

# Conservation of biodiversity

## Nature Conservation and Ecological Corridors in Bolivia

### 1. Introduction

The natural forests of the world still vanish at an alarming rate. What is left after human intervention are dispersed and isolated patches of forest and bare land. This imposes a serious threat upon the world's biodiversity. Valuable wildlife and plant species are left on small isles after which extinction is only a matter of time. With the extinction of many species mankind loses the greatest treasure that mother earth has to offer.



Rainforests are among the most biodiverse ecosystems on earth

#### 1.1 What is biodiversity?

In the simplest of terms biological diversity is the variety of life and its processes; it includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

(Keystone Center, "Final Consensus Report of the Keystone Policy Dialogue on Biological Diversity on Federal Lands," 1991)

#### 1.2 Why is biodiversity so important?

The natural environment is the source of all life. Environmental processes provide a wealth of services to the living world — providing us with air to breathe, water to drink and food to eat, as well as materials to use in our daily lives and as natural beauty to enjoy.

Complex ecosystems with a wide variety of plants and animals tend to be more stable. A highly diverse ecosystem is a sign of a healthy system. Since the whole of the living world relies on the natural environment, and especially we ourselves, it is in our best interest and the interest of future generations to conserve biodiversity and our resources.

[www.eco-online.qld.edu.au](http://www.eco-online.qld.edu.au)

## 2. The Sicirec context

Sicirec realises and supports sustainable and ecological reforestation projects that earn a good financial return and at the same time, by means of conservation and restoration of ecological networks, maintain or restore biodiversity. More specifically, in all Sicirec's projects the emphasis is on the establishment of permanency for all restored and protected ecological areas. In that way the realised ecological networks are made irreversible and permanent. Profitable forestry is thus combined with lasting repair and protection of biodiversity.

### 2.1 Sicirec's philosophy

Sicirec's philosophy is simple: anywhere where land is used in whatever way, ecological repair and production methods based on ecological principles, can very well be combined with profitability. It is a common misunderstanding that ecology and profitability are always incompatible. Combining the two is a matter of know-how, which is still missing most of the time. Sicirec helps to spread this know-how.

Combining the two aspects of ecological repair and profitability is of the utmost importance since:

- If nature conservation is not supported by economic and social sustainability, it will not be sustainable in the long run. The active protection of a nature reserve cannot earn the qualification sustainable as long as there is any chance that in the future the protection of the reserve can no longer be guaranteed.
- Only preservation is not enough. A healthy environment also depends on sound ecological networks. By restoring these networks a coherent ecosystem will be established that is worth preserving.

Each project making use of Sicirec's investment and subsidy-scheme for planting trees, is obliged to have a minimum of 20% of the area in question contributing to an ecological network. The areas are selected in such a way that they as much as possible connect the project area with surrounding nature reserves.

In case it is not possible to establish connections with surrounding nature reserves, establishing stepping stones of natural pockets is a proper intermediary goal and in such cases the ecological stepping stone effects should be optimized.

In all Sicirec's projects the ecological areas created will be given a permanent status by means of ecological leans (*servidumbres ecológicas*) or by means of any other comparable structure.

### 2.2 How?

Combining ecology and profitability is realised by proper land-use planning and long term safeguarding of sound ecological networks and corridors. Within the production areas the goal is maximization of profits, whereas in the natural core

areas and in the corridors the goal is for one hundred percent the preservation of nature and the maximization of ecological values.

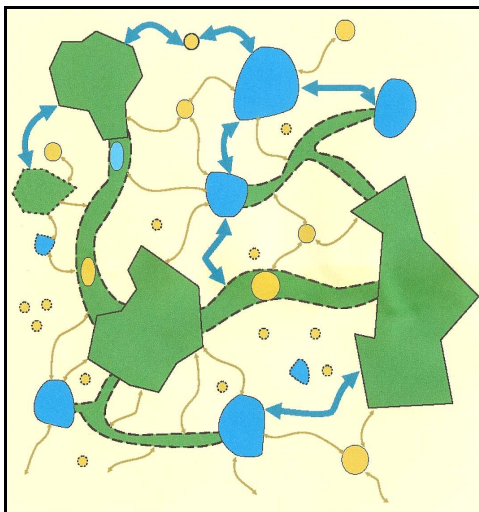
### 2.3 Importance of ecological corridors

Ecological corridors, as crucial elements of ecological networks, have the vital role of facilitating the movement and migration of animal and plant species between core and adjacent areas. As such, ecological corridors are essential for the long term survival of biological diversity.

The fragmentation of nature, or what is left of it, is in fact one of the major causes of species going extinct. If unable to migrate, due to natural fluctuations in numbers, animals and plants sooner or later go extinct locally with no option to repopulate the area again in a later stage. This tendency can effectively be prevented by preserving and repairing ecological corridors between the remnants of nature that are still ours.

Since an ecological network provides a home to many different animal and plant species it helps to diminish the probability of plagues en pests in the adjacent production areas. As a result, less effort needs to be put in combatting plagues and pests, thus saving time and money.

### 2.4 Main elements of an ecological network



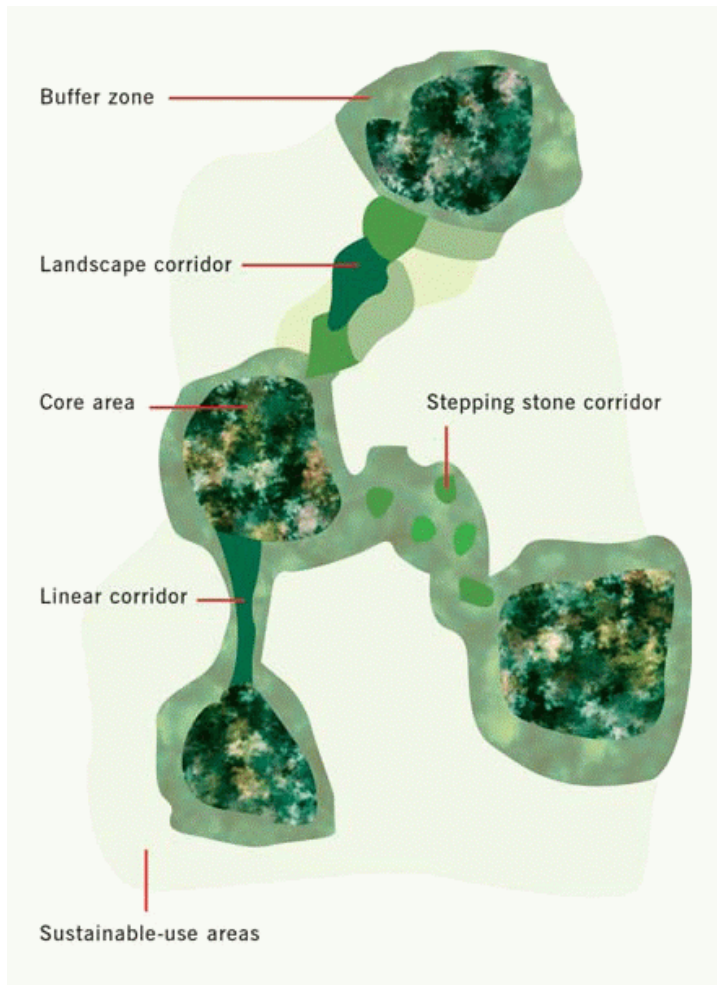
function	core areas	corridors	stepping stones
national			
regional			
local			

Ecological network

(source: www.bfn.de; presentation of dr. Karin Ullrich)

#### 2.4.1 Core areas:

These are areas where the primary function is biodiversity conservation. They should be legally protected under national or regional legislation. These areas preferably should provide a substantial representation of key natural or semi-natural ecosystems and contain viable populations of important or threatened species.



Source: countdown2010.net

### 2.4.2 Corridors:

These are areas of suitable habitat and limited width that provide functional linkages between core areas. For example, they may stimulate or allow species migration between areas. Corridors can be continuous strips of land or 'stepping stones' that are patches of suitable habitat.

### 2.4.3 Stepping stones:

These are patches of natural areas that are interlinked due to the fact that the distance between them is limited and small enough for animal and plant species to be able to migrate from one to another, thus facilitating the possibility to move between different core areas.

### 2.4.4 Buffer zones:

Protected areas should not be considered as islands that are safe from negative external effects. Buffer zones allow a smoother transition between core areas and surrounding land use. The size and utilisation of buffer zones depends heavily on the particular needs of the specific ecosystem and its local population.

#### 2.4.5 Sustainable use areas:

These are remaining areas that can be subject to more intensive land-use. But they should still contribute to the successful provision of ecosystem goods and services.

### 3. The Bolivian context

The Republic of Bolivia is a landlocked country in central South America. It is bordered by Brazil in the north and east, Paraguay and Argentina in the south, and Chile and Peru in the west. The west of Bolivia is situated in the Andes mountain range, with the highest peak, Nevado del Sajama at 6,542 m. The center of the country is formed by a highland plateau, the Altiplano, where most Bolivians live. The east of the country is lowland, and covered by the Amazonian rainforests.

Bolivia is classified currently among the eight countries with the greatest biodiversity, in view of the wide variety of ecological regions and layers, which contain an outstanding diversity of plants and animals; yet, it is the poorest country in South America where both poverty and development lead to biodiversity degradation and loss.

Conservation efforts have evolved rapidly from the first species-protection-laws in the nineteenth century, to the creation of the first national park in the mid-twentieth century, to the implementation of the U.N. Convention on Biological Diversity, the formulation of a national biodiversity strategy, and a current national protected-area-coverage of 16%. However, there are severe conflicts with accelerating economic growth and development. Threats in the most sensitive ecoregions (e.g. population shifts from the Andes to the forest lowlands, increasing agricultural activities, growing activities of the oil and gas sector, deforestation, climate change) represent important conservation problems.

#### 3.1 National objectives

Bolivia wants to establish an image or “country branding” that shows an ecological, organic production with high ability, innovation and skills.

Bolivia directs its productive development toward areas where value can be added to natural resources, through participation of indigenous populations, communities, associations, and groups of small producers. This also includes companies using a higher level of technology.



## 4. The CETEFOR-SICIREC CDM-AR project "Cochabamba Tropics"

In the course of 2007 CETEFOR and SICIREC agreed to initiate a series of small scale reforestation project in Bolivia. Together with some 1,500 small holders a project will be realised that covers a total of 7,200 hectares. Of these 6,000 hectares will be reforested with a selection of mostly native tree species; 1,200 hectares will be destined as lasting ecological corridors and protected nature reserves. As from August 2007, the project will be realised in the Cochabamba Tropics, Northern La Paz, South-West Beni and the province of Ichilo in the department of Santa Cruz. In the figure below the project areas are outlined in red.



Project locations CDM-AR project Cochabamba Tropics

The main goal of the project is to create a sustainable way of land-use in which commercial land-use is combined with nature conservation. The goals of the project are to help the local small holders to develop a way of sustainable land-use that combines commercial forestry with improved agricultural techniques that are adapted to the region and restoring or maintaining local biodiversity by restoring and permanently protecting ecological networks and ecological corridors.

### 4.1 Project area characteristics

The project areas comprise national parks, indigenous territories and areas colonised by settlers. The latter however, are not limited to the areas originally allotted for this purpose. Small farmer families have also invaded and still are invading the national parks and indigenous territories.

The settler areas have been a destination for migrants coming from High Valley and Altiplano regions of Bolivia since the 1930s. This migration has intensified during the last three decades due to increased poverty and deterioration of the mining and agricultural economic base that has traditionally supported the people of the Bolivian highlands.

Small holders own some 95% of the land in the project regions. The size of their properties varies slightly, but is on average 20 hectares per family in the Cochabamba Tropics and 25 and 50 hectares in the other regions. The recent settlers have tried to apply traditional land-use practices as they know them from their native regions. These practices however, are not adapted to the tropical setting where soils, climate and pests are completely different.

As such, these unsustainable land-use practices and associated over-harvesting of native forests have led to widespread deforestation, causing, among others, substantial emission of greenhouse gases. Nevertheless, there are still pockets of primary forest left in the settlement areas. Based on studies on current and future deforestation rates, it is expected that in the next two decades most of these forest remnants will be converted into low productive agricultural land.

#### 4.2 Local need for conservation and ecological corridors

The conversion of forest land into agricultural land has led to a growing shortage of timber from commercial native species, ecological damage, erosion and increasing damage by floods and droughts. Since rivers have higher peak discharge levels due to lower water storing capacity of the clear cut areas, floods and periods of drought are both more common nowadays.

This has spurred interest by small farmers in the conservation and sustainable management of the primary and secondary forests and tree planting on their farmland, not only for commercial purposes, but also as a means of protection against calamities.

Since 2003 CETEFOR, together with local farmers, has been working on the implementation of forest plantations, protection measures, and the establishment of ecological corridors on a pilot scale. From this pilot the farmers learned:

- that improper agricultural practices and over-exploitation of the native forests resulted in severe ecological problems
- that they need guidance on how to manage their land in a sustainable way, and that basically there is a need for proper land-use planning
- that outside technical and financial support is required for the implementation of conservation and protection measures
- that some clear cut areas should be reforested to prevent further damage
- that certain pieces of primary and secondary forest, that are in danger of being clearcut, should be protected for reasons of soil and river protection, watershed management and preservation of biodiversity.

Complementary to the realisation of commercial forest plantations, the project should play an active role in:



- land-use planning
- capacity building
- forest conservation
- river-bank protection
- erosion control
- preservation and restoration of biodiversity by laying-out a sound and lasting network of ecological corridors.

### 4.3 Conservation and ecological corridors in the project area

The activities of the Cochabamba Tropics project will not only be focused on commercial forest plantations, but also on the preservation and restoration of ecological networks. For every 5 hectares of commercial forest plantations planted, a minimum of one hectare is destined for nature preservation or ecological repair. Putting aside 20% or more of the project area for preservation or for ecological repair, stems from the business philosophy of Sicirec.

The preservation and restoration activities within the project area are aiming at:

- Conservation of remaining patches of primary forest
- Conservation and rehabilitation of secondary vegetation
- Establishment of new ecological corridors

The conservation areas and ecological corridors are given a permanent protection status. In these hectares the long term goal is a succession sequence towards a so called "climax vegetation".

The project intends to establish a total of 6,000 hectares of commercial forest plantations. Therefore the area that will be dedicated to preservation and restoration activities will cover an area of 1,200 hectares. These activities will be distributed as shown in table 1.

	Type of activity	Surface (Ha)
1	Conservation of remaining patches of primary forest	400
2	Conservation and rehabilitation of secondary vegetation	600
3	Establishment of new ecological corridors	200
	<b>Total</b>	<b>1,200</b>

**Table 1: conservation and restoration activities**

Apart from the ecological gains, ecological corridors contribute to the protection of slopes and river banks from erosion and also serve as windbreaks. Also, ecological corridors stop a further loss of minerals.

The commercial forest plantations will be designed according to a system of species (natives) and site matching that results in a relatively high ecological value as well.

The project aims at establishing permanent ecological reserves, stepping stones and corridors, also at the relative small scale of local farmers and coöperations of farmers. As soon as this principle is more widely adopted, an ecological network will gradually develop which will be increasingly better interconnected.

Our project locations are all close to vast national nature reserves. Therefore the newly formed ecological corridors quickly help to enlarge, protect and buffer the already existing larger ecosystems. The local sites for ecological protection and restoration are selected in such a way as to optimize these effects on the total ecosystem.

#### 4.4 Costs and Financing

Preservation of primary and secondary forest remnants and the establishment of ecological corridors and thus a sound ecological network, can in principle be realised at very low costs.

The total estimated implementation costs for 1,200 hectares of nature conservation and establishment of ecological corridors in the project area amount to € 225,000. Appendix I gives a breakdown of the different implementation activities and the costs thereof. In order to be able to finance these activities the project is looking for a nature conservation partner.



Multi-functional river bed vegetation; a perfect corridor

#### 4.5 Local livelihood scenario

Studies done by CETEFOR show that it is very likely that the agricultural frontier will continue to advance. Farmers tend towards the advance of the agricultural frontier and not towards reforestation, although they recognize the environmental problems caused by deforestation and the benefits that could be obtained from forestry.

Other land-use types, however, respond better to the direct socio-economic needs of the farmers families than tree planting. A livelihood analysis resulted in a list of important requirements that should at least partly be met when

considering alternative types of land-use. For farmers families the following characteristics and requirements for land-use are considered important:

1. Income within a relatively short period
2. Possibility to have direct access to capital in case of emergencies
3. Investments should generate an increased value of land
4. Markets for products should be visible; farmers are more willing to invest if clear markets exist for their products
5. Access to markets should be relatively easy, preferably access should be possible on an individual basis, without intervention of many intermediary stakeholders (middleman, community or producers organizations, etc.)
6. Handling of products should be relatively easy
7. Constant and secure markets are preferred above insecure in markets
8. Labour demand, and peaks in labour demand should be well related to labour supply
9. Relatively simple land-use methods are preferred above more complex land-use methods
10. Level of investment
11. Cost-benefit ratio

Without project intervention, using specific strategies to solve the social and economic needs mentioned above, it is not very likely that land holders will implement forest plantations by themselves and will carry through the continued management over the years, because:

- Agroforestry activities can not compete in terms of points 5, 6, 7, 8, 9, 10, as compared with traditional land-use systems
- Silvipastoral systems can not compete in terms of points 8, 9, 10, as compared with traditional land-use systems
- Commercial forestry plantations cannot compete in terms of points 1, 2, 5, 8, 9, 10, as compared with traditional land-use systems
- Nature conservation cannot compete with any of these points

#### 4.6 Activities to be developed to obtain lasting ecological gains

To achieve the ecological goals of the project as mentioned earlier, the ongoing advance of the agricultural frontier will have to be slowed down. This is done by:

- Proper Land-Use Planning
- Improved methods and intensification of agricultural production
- Agroforestry and Silvipastoral activities
- As part of the land-use planning, conservation areas are defined within the farm, with the objective to:
  - Protect and restore biodiversity within the farm
  - Protect land against erosion, flooding or loss due to floods

Land-use Planning will be defined in a 'Plan de Ordenamiento Predial' (POP), which will be submitted for approval by the Superintendencia Agraria. This will give a legal and permanent status to the proposed type of land-use, a legal

status for areas defined as conservation areas inclusive. This supervision and control by the Superintendencia Agraria guarantees a governmental level of involvement.

For the protected areas the following management activities will be carried out to realize a high ecological gain:

1. Conservation of remaining patches of primary forest
  - a. With GPS the areas are demarked
  - b. Areas are marked with painted poles
2. Conservation and rehabilitation of secondary vegetation
  - a. With GPS the areas are demarked
  - b. Areas are marked with painted poles
  - c. Three options:
    - i. No intervention will take place and vegetation will develop to a climax situation in the long run
    - ii. To define species diversity, an inventory of tree species is carried out. If only pioneer species are present, enrichment planting is carried out to enhance succession to a climax vegetation.
    - iii. Fast growing tree species are planted, which might be commercial species. Provided that the objective of conservation will not be jeopardized, these species may be harvested. The pioneer species serve as a cover for a second generation of trees in the chain of succession. Besides, understory growth should be allowed to develop fully.
3. Establishment of new ecological corridors
  - a. With GPS the areas are demarked
  - b. Areas are marked with painted poles
  - c. Three options:
    - i. The area will not be intervened anymore which will lead to a pioneer forest vegetation, that slowly but surely will develop to a climax vegetation.
    - ii. Trees will be planted that will be managed towards a diverse ecological forest. Besides the advantage of enhancing succession, within the first period carbon stocks will be higher too.
    - iii. Fast growing tree species are planted, which might be commercial species. Provided that the objective of conservation will not be jeopardized, these species may be harvested. The pioneer species serve as a cover for a second generation of trees in the chain of succession. Besides, understory growth should be allowed to develop fully.

#### 4.7 Enhancing the success of the conservation objectives of the project

In view of traditions, raising the farmers interest to permanently preserve the ecological network areas will be difficult, but not impossible. The project is designed in such a way that its mix of activities can compete with the considerations of farmers as mentioned in the local livelihood scenario. Only if the project can meet the requirements that are important to the farmers families,

it will be successful. Therefore, to motivate farmers to change their present land-use practices and to maintain a 100% protection status on a portion of their land, a mix of the following approaches will be applied:

1. Participative approach

- Farmers and their organisations have participated in the design of the project; they will participate in the implementation of the project as well.
- During the implementation and consolidation phase of the project, farmers and their organisations will play an active role in setting the policies and strategies of the project.
- The project will have a high presence in the area, and work in very close relation with the farmers.

2. Promotion and education

- Implementation of an extension program to create awareness of the advantages of the proposed land-use practices among farmers.
- Training of farmers to transpose the necessary knowledge and skills concerning the new land-use practices.

3. Economic incentives

- Opportunity costs of alternative land-use will be analyzed, if necessary based on this analysis, farmers will be compensated.
- Establishment of commercial forest plantations is integrated with conservation measures. An economic incentive system is part of the program.

4. Legal arrangement

- Contracts will be signed with each land owner underlining commitments to project activities to be implemented on his land, including a protected area, equivalent to at least 20% of the commercial plantation.
- The areas defined as protected areas (servidumbres ecologicos) are defined in the POP. Through approval by the Superintendencia Agraria these areas will be protected by law.

5. Farm visits (internal monitoring system)

- Compliance to the contract during the various stages of project implementation will be monitored by CETEFOR through site visits.
- Established and managed areas will be measured with GPS.

## 5. Carbon gains from conservation and corridor areas

Apart from the positive effects on biodiversity, the conservation activities and establishment of ecological corridors result in the permanent fixation of large quantities of carbon dioxide (CO<sub>2</sub>). These can be sold on the international market as Verified Emission Rights (VERs).