolic payments and negotiations and through rituals.
8. Each ethnic group has spiritual ancestors with certain species of the forest; they are their grandparents and are highly respected.
9. Each animal has its own place of origin and range that must be respected.

This set of principles contains symbolic references that are highly important to the life of the indigenous people in the forest. The principles also provide the basis for more detailed and strict regulation of the relations with, and use of, each of the resources of the forest, nature or the "world," as the macro-region is defined in shamanist terms.

Applying the principles ensures a good way of living, but there is also one basic underlying principle that concerns everyone: knowing the tropical forest, the species that form part of it and their relations and interactions is fundamental to understanding it, since one must know things in order to respect them. Knowing the world implies respecting it. This is why transferring knowledge about nature and its management is a cultural duty. Undoubtedly, a number of alterations and contradictions arise in the use of nature due to new circumstances, interactions and threats to cultural integrity which are currently being experienced by most ethnic groups in the Amazon.

In spite of the great changes, the principles operate in a different way, since they are associated with the generation of illnesses; any contravention in the use of nature's resources is punished by the "spiritual owners." This punishment can be illness or, in extreme cases, death.

The establishment of ecological principles is fundamental and constitutes the basis for action over the "world." Likewise, the formulation and application of EA principles open up a whole series of options and possibilities for application in the western world and in the context of indigenous communities.

Application of the EA principles can be a broad and powerful tool in light of how practical they can be in many institutional settings, legal contexts or in the field of research.

The EA principles in a double perspective

The ecological-cultural principles of the indigenous communities in the Amazon coincide with and complement, but in some cases also contradict, the EA principles. The EA principles that include social aspects — such as Principle 1 (which acknowledges that management objectives are of a social order), Principle 2 (on decentralization to the lowest most appropriate level), Principle 11 (on the integration of all forms of information or relevant knowledge including indigenous and local practices), and Principle 12 (on the integration of all sectors of society) — have been fundamental to the recognition of indigenous peoples' knowledge and traditional practices, and to society's acknowledgement of this knowledge. They are complementary to ecological-cultural principles because they place such principles in the wider dimension of the society with which indigenous people interact.

Social, institutional and political acknowledgement of indigenous communities has been fundamental in Colombia; environmental legislation recognizes the rights of indigenous people to formulate land-use plans. This is in effect a form of decentralization to the lowest most appropriate level (Principle 2).

Principles related to ecosystem aspects — such as Principle 3 (on the effects on adjacent ecosystems), Principle 5 (on maintenance of the function of the ecosystem) and Principles 7 and 8 (on spatial and temporal scales and connectivity) — also correspond to a great extent to ecological-cultural principles and are oriented to conservation and human well-being.

In some cases, however, EA principles contradict or are opposed to indigenous principles. Principle 9 (on the acceptance that change is inevitable) is an example; since forest conservation is a priority for indigenous people, all uses and activities must be oriented toward reconstruction of the vegetative layer and the management of

the succession phases that will keep the forest free of long-term changes, since everything must return to the "spiritual owners."

Similarly, Principles 4 and 10 (on the economic context) can present both possibilities for use and management, as well as serious threats within the symbolic context when included in the market. Principle 5 (about maintaining environmental services) may be able to include the possibility of including environmental compensations in the market without carrying the threat of unsustainable use.

Comparing the ecological-cultural principles of the Amazon indigenous people with the EA principles shows the enormous potential of these symbolic, conceptual, cultural and institutional bases that rule peoples' practices in the relationship with nature or with the "world," as indigenous people call it.

It is not only by chance that the same or similar principles are reached. The relationship with nature implies a frame of action standardized in many ways that can result in a good way of living or a balanced relationship.

A clear difference between the indigenous and western visions lies in the scale of the interventions or in the magnitude of use. Among indigenous people, upsetting the balance leads to disorder and therefore to disease; a punishment is sent by nature and by the "spiritual owners" to humans to control disorder in the use of the resources.

The EA does not follow any normative frame as such, nor does it include provisions for punishment, but it does include the concept that when principles are not present, this can lead to disorder and irreversible damage to the environment and to a major impact on humanity, which would be equivalent to the disorder and sickness mentioned by the indigenous people.

Conclusions

EA principles and knowledge dialogue

One of the major challenges for the application of the EA principles and of the ecological-cultural principles of the indigenous communities is the development of strategies and participatory research programmes, based on Principles 11 and 12, which stimulate the dialogue of knowledge. The experiences acquired by TBI-Col during more than a decade of working in the Colombian Amazon have shown the scope and possibilities for the application of participatory work methodologies in the research on the management of wet tropical forests by Amazon indigenous communities. These methodologies include support for academic research, indigenous research and joint research mechanisms that acknowledge and support different ways of generating knowledge relevant to conservation or conservation decision-making, in political negotiation and administrative decentralization with local indigenous authorities.

In the final analysis, what is needed is rapprochement and full acknowledgement of the validity of the different ways of conceiving and acting in the world, about the world and with the world to ensure conservation. This is understood as the sharing and coexistence with all forms of life to prevent disorder and promote balanced use or equilibrium to prevent the illness of the planet.

Another challenge for the EA and its principles is setting up a series of indicators that will enable participants to measure compliance with the 12 principles in different types of applications. This will in turn provide for better monitoring and follow-up systems, developed locally and in a participatory manner, to allow the formulation of warning signs and the construction of a more appropriate framework that will ensure the ecosystem's well-being as a base for human well-being.

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Case study 9

Contributions of the Alexander von Humboldt Institute to Ecosystem Approach application in Colombia

María Claudia Fandiño Orozco,[66] Fabio H. Lozano Zambano[67] and Inés Cavelier Franco[68]

Introduction

This paper presents some of the technical, conceptual and methodological contributions made by the Alexander von Humboldt Institute (AvHI) regarding the ecosystem approach in Colombia.

The institute's activities are analyzed at the institutional management level and the case-study level. At the institutional level, the Strategic Institutional Plans designed and implemented by AvHI from 1995–2007 are reviewed. The degree to which the EA principles were incorporated in the conceptual approach and in the strategic guidelines, such as mission, vision, objectives, goals, principles and institutional strategies, was studied for each plan.

The second level of analysis looks at three projects carried out by AvHI:

- the formulation of the Biodiversity Regional Action Plan (*Plan de Acción Regional en Biodiversidad para la cuenca del Orinoco* or PARBO) for the Orinoco Basin, Colombia, an action-planning process that took place in 2003–2005 within the framework of the Biodiversity and Development Project in Strategic Ecoregions, Orinoquia.
- planning for biodiversity conservation in the rural landscape of the middle basin of the Quindío River, in Filandia municipality, Quindío in the Colombian coffee-growing region. This local process was carried out within the framework of the Biodiversity Conservation and Sustainable Use project of the Colombian Andes, 2003–2007; and
- the use of biodiversity by local Andean communities and its management challenges, an analysis that focuses on the EA principles that are more directly applied to the case studies and that have a tangible expression in the products obtained and in the development of related processes.

Results

Institutional strategic management level

Since its foundation in 1995, AvHI has implemented three institutional strategic plans, 1995–1999, 2000–2004 and 2005–2010. These were based on a legal, political and technical framework and through consultations with the Ministry of the Environment, Housing and Territorial Development (MAVDT), government and private entities related to biodiversity, specialists from different disciplines and the institute's own researchers (AvHI 2006).

As a scientific and technical support institution to MAVDT — Law 99 of 1993 — and in the development of the CBD, ratified by Colombia through Law 165 of 1994, AvHI has had as its mission to "promote, coordinate and carry out research that contributes to the conservation and sustainable use of biological diversity." The institute uses CBD's definition of biodiversity, which includes different levels of complexity (ecosystems, species and genes) and the study of their different attributes (composition, structure and function).

In developing its mission the institute has contributed to the fulfillment of the three CBD objectives and the National Biodiversity Policy (1996), defining research guidelines framed in five strategic work programmes: inventory; conservation biology; use and appraisal; policy and legislation; and information and communication.

The EA has not been explicitly applied but is included in the strategic plan that is currently in development (AvHI 2005). The approach of the strategic plan focuses on the concept of the ecosystem and the sustainable management of ecosystems, which attempts to balance the three CBD objectives. The plan reflects an adjustment to the institutional mission, incorporating the link between biodiversity and human well-being and recognizing humans as an integral part of ecosystems.

This is why application of the EA is one of the nine institutional strategies that have been structured to achieve the institutional objectives and goals for 2005–2010. Recognizing that there is not just one way to apply the ecosystem vision — that this can be done at different levels of organization and planning — the proposed approach has conceptual and methodological frameworks with the possibility of replication and lessons learned, both in its processes and its institutional products.

This is reflected in other institutional strategies defined in the plan, which relates to the structuring of pilot projects for EA application using a research route to manage four institutionally prioritized ecosystems: tropical grasslands and flood plains, arid and semi-arid ecosystems, Andean forests and tropical rainforests (AvHI 2005).

AvHI case studies

Biodiversity Regional Action Plan for the Orinoco basin, Colombia

The Plans of Action area of the institute's Policy and Legislation Research Programme led to the formulation of the PARBO in 2003–2005, within the framework of the "Biodiversity and Development in Strategic Ecoregions, Orinoquia" project.

The plan is the main achievement of this project, because it is a road map for biodiversity management at the level of the Colombian Orinoquia region. It defines integral strategies that link conservation with use, thus achieving a balance in the treatment of these issues according to the specific needs of the region in a 25-year vision, thus reflecting Principles 8 and 10.

The application of Principle 7 should be emphasized because the scale defined in the creation of this plan was carefully analyzed by the Inter-institutional Committee, which decided to work at the Orinoco River basin level due to its enormous natural and cultural potential, its strategic importance for regional development and because it is one of the main suppliers of environmental goods and services to the country's capital city, supplying around 80 percent of the water for the capital's residents.

Ecosystem approximation at the basin level included an integrated approach to the various ecosystems that fulfil the basic ecological functions for the basin's watershed cycle, which include water collection on the moors of the Eastern Mountain Range and its regulation in the Andean and sub-Andean jungles, foothill forests and gallery forests.

PARBO's elaboration consisted of several phases (Ruiz et al. 2006), the most critical of which was the diagnostic phase. This phase entailed the compilation of up-to-date and computerized information about the status of knowledge, conservation and sustainable use of biodiversity in the Orinoco River basin, taking into account knowledge modes I and II (in other words, scientific knowledge and traditional and local knowledge), in accordance with National Research Environmental Policy.

The application of Principle 11 was especially important for this process, because the Orinoquia is a region where many different cultures and layers of knowledge converge: indigenous, peasant, *llaneros* (inhabitants from the *llano* region) and settlers.

PARBO's formulation phase lasted about 12 months and was highly participatory, with various technical, political and social interests and visions being negotiated. Its final objective was to orient the use and evaluation of comparative advantages and opportunities of the territory. Principle 1 can therefore be considered to have been followed in the planning phase, which involved close to ten regional events and more

than 20 meetings of the coordinating group established to make the plan operational in the different areas of the basin (Correa et al. 2006).

One of the bases of the formulation process for the regional action plan was the establishment of a network of regional institutions, securing process leadership, commitment and acceptance by the regional environmental authorities who are responsible for implementing the National Biodiversity Policy in the regions, under the decentralization approach to management stated in Principle 2.

The participatory process used in the creation of PARBO, as called for in Principle 12, led to a greater knowledge of and interest in biodiversity and increased awareness about its conservation and sustainable management.

Planning for biodiversity conservation in a rural landscape

The design and application of a plan for the conservation of biological resources in rural landscapes is a high priority. The great transformation of the Colombian Andean region has made rural landscapes the only conservation alternative for a great number of species and ecosystems that are no longer found in natural landscapes.

The rural landscapes research line of AvHI, in the framework of the Biodiversity Conservation and Sustainable Use Project in the Colombian Andes, developed and implemented a rural landscape plan for biodiversity conservation. The plan included a range of spatial scales, from local (individual farms) to the ecosystem scale (landscape), using biological, social, economic and institutional criteria, in a participatory process that in general terms reflected principles 4 and 7.

The plan recognizes the value of a range of rural Andean landscapes and proposes a number of phases with a long-term vision, as proposed in principle 8: getting to know the land and its characteristics, design of conservation strategies, structuring of landscape management tools, and follow-up and evaluation.

The design of the conservation strategy recognizes the history of the territory and of the stakeholders who have generated and are promoting past, present and future socio-environmental dynamics, in correlation with principles 1 and 4. The first step is to rank places and elements in the rural landscape according to their conservation value, in order to design appropriate landscape management tools (*herramienta de manejo del paisaje* or HMP)[69] with local and institutional stakeholders. Conservation opportunities are not restricted to biological variables; they also integrate biological, socio-economic, cultural and institutional information.

The HMPs take into consideration the needs and interests of the region's productive systems, the food or habitat potential for biodiversity, altitude range, extent of ecosys-

tem deterioration, the existence of native species and the species needed for local use, aiming to conserve the structure and functioning of the ecosystem for the provision of environmental services (in accordance with Principle 5).

The municipality of Filandia in the department of Quindío is one of the places where the plan for biodiversity conservation in a rural landscape has been tested. The Barbas-Bremen Biological Corridor is an HMP that connects two forest fragments in order to increase functional connectivity between the areas, countering the effect of habitat loss and the isolation of threatened fauna and flora populations (Mendoza et al. 2007). The total area of the corridor is approximately 60 ha and the forest area benefiting from the reconnection covers almost 1600 ha.

By the end of 2006, as a result of this institutional process, the Quindío Regional Autonomous Corporation and the Risaralda Regional Autonomous Corporation had designated the area (of 9651 ha) the Barbas-Bremen Natural Regional Park, in line with Principle 2.

A number of policies were put in place that took into account the different spatial and temporal scales that influenced the sustainability of the process. Non-economic instruments such as technical assistance, technology transfer, shared financing of the establishment of the HMP and in-kind compensations to free productive areas for conservation were applied. Taking note of principle 4, economic incentives (such as property tax exemptions) and juridical instruments (such as commitment agreements) were also implemented.

Follow-up and assessment shows evidence of restored connectivity between the Barbas and Bremen forest fragments with signs of the area being used both by bird species sensitive to fragmentation, and by howler monkeys. More importantly, however, the biological corridors are part of the everyday lives of the local population, in accordance with Principle 1. They see the strategy as their own and view it as an environmental opportunity for their region with an immense ecotourism potential.

The use of biodiversity by local communities in the Andean mountains

Although rural Andean people make up less than 30 percent of the total population, they represent a tradition going back more than twelve millennia. Over this time they developed various ways of interacting with the environment that contributed to the configuration of existing rural landscapes. Those inhabitants, both indigenous and peasants, still use biodiversity resources for food, medicine, construction materials, fuels, domestic implements and other elements in their daily lives and rituals.

The strengthening of knowledge and practices associated with resource use is a part of biodiversity conservation, as stated in Principle 10, since using any species requires

knowing where and how it can be obtained, the techniques for processing and consuming it, and the linguistic richness associated with local names. In effect, biological diversity is intimately connected to cultural diversity.

The Biodiversity Conservation and Sustainable Use Project included activities to survey the use of biodiversity in the Andean region. These surveys revealed the resources used, both animals and plants; the ecosystems and specific locations where the resources were obtained and how to obtain them; and who the users were, including their social aspects, gender, age, and collective behaviour such as rules of use.

In some cases, community members were trained to do the surveys; this also contributed to capacity building. The results identified those species that, due to their importance in terms of use, required a plan to guarantee their future existence. The use relationship between a human group and biodiversity forms socio-ecological systems that are complex, changeable and hard to predict. They require flexible management alternatives that allow adjustments to be made in decisions regarding their use.

These adaptive management schemes for useful species have been designed based on local and scientific knowledge, and have had the cooperation of environmental authorities, NGOs and the users themselves, as stated in Principle 11.

These management plans do pose adjustment challenges in legal mechanisms and structures due to the different biological, social and economic conditions that apply in each case. An attempt was made, however, to look at ecosystems and species that would allow experiences to be replicated in the future. Proposals and agreements were generated in the high Andean forests regarding edible oak forest mushrooms and wild berries with a high commercial value in the food industry.

Rattan for basket-making, along with other fibres and seeds used by indigenous and peasant artisans, are found in the sub-Andean forests. Species such as reeds, associated with high plateau wetlands, have allowed artisans to continue an ancestral tradition of manufacturing reed mats for beds and baskets. The existence of dry enclaves that contain ornamental cactus species that face serious threats, has led to community training in propagation methods that do not endanger the remaining population.

For some Andean ecosystems, including useful wood species that can be used in living fences and in wood energy forests satisfies a basic need in rural sectors that responds to cultural preferences such as cooking certain foods.

In all cases, as defined in Principle 2, there has been an attempt to build management agreements in a participatory manner in order to guarantee their legitimacy and

acceptance by the users themselves, to achieve real sustainability of the processes at the appropriate scales and truly decentralized management. This will require future institutional commitments to achieve a consolidation of the proposals from the recognition of cultural practices associated with biodiversity.

Conclusions

Although from the institutional point of view, explicit reference to the EA didn't begin until 2005, the case studies show that EA principles have been applied over several years in the development of processes aimed at promoting conservation and sustainable use at regional and local levels.

The application of the EA has mainly occurred in the implementation phase, rather than at the planning phase. This is of great institutional relevance, since the EA can contribute elements of analysis and judgment to strengthen projects and processes from their planning and design phase to their implementation.

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Case study 10

The Ecosystem Approach and the management of Marine and Coastal Protected Areas (MCPAs) in Chile

Roberto de Andrade[70]

Introduction

The Biodiversity Conservation Project of Global Importance along the Chilean Coast — the GEF Marine Project— is the manifestation of the conservation commitment to marine and coastal resources, economic development based on sustainable use of these resources and the strengthening of local governance.

The project started in 2005 with the designation of the first three multiple-use marine and coastal PAs (MU-MCPA), one in each of the country's three bio-geographical macro-regions: Isla Grande de Atacama, warm temperate zone, Atacama region; Lafken Mapu Luhual, warm transitional zone, Lagos and Francisco Coloane region; and cold temperate zone, Magallanes and Chilean Antarctic region. These three conservation areas are part of a national network.

The MU-MCPAs in Chile

In addition to considering the biological environment, the MU-MCPAs created in Chile (Map 5) incorporate people and their communities as the main stakeholders in conservation action through the development and structuring of sustainable activities in accordance with specified objectives. These areas are used to conserve biodiversity, manage natural resources, protect threatened marine species, reduce use conflicts, generate research and education opportunities, and support commercial and recreational activities that are in accordance with their conservation purposes.

Together with the opportunities they provide to improve people's living conditions, these areas allow an increase in the understanding of, and research into, their ecosystems and bring people closer to a natural heritage that is often seems distant, unknown and not fully valued.

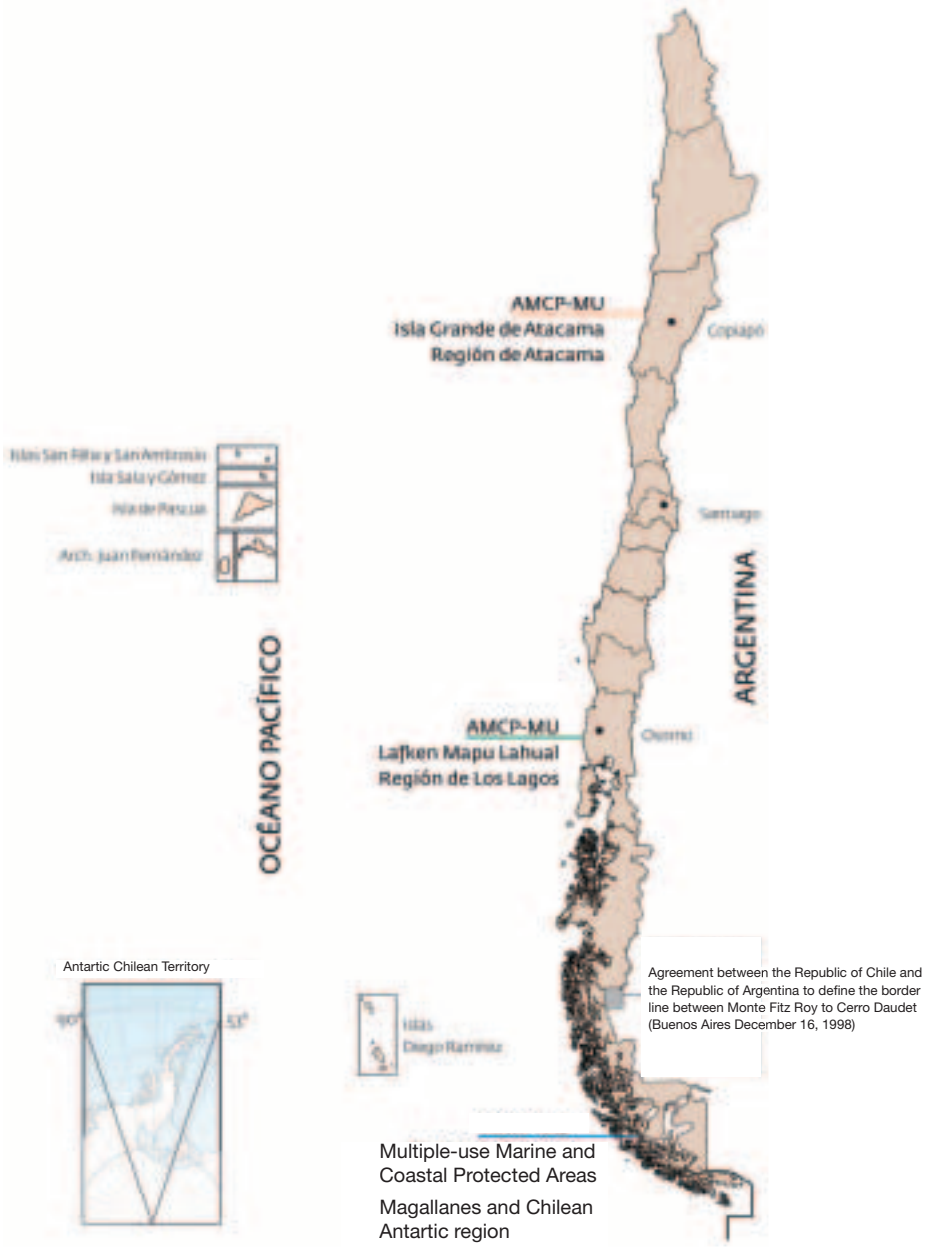
From a partial to an integrated approach

At present, marine and coastal resources are managed based on what could be called a partial approach. Management plans use a species — an object of capture or conservation — as the starting point. This form of natural marine resource management is used in deep-sea resources management, a management measure for artisanal fishing that was established in the fisheries law of 1991.

Management is based on research aimed at understanding the differences among fisheries. This is why it is necessary to move towards a more holistic view from a marine and coastal biodiversity management perspective.

Although marine ecosystems are home to many more forms of life than terrestrial ecosystems, less is known about marine species diversity than terrestrial biodiversity.

Map 5. Marine and Coastal Protected Areas (MCPAs) for multiple use in Chile



While taking into account this lack of knowledge and the great number of benefits generated by marine and coastal resources, it is undeniable that human activities are the direct or indirect cause of most of the deterioration and loss of marine and coastal biodiversity. This makes it necessary to adopt a new approach to management of these resources. The approach should be ecosystem-related; that way it is possible to make efficient use of resources and at the same time know what is being lost.

Application of a new approach

Overcoming information gaps

In the first phase of the GEF Marine Project, the main objective was to fill existing information gaps to support comprehensive management of the MU-MCPAs. Work is being done to supplement both terrestrial and marine biological baseline data, and geomorphological, oceanographic and archeological studies of terrestrial flora and fauna and macro algae and benthos, among others, have begun.

This information will make several things possible:

- establish the conservation status of ecological units of interests and identify potential threats;
- determine the degree of acceptance for the measures adopted (there are a number of stakeholders in the coastal zone, mainly artisanal fishing communities and *mapuches huilliches*);
- carry out an analysis of the costs of proposed conservation measures; and
- define the elements that will form part of the general management plan,[71] including administration, research, management, training, monitoring, auditing and surveillance.

Public-private dialogue and decentralization

The project has two private-public administrative bodies: a political and strategic entity, and another body responsible for management. The first is the Regional Commission on Marine and Coastal Protected Areas (*Comisión Regional de Áreas Marinas y Costeras Protegidas* or CRAMCP), headed by the regional administrator who represents the President of the Republic in the territory. Strategic conservation guidelines and annual operational plans are presented to the CRAMCP. Once the project is completed, this body will be responsible for supervising and training the area management unit.

The objective of this institutional architecture is to decentralize and to permit the participation of sectors with biodiversity conservation interests, contributing to the realization of the goals outlined in the national biodiversity conservation action plan. This incorporates the concept of the rational use of the environment at different levels, mainly through regional and local decision-makers, both public and private.

Evaluation of marine and coastal biodiversity

One of the main problems in marine and coastal environment assessment is the lack of information on biodiversity. Studies are being carried out to gain a better understanding of the ecosystems and the species that exist in the MU-MCPAs, and be better able to assess the environmental and productive services they can provide to society.

Incorporating the local community into ecosystem management

Two of the marine and coastal PAs of the GEF Marine project are used by communities for their natural resources and as recreational zones. In both areas, community work is being done with specific groups of relevant stakeholders, and with a larger target audience — mainly students from local schools — in another field (participatory environmental education). The communities are committed to helping to elaborate the general management plan, which will be open to public consultation before being approved. To avoid having just a plan, and no results, the decision was made to incorporate a methodology into the implementation of the management plans. This methodology is being developed.

The Francisco Coloane marine and coastal area in the Magallanes Region and the Chilean Antarctic has stakeholders who participate in the area's biodiversity conservation. A group of scientists there work as tourist operators, in addition to their research; they use the facilities to receive visitors. They carry out research on one of the area's iconic species: the Humpback whale.

Restoring ecosystems

Ecosystems are in good condition in two of the three areas initially selected. In the third area, however, at the Isla Grande de Atacama, the algae meadows are in very poor condition. An ecosystem restoration strategy is being developed.

Incorporating the areas into land-use plans

There are some zoning instruments in Chile. Community regulating plans are mainly used in urban zones; inter-community plans allow the territory to be divided into urban zones and transitional zones between communes. Coastal zoning, which uses participatory methods with the main stakeholders interested in the territory, also exists, although it is more of an indicative instrument that defines preferential uses.

Because of their conservation value and location, the three pilot areas are included in the coastal zoning. At the end of 2007, the Marine Sub-secretary will start zoning the Los Lagos and Magallanes Region and the Chilean Antarctic. The Lafken Mapu Lahual and Francisco Coloane areas will then be incorporated into the coastal zoning of their respective regions.

Case study 11

Development of Panama's National Agro-ecological Zoning Programme: an Ecosystem Approach

Cecilia del Rosario Guerra[72]

This was a proposal to develop a strategy to increase the competitiveness of the agricultural sector in Panama and reduce vulnerability to food insecurity. The goal is to zone crops according to the agro-ecological attributes of the soil and the socio-economic capacity of the region using geographical information system (GIS). This will allow proactive competitiveness models, which apply the EA, to be developed.

Scenarios

With the development of the National Agro-ecological Zoning Programme, scenarios are being elaborated for various changes in land use and their consequences for national and regional agricultural sustainability, which also depends on changes to prices, access to credit and commercialization policies. With the establishment of zoning and evaluation of food security crops, about 40 percent of the population who live in absolute poverty today will benefit directly. Three components are being developed simultaneously:

- viability of the agricultural business in the basins;
- agro-ecological zoning of crops in high-priority watershed basins; and
- precision agriculture through a pilot project on rice cultivation

Viability of the agricultural business in the basins.

The main goal is the elaboration of competitiveness maps per item for agricultural business development. Using satellite imagery, the project will develop national maps on agricultural soil fertility, vulnerability of the lands for agricultural use, expected production of the main crops and the variability in time and income probability per selected item.

Agro-ecological zoning of crops in high-priority watershed basins

The main goal is the elaboration of agro-ecological zoning maps in the provinces, by items, at a 1:50,000 scale, to improve regional competitiveness in the development of conglomerates in selected districts. The expected products are a map of the soil for prioritized provinces, an agricultural information integration protocol, GIS training, development of web applications and SIRTPLAN-ZAE-FAO methodologies (FAO 1996), four workstations in the main headquarters, design of a permanent informa-

tion virtual network for the agricultural sector, annual zoning maps per item in the provinces, workshops for item prioritization and compilation of information gathered, and a competitiveness prediction model per item per province.

Precision agriculture through a pilot project on rice cultivation

The goal of this project, in the Alanje district, Chiriqui Province, is to make rice producers aware of the use of remote technologies for crop yield improvement. With this, the criteria and minimum standards required for integrated pest management can be set up. This will allow farmers to survey and control their fields in order to reduce to an absolute minimum the use of costly, potentially damaging, chemical pesticides and maintain the system's ecological balance.

The project envisages interdisciplinary, intra- and inter-institutional work, strengthens existing initiatives and creates strategic alliances. This creates synergies in order to reduce costs and achieve investment efficiency, aiming for the sustainable development of this activity and the reduction of rural and indigenous poverty.

Introduction

From 1965–1968, the Land and Water Survey of Panama was carried out. The survey consisted of nine studies covering the Pacific slope (51 percent of the country's area). A soil study conducted at a semi-detailed level includes 59 maps at 1:20,000 scale and 105 maps at 1:50,000 scale.

In March of 1983 the Inter-American Development Bank (IDB), funded a technical assistance project in the Republic of Panama that used satellite images to monitor the sowing, growing and harvesting seasons of the main crops.

Around the mid-1980s, during the implementation of the PAN 81/011 project, "Development of Agricultural Production At Risk," the bases for agricultural zoning were established under the planning component, with funding from the FAO. This initiative was not welcomed by the national government of the time.

In 1991, a project coordinated by the Ministry of Planning and Economic Policy was formulated, using the Tomás Guardia National Geographic Institute as its headquarters. Its purpose was to contribute to the quantitative assessment of the country's natural resources and classify the national territory based on the potential of those resources, so that more efficient use could be made of them, enhancing Panama's economic and social development.

In 2000, an initiative for agro-ecological zoning of crops was proposed, to be financed by FAO and carried out by the Ministry of Agricultural Development and the Water

Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC). This initiative was not accepted by the government, however, in spite of an unofficial funding offer of US$400,000.

Despite such initiatives, national exploitation and unplanned use of natural resources — including soil, forests, water and biodiversity— have triggered a series of productive and environmental imbalances, recovery from which is almost impossible. Indeed, even if recovery or restoration were attempted, the economic and social costs would be greater than the direct or indirect benefits produced by the transformation, use and commercialization of the raw material extracted, or from the resulting agricultural products.

In Panama the agricultural sector bases its competitive advantage on the low cost of natural resources and unskilled labour and pays very little attention to technology and innovation. This makes it impossible to gain in production, distribution, sale, market expansion and diversification of related activities. Natural resources are becoming increasingly scarce, however, and consequently becoming the main driver when facing the problem of competitiveness in global markets.

This is why today's agricultural production must have a scientific base with a technological dimension developed under institutional performance models that are focused on the environment.

As one observer has noted, "If we set off from the fact that competitive advantage is the result of an effective combination of available natural resources with strategies adopted by the agricultural business, then the State, through its development institutions, has an obligation to create favourable conditions to facilitate gains in competitiveness. But what really increases competitive capacity is the effort made by the government to adequately plan the use of the resources it has available." (Sarmiento 2005).

The uncontrolled encroachment of agricultural and livestock production into land more suitable for forest or into protected territory has given rise to the establishment of large areas of marginal production, whether agricultural, cattle-raising or forestry. This has caused a rapid deterioration of the soil's productive capacity. In some cases, areas with agricultural or livestock-producing capacity are being under-utilized.

New simulation methods based on GIS use (FAO 1996) are assessing scenarios on changes in land use and their consequences for regional agricultural sustainability produced by changes in price, credit or commercialization policies. Precision agriculture promotes an ecologically balanced system, where farmers compare the yield of an experimental plot with that of their land and weigh the cost of pesticides that they

have applied against the cost of the extra time they have spent in the field monitoring the situation.

Rural sector investment decisions should focus on different objectives such as poverty relief, assuring food security for the population, competitiveness of the sector vis à vis economic globalization processes, concerns for future generations and the sustainability of rational use of natural resources. These issues become more difficult due to the variety of ecological, social, economic and political systems and their interactions at local, national and global levels (García Benavides 1974).

For these reasons, it is necessary to carry out studies that determine the true competitiveness of the productive chains of the country's most important items to determine any "natural" and "technological" advantages they have. Diagnostic tools for the sector's structure are needed, as are management tools to analyze its competitiveness, Carrying out activities which lead to developing these tools is key in defining the quantitative and qualitative realities that determine future development.

The EA balances the three objectives of the CBD. It is the CBD's action framework and is based on the use of appropriate scientific methodologies, focused on the levels of biological organization (which include essential processes, functions and interactions between organisms and their environment), and it recognizes that human beings — with their cultural diversity — are an integral part of ecosystems.

The project also contributes directly to the fulfilment of the Strategic Plan *Manos a la Obra* 2004–2009, which proposes five strategic areas — market and agricultural-business development; competitiveness support; agriculture financing; agriculture and rural development; and institutional adaptability — and ten policies specific to the agricultural sector including food security, agriculture and livestock transformation, commercialization and financing, for the development of a national agriculture-livestock production planning strategy based on sustainable development.

Once the first stage of the program's structuring is completed, the nine provinces of the country will be covered. Panama City will be the central hub, receiving information from all the provinces. The following points were established to achieve this objective:

- using existing internet links in each province, a server will be made available to receive the GIS data;
- in the field, mobile methods using ArcGIS with a hand-held device will allow officials to input information;
- the servers will allow field operators and officials to immediately download information on each province;

- once all the data has been entered onto the mobile system, it will be broadcast to the nine collection points — the provinces — and the corresponding servers by GIS;
- data will be transferred on a daily basis from the different provinces to the main processing center in Panama City;
- the information contained in the database and on the web will be available for consultation;
- training and technology-transfer workshops will be held in order to develop the concepts, the knowledge and the techniques required for the management of the different programmes used;
- there will be a massive data entry interface in the main production server towards the web publication server;
- at this point, profiles and sections — public and private — of the web portal for the agriculture and livestock sector will be developed. The data will be available to the public and will be in the public domain.

Conclusions

The data generated in the country and in other similar agro-ecological zones will be computerized in agriculture production models. The results of the research may be adapted over a shorter period of time and at a lower cost by combining validated models, past results, agro-ecological zoning and climate data.

The results will be integrated in a computerized system that can be used to evaluate the impact of agricultural sector policies and strategies, research, investment projects, production risks, commercialization processes, disaster mitigation strategies and climate change.

The project will provide broad-based information about the limits and possibilities of agriculture for each agro-ecological zone. The EA will be applied to benefit the local populations in the prioritized watershed basins.

The pressure of current levels of use on natural resources from agriculture and livestock production can be determined, and it will also be possible to identify the goods with which the region can compete in the international market.

Production and post-production technologies to maximize productivity and profitability of the agricultural activity can be defined. Priority can also be given to the research needed in order to become more competitive, considering the climate changes that are occurring.

It will be viable to quantify both the environmental impact of current production systems and of proposed changes such as the relationship between productivity increase and environmental quality.

Indirect beneficiaries of this project are institutions, research centers, university professors, officials, agriculture and livestock producers, businessmen and agro-exporters. This will be a planning tool that will support the country in decision-making at different levels.

Consumers of agricultural and livestock products will benefit because there will be a greater amount and better quality of products from the sector. Civil society as a whole will also benefit because mitigation measures against negative environmental effects in agricultural zones can be adopted. This will allow healthier production methods to be developed.

Alternative options will be established for rural sectors with limited competitive advantages in agriculture production; for example, income due to improved environmental quality achieved by applying the ecosystem approach with its principles and actions.

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Case study 12

The Ecosystem Approach as a Guide for Action: The Fúquene Wetlands Complex in the Eastern Andes of Colombia

Germán I. Andrade Pérez[73] and C. Lorena Franco Vidal[74]

Introduction

The CBD recommended the adoption of the EA[75] as "a strategy for the integrated management of land, water and living resources that promotes their conservation and sustainable use." Little information on the scope of its practical application is available, however. The EA principles, grouped as ecological, social and management principles, were used by the Wetlands Foundation *(Fundación Humedales)* in its project for biodiversity conservation in the Fúquene lagoon, an ecosystem that has been mainly managed for economic development objectives.

Description of area

The Wetlands Foundation began work in the Fúquene lagoon in 2000, seeking to create technical and social bases for equitable and ecologically sustainable development in the region. The lagoon is located in the Cundinamarca and Boyacá plateau on the western slope of the Eastern Mountain Range, in the high basin of the Suárez River. It is 130.6 km^2 in area. The Fúquene, Cucunubá and Palacio lagoons are located in the Ubaté River Valley, a relict of an old lake, between 5° 37'23" and 5°08'04", with respective surface areas of 3155.8 ha, 214.3 ha and 37.5 ha (Franco et al. 2007).

These are highly important wetlands. They shelter species at a high risk of extinction and have great national and regional importance as sources of drinking water (e.g., for Chiquinquirá, with 150,000 inhabitants) and as a support to an important dairy industry. They support a significant local fishery (Valderrama and Hernández 2007), their marshes supply the raw material for local arts and crafts (Hernández and Valderrama 2007) and they are a centre for recreation and tourism.

The fact that the Ubaté valley has over 300 inhabitants per km^2 (CAR 2001) reflects the economic success of the dairy industry. The development of the industry has brought about a fundamental transformation of the ecosystem, beyond the limits of sustainability. The lagoons are clogged with vegetation and are in an advanced state of eutrophication, with a loss of environmental values and a perceived risk to agriculture. The situation has drawn the attention of decision-makers who wished to pursue a conventional approach to correct "inefficiencies" in the irrigation system (JICA-CAR 1999) and has also attracted some proposals for a "natural system" approach (van der

Hammen 2003). The response of the government in its Economic and Social Policy document (CONPES 2006) includes water use regulations, prompt pollution control, environmental improvement in the basin and minor investments in conservation and monitoring. It is not clear, however, if these interventions will be effective or if, due to their limited character, they will bring about unexpected changes, perpetuating "pathological management" (Meffe et al. 2002).[76]

Results

The project started by recognizing the spatial and functional structure of the ecosystem on three levels: the reception basin, the wetland complex and individual sites or habitats. Based on a simple conceptual model that integrated climatic, hydrological and ecological variables, a hypothetical approximation was made of the functionality of the ecosystem in its natural state. The hydro-ecological complex is a high, shallow, tropical mountain lake with a highly fluctuating water regime dependent on extensive wetlands. Its small watershed basin means it has limited capacity for water regulation (Cabrera et al. 2007) so the system is affected by climate variability.

The basin system — the lakes and wetlands complex — has undergone great changes since the second half of the 19th century, due to drainage and land reclamation driven by the development of agriculture and animal husbandry in the area. Four main factors contributed to this transformation:

- the straightening of the Suárez River and reduction in the water level;
- fragmentation of water bodies;
- changes in land use in the reception basin; and
- introduction of invasive alien species (Franco 2007).

The result is a dairy-agricultural system as a matrix in the landscape, with relicts of water bodies and marshes and a modified immersed water network. Changes suggest that the system is beyond the limits of normal function (Table 5).

A review of climatic variability (van der Hammen et al. 2002) shows that in the Colombian Andean zone an increase in temperature of 2.5–3° C is possible, as are a 500-m increase in altitude of the habitable zone and a 10–20 percent reduction in rainfall. The general climatic scenario is aridity, with an increase in the intensity and frequency of El Niño-La Niña events. Two possible management options can be identified: a trend scenario and an adaptive scenario.

Table 5. Issues and processes, Fúquene lagoon

issue	process
• ecological structure of the basin: relationship between natural, semi-natural and transformed cover	expansion of the anthropic moorland in the high Andean forest; deforestation and change in land use; evidence of recent deforestation in the upper part
• inflow of water	in 1969–1989 it decreased from 3.97 to 2.08 m^3/sec (Useche 2003)
• sedimentation	increased from 0.4 mm/year before human activity to 1 mm/year recently (van der Hammen 2003)
• phosphorous and nitrogen content	very high levels (according to JICA-CAR 1999); no recent measurements available
• total extent	decreased from 100–30 km^2 in about 70 years (1930–2000) and continues to shrink
• rate of reduction in surface area	0.3%/year from 1880–2000; there are signs that the loss in surface area continues
• amount of surface covered with aquatic plants compared to open water	in 2000 there were 979.37 ha of marshy system and 1986.07 ha of lacustrine system (Franco et al. 2007); marshy vegetation in the lagoon is spreading
• depth	from 1962–1994, mean water level went from 2539.2 to 2538.1 m, a decrease of more than 1 m; minimum values went down by 1 m and maximum values by 1.5 m (van der Hammen 2003)
• total biodiversity	undocumented changes; two extinct vertebrates and four threatened
• richness of bird species	historically it decreased up to 1980; has increased since 2000 (Morales et al. 2007)
• invasive alien species	three fish and two plants that were introduced have settled in the aquatic system; numerous species in the basin
• number of fishermen	198 fishermen, 48 of them permanent (Valderrama and Hernández 2007)
• number of artisans working with rushes	increased from 100 to 400 — 400% — in the last two decades (Vieira and Hernández 2006)

Trend scenario

In the trend scenario, the water supply continues to decrease and marshy vegetation expands. Managing irrigation district through dredging and dams could make more water available for the dairy industry, but could also exacerbating the area's problems through the release of contaminants. With an increasing shortage of water and higher demand for it, conflicts over use of water could worsen. Although in the short term, this scenario has shown an increase in wildlife due to a greater availability of habitats, its future is not assured if the lake were to clog up completely.

There is the possibility of correcting past mismanagement if the community is capable of managing the system within its functional limits, and has the skill to guide the changes until the ecosystem has reached the desired state. Addressing the adaptation-transformation dilemma depends on the application and development of adequate measures and on the existence of stability limits and change thresholds.

Adaptive management scenario

An adaptive management scenario has four components: i) adjustment of the basin inflow by building dams upstream; ii) adjustment of the mean water level to at least 1.5 m above the current level; iii) a compromise between water use and limiting the growth in demand; iv) limiting levels of eutrophication by controlling pollution. A higher mean water level is urgently needed to prevent a transition to a marsh-dominated system.

It is not clear to what extent the magnitude of the impacts and climate processes have crossed irreversible change thresholds, placing the system beyond the scope of adaptive management and precipitating an inevitable change. In a changing scenario such as this one, just maintaining the lacustrine-marshy phase may be the only possible restoration outcome, as was the case with the Palacio lagoon.

The economic importance of the dairy industry has led to a management regime focused on maximizing irrigation. Increasing one function at the expense of other environmental values is usually accompanied by a loss of ecological resilience; i.e. the capacity of the system to maintain its structure and function in the face of disturbance (Walker and Salt 2006). People who benefit from economic development win, and some small land-owners — to whom the biological resources of the lagoons are vitally important — lose. Those who value natural spaces, biodiversity and society in general also lose.

Discussion

A change in perception is being promoted. Information has been disseminated to try and make people understand the change in the ecosystem and its environmental values, especially those related to the transformed system. There has already been a shift in official discourse about the lagoon. The wetland has changed from "an irrigation and drainage district in the Fúquene lagoon" in crisis at the end of the 1990s (JICA-CAR 1999), to an Important Bird Area (Franco and Bravo 2005); a proposed Ramsar Wetland of International Importance; and pre-selected for the Natural Protected Areas System in a regional management category (Matallana et al. 2007).

The Bogota Association for Ornithology, together with AvHI, has been carrying out a bird census since 2000. There has also been an increase in awareness of the importance of biodiversity, including the Living Lakes network, Ramsar Convention and IUCN.

The acknowledgement of these values generates new determinants for institutional management and sets limits to over-exploitation. CONPES 2006 acknowledges the legal and political aspects of the lagoon as a wetland (van der Hammen et al. 2002), establishes limits to human interventions, and provides guidance for multi-sectoral development objectives.

Progress has been made in developing economic opportunities linked to conservation, and in the participation and organization of groups of fishermen and artisans working with rushes. The participation of the Rural Development Institute, the fisheries authority, has led to the creation of the Committee for Fisheries and Environmental Regulation. This moves the process a step closer to the comprehensive management of the ecosystem. A similar process has been carried out with the artisan community through assessment of the levels of extraction and a census of users (Vieira and Hernández 2006). In addition, dealing with the invasion of exotic species has provided an economic opportunity for a bio-fertilizer company.

Progress is also being made in the promotion of rural tourism and ecotourism. The generation of economic benefits from the management of biological resources is the first step towards equitable and sustainable economic management. Internalization of the dairy industry's environmental costs and of other productive activities is pending, as are incentives for sustainable use of water and PES.

The core of EA application is in the participatory monitoring that seeks to fill the gap between knowledge, information management and adaptive management, according to what can be called "community science." It is based on the reading of hierarchical indicators that are relevant from a scientific point of view and from local perceptions. The indicators are referred to the ecosystem operation model and show if there are negative changes. The proposal avoids using indicators that are out of context or that

are applied rigidly or incompetently, which runs the risk of disguising the processes. It also and moves away from the unfortunate trend of suppressing monitoring, which blocks the way to adaptive management.

The inclusion of the vision and of interests of the weakest groups and of those interested in biodiversity prevents or counteracts decisions that giving priority to just one function. It allows activities such as dredging and drastic morphological re-conversion of the riverbanks to be mitigated. The scale of the intervention does not reverse the causes of the deterioration of a complex ecosystem, but by focusing on the most vulnerable social groups, it increases the resilience of the social system and thus acquires a strategic nature.

Conclusions

The EA as a guide for action shows that sustainable management means not only efficient use of water by the dairy industry but making that use compatible with a multifaceted set of ecosystem values and functions. The only limitation to a management oriented solely to irrigation comes from the downstream use of resources for the Chiquinquirá water supply system. This, in spite of purification costs, has generated a legal obligation to manage water levels at a minimum level, that has contributed to having a certain margin for maneuvering for more balanced management. The management intervention being promoted will try to make room for the participation of the most vulnerable farmers who are the direct users of the lagoon's biological resources.

The ecosystem challenge could be defined as the need to manage the water, ecological and social systems of the Fúquene lagoon by making management of the irrigation district compatible with the creation and management of a PA. This would be based on the sustainable use of the biological resources by the local communities with benefits for the community in general. Nature has already shown that it can recover; the challenge is for the community to consider it desirable and achievable.

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Summary of lessons learned

- The EA has been applied according to the circumstances of each country, region or project. Scientists and initiative leaders are using it in their daily work, often without being conscious of the principles or the definition within the context of the CBD. Applying the EA has not been done in order to comply with the mandates of the CBD itself but as a result of the need to link biodiversity and development. This makes the process more spontaneous, allows it to be adjusted more easily to changing circumstances and to evolve in identifying the elements required.
- The EA must not be oriented exclusively to conservation and sustainable use of biodiversity. Most of these case studies relate to conservation and development projects, but it is necessary to involve stakeholders from sectors such as fisheries, animal husbandry, and agriculture. They must be convinced of the importance and benefits of the EA.
- The EA can be interpreted in different ways by different project managers. This is why it is important to clarify the concepts and take local knowledge into account.
- Application of the EA must take into account the specificities of each situation. Some cases achieve local success but there is no regional or national support; there are unsuccessful national approaches but fruitful experiences at a regional level. It would be useful to gather all this information, identify the success stories and make a systematic assessment of the failures and their causes.
- Greater dissemination of the EA concept is needed so that it is more likely to be incorporated in public policies and in planning exercises at various levels.
- The issue of adaptive management is very important; however, a deeper reflection on its scope and method of application is necessary.
- There is a growing demand for integrated development strategies. The EA is being used more in planning than in the structuring of projects. The philosophy of the EA is taken into consideration, but not its principles.

Limitations

- Conflicts over land tenure are one of the limiting factors in applying the EA.
- The level of uptake of the EA by national authorities is low; at times it is used in political discourse but in reality there is no commitment.
- Adequate participation by farming communities can be problematic due to high levels of illiteracy and armed conflict. Participatory processes are very costly and not all projects or organizations are willing to finance them.

- Although the EA is accepted conceptually by many environmental institutions, traditionalist conservation visions predominate in the design of development actions.
- Social processes with broad public participation often create expectations that projects cannot meet. This is due, among other things, to projects' short development periods. In some cases, the organizations that initiate the projects are not able to respond to the communities' development needs and end up concentrating their efforts on conservation and designation of PAs. This generates additional conflicts.
- Acceptance of the EA concept is limited at the highest levels of public management. Wide-ranging economic policies and processes lack long-term vision and an integrated view of conservation and development.
- It is difficult to establish long-term objectives due to the predominant short-term view of governments and society.
- The EA continues to be restricted to the environmental sector, in contradiction of its own philosophy. The EA concept is not sufficiently known or understood and in many cases, there is an element of competition between the different approaches in the management of development projects.
- The region is very weak on generation of knowledge and scientific information, largely due to economic limitations and a lack of opportunities for research. It is necessary to make scientists aware of the research problems that can close these gaps. In addition, traditional knowledge must be recorded and valued.

Opportunities

- Planning and prioritizing new conservation and development projects in the region provide an opportunity for the application of the EA and would help incorporate concepts such as ecosystem services, climate change and adaptive management. This would help in developing better criteria to achieve the maximum benefits from any interventions and would make management more cost effective.
- A wide network of people work on initiatives in different Latin American ecosystems that could submit the results of their studies and show the significance of the EA. These studies could be disseminated by IUCN CEM to increase awareness of the concept and its practical implementation.
- The EA could be included as a component of the regional education system.
- Processes are ongoing in the region to motivate public participation in decision-making. This promotes land-use regulation at a local level. EA application should be oriented toward such decentralization and social and political opportunities.

- It is important to be able to measure success or failure in the application of the EA. Therefore, it is extremely useful to use indicators to guide the process that can, in turn, assist with planning, strategy analysis and evaluation.
- Each day more case studies are implemented and analyzed, allowing the EA to become less theoretical and more practical. The development of guides, indicators and tools is fundamental in order to move forward in priority development agendas, poverty mitigation, compliance with the MDGs and in competitiveness based on ecosystem services.
- It is important to find mechanisms that show the benefits of EA application to people who are not directly related to it and establish its contribution to the achievement of social and economic objectives for local communities.
- A way must be found for the EA to be understood and adopted by sectors of society other than the environment sector and included in local, national and regional policies.
- The EA needs to overcome application limitations caused by a lack of information. All types of knowledge need to be integrated and used to generate a minimum baseline of information that can support planning and management. Information is needed at three stages: the planning stage; the structuring process (closing all the knowledge gaps); and the monitoring phase. These areas are all weak because of the lack of accurate and reliable information
- In specific situations — such as those in Amazonia — it is fundamental to incorporate the ethnic component and link it to all the processes. Each community has its own distinctive perception of its territory and its own vision of the universe and terminology, in a holistic framework. There is no specific orientation toward biodiversity. This has been both an opportunity and a challenge for coordinating the communities' vision and the institutional vision.

Recommendations

Several recommendations relate to the application of the EA:

- develop application mechanisms for land classification, conservation and use that include the cultural aspect, which are useful to local communities in territorial planning;
- increase the dissemination of the adaptive management concept at different scales since there are no clear guidelines regarding its application; CEM could promote guidelines and more technical recommendations;
- promote, via IUCN — with the support of the regional office — the development of an operational guide that includes criteria and indicators for assessing the EA, and a standard guide for the different scenarios, both for planning and for monitoring, with indicators, specifically including adaptive management;

- develop training strategies addressed at decision-makers at different public and private levels;
- identify ecosystems, with an emphasis on marine and coastal areas, for which at least one EA case study can be developed, first at a national level and then at a regional level, that incorporates both biodiversity conservation and ecosystem services, or more regional processes. A regional portfolio in the context of the CBD, coordinated by IUCN, is suggested, where high-priority areas can be identified;
- the EA is very close to the hearts of South American peoples, especially to the indigenous peoples, who have been applying it in a very intuitive way. To convince other countries, it is important to show them that the EA is effective;
- in the region there is an opportunity to make progress in the application of the EA, bringing it to a more global level; flexibility is important, as not everything can be applied in all countries and regions;
- the EA can reveal the gap that exists between protected and unprotected areas. The EA integrates and protects the different scales and spaces and helps manage protected and unprotected areas with the participation of local people; and
- the EA's flexibility allows for adaptation at different scales.

Relationships

- The EA links to different sectors via development planning, both in conservation aspects as well as in economic components (agriculture, energy, hydrocarbons, etc.).
- Since most countries in the region have ratified the CBD, the EA can be promoted at a sub-regional scale. There are cases of active cooperation in Latin America where plans that involve several countries are being developed. The EA should be promoted in integrated and cooperative regional initiatives such as MERCOSUR, the U.S.-Mexico Border Information Center on Air Pollution *(Centro de Información sobre Contaminación de Aire)*, the Union of South American Nations *(Unión de Naciones Suramericanas)* and the Treaty for Amazonian Cooperation *(Tratado de Cooperación Amazónica)*.
- The EA is a solid conceptual framework that supports institutionalism. It must be viewed from local, regional, national and global perspectives.

Communications

- Information about the EA could be disseminated through the exchange of information and methodologies, adapting experiences to be replicated and comparing case studies.

- Communicating the EA is fundamental to establish alliances between stakeholders for presentation to different audiences and for environmental education.
- A web page or an internet discussion forum could be useful. The CBD's existing mechanism might be able to be used for this purpose.

Management

Governments

National governments must make arrangements for incorporating the EA into the planning and management of development sectors, taking these elements into account:

- development sectors should establish policies that include the EA vision; and
- government policies must be committed to the application of the EA.

As key elements for negotiation, governments must consider the following:

- show that the EA is a solution instead of a problem;
- try to understand the logic and language of the development sectors;
- have a clear understanding of what the other sectors have to do and what governments must do to convince them;
- governments must choose the right time for negotiations with the sectors, taking advantage of activities such as sectoral planning; and
- during negotiations the governments must have a clear vision of the sites that need conservation, either for ecosystem importance, environmental benefits, connectivity, cultural importance, etc.

The EA is a tool for making progress in sustainable development. Economic, technical and institutional sustainability are highly important elements. To achieve this, capacity building must take place at three levels of training: personal, institutional and at a system level as a cross-sector element.

Governments and CEM

Governments need to strengthen the application of adaptive management through greater use of monitoring tools — including the economic, financial, social and environmental dimensions — so that attention is not directed only at planning and structure.

Governments and CBD

Governments need to analyze how the EA has been applied in other countries that face complex situations — such as armed conflict and natural disasters — and how it could be useful.

CBD

The CBD should develop a strategy to incorporate EA elements into private-sector policy and thus strengthen its social and environmental responsibility. It should also analyze case studies on EA application in the private sector.

It should also include guidelines to integrate explicitly cultural values into the EA principles, particularly Principle 1.

It should try to incorporate the EA principles at all levels of decentralization, not only at the lowest level of decision-making, which at times is more concerned with the short term.

CEM-CBD

CEM-CDB should strengthen communication and education strategies to achieve the incorporation of the EA into various territorial planning processes, high-level policies and at different operational scales in other sectors. These strategies should take the following into account:

- use simple language for better understanding;
- translate scientific information as the base for political decision-making; and
- show that it is not necessary to apply all the EA principles from the beginning, and that a project can begin by using the easiest and most viable ones, in order to counter the impression that the EA is an all-or-nothing method.

CEM-CDB should also create opportunities for the exchange and dissemination of information about experiences between Latin America and other parts of the world where land management by indigenous or traditional communities is taken into account. It is necessary to show, through the indicators, the results achieved.

CEM and IUCN

CEM and IUCN should actively explore opportunities to work with the private sector in the application of the EA showing its advantages and benefits.

CEM

CEM should recognize in its dialogue with other stakeholders — local communities, private sector, development sectors, etc. — the need to let go of predetermined ideas in order to gain better understanding from others; i.e. to achieve flexibility in the application.

CEM must make progress in the assessment of elements such as social and cultural dimensions — social benefits, the value of self-determination in the management of the PAs, and economic and financial dimensions — and the cost of environmental losses and liabilities.

CEM should define the scale at which work is being done and which criteria are being used, taking into account that the EA must operate at a multi-scale level in space and in time.

Criteria and indicators need to be defined for assessing the effectiveness of the EA in different cases and contexts. A guide for general application should be developed that does not limit any necessary adaptations.

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34. CEPF is an alliance between the World Bank, the GEF, CI, the Government of Japan and the MacArthur Foundation with the goal of investing in biodiversity conservation strategies in the most threatened hotspots of the planet.

35. Terrestrial areas with a high value in endemic biodiversity that are exposed to extreme threats. They cover 1.4% of the surface of the planet and include almost 60% of the earth's biological diversity.

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52. For further information see Sustainable Development Strategy Guantiva-La Rusia-Iguaque conservation corridor.
53. To view this and other related documents please see www.corredordeconservacion.org.
54. An invitation to participate in the Oak Forest Andean Corridor was created within the framework of the Forest Conservation Agreement of the Fund for Environmental Action and Childhood, Colombia.
55. The coffee-growing region has priority because production under shade generates connectivity between the Andean forest above 2000 m in altitude and dry forests below 1200 m.
56. Protected area managed by the government.
57. *Ministerio de Ambiente Vivienda y Desarollo Territorial* (MAVDT).
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59. Coordinator of the Water, Wetlands and Fishing Program. PROTEGER Foundation. IUCN-CEM Member.
60. Moisés Bertoni Foundation, Paraguay. dsalas@mbertoni.org.py, danilosalas@gmail.com, egarcia@mbertoni.org.py
61. International consultant in the management of ecosystems and environmental policies. IUCN-CEM member.
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64. External University of Colombia; e-mail: maria.vanderhammen@uexternado.edu.co.
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