

Chapter 25

Sustainable and Non-Sustainable Use of Natural Resources by Indigenous and Local Communities

P. Pohle(✉) and A. Gerique

25.1 Introduction

By now it is sufficiently well understood that any attempt to preserve primary forest in the tropics is destined to fail if the interests and use claims of the local population are not at the same time, and in the long term, taken into account. Therefore, in addition to strict protection of the forests, an integrated concept of nature conservation and sustainable land use development needs to be sought (e.g. Ellenberg 1993). The DFG research project presented here will figure out the extent to which traditional ecological knowledge and indigenous biodiversity management strategies can be made available for a long-term land use development. The project chose to use a specialized approach, namely the investigation of indigenous/local knowledge systems as part of the ethnoecological methodology (e.g. Münzel 1987; Posey and Balée 1989; Warren et al. 1995; Müller-Böker 1999; Nazarea 1999). In biodiversity-rich places local people usually have a detailed ecological knowledge e.g. of species, ecosystems, ecological relationships and historical or recent changes of them. Numerous case studies have shown how traditional ecological knowledge and traditional practices serve to effectively manage and conserve natural and man-made ecosystems and the biodiversity contained within (e.g. Posey 1985; Toledo et al. 1994; Berkes 1999; Fujisaka et al. 2000; Pohle 2004). In ongoing interdisciplinary and integrative research projects like BIOTA AFRICA (Biodiversity Monitoring Transect Analysis in Africa, German Federal Ministry of Education and Research), STORMA INDONESIA (Stability of Rainforest Margins in Indonesia, German Research Foundation, Collaborative Research Centre 552) or within the interdisciplinary programme of the National Centre of Competence in Research North–South implemented by the Swiss National Science Foundation (SNSF), investigations on traditional ecological knowledge and biodiversity management are an integral part.

25.2 The Tropical Mountain Rainforests of Southern Ecuador – a “Hot Spot” of Biodiversity

The area under study, the Podocarpus National Park and its surroundings, is especially noteworthy for its species diversity and belongs to one of the so-called “hot spots” of biodiversity worldwide (Barthlott et al. 1996; Myers et al. 2000; cf. Chapter 1 in this volume). The tropical mountain rainforests of southern Ecuador are of crucial importance for the preservation of genetic resources and play an important role as an ecosystem and habitat for flora and fauna. At the same time humans have lived here and sustain themselves since centuries. However, in more recent times (the past four or five decades), these mountain forest ecosystems, which have been described as particularly sensitive (Die Erde 2001), have come under enormous pressure from the expansion of agricultural land (especially pastures), the extraction of timber, the mining of minerals, the tapping of water resources and other forms of human intervention. According to Hamilton et al. (1995), 90% of the original forest cover in the Andes can be regarded as either destroyed or altered.

25.3 Indigenous and Local Ethnic Communities

The surroundings of the Podocarpus National Park are settled by indigenous Shuar and Saraguro communities as well as Mestizo-Colonos (cf. Chapter 3 in this volume).

The Shuar area of settlement extends from the lower levels of the tropical mountain rainforest (approx. 1400 m a.s.l.) down to the Amazonian lowland (*Oriente*) in the region bordering Peru. The Shuar, who belong to the Jívaro linguistic group (Amazonian Indians), are typical forest dwellers who practice shifting cultivation, mainly in a subsistence economy. Their staple crop is manioc which they plant together with taro and plantains on small rotating plots in forest gardens. They also fish, hunt and gather forest products. During the past decades some Shuar have also begun to raise cattle and some are engaged in timber extraction as well.

The Saraguros, highland Indians who speak Quichua, live as agro-pastoralists for the most part in the temperate mid-altitudes (1800–2800 m a.s.l.) of the Andes (*Sierra*) in southern Ecuador. As early as the nineteenth century the Saraguros kept cattle to supplement their traditional “system of mixed cultivation”, featuring maize, beans, potatoes and other tubers (Gräf 1990). Now, cattle ranching has developed into the main branch of their economy.

In the North and East of Podocarpus National Park Mestizo-Colonos are the most dominant ethnic group in numbers. They are colonists of mestizo ethnicity, who came into the area during the past four or five decades to log timber and to practice cattle farming and agriculture. In Latin America the term mestizo is generally used to indicate people of mixed Spanish and indigenous descent. In South Ecuador, however, the Mestizo-Colonos have little tendency to identify themselves as a distinct ethnic group, instead they refer to themselves as Ecuadorian but not as mestizos.

25.4 Aims and Methods of the Ethnoecological Research Project

During 2004, 2005 and 2006 ethnoecological, especially ethnobotanical, and agro-geographical research was undertaken in sample communities of the Shuar (Shaime, Napints, Chumbias), the Saraguros (El Tibio) and the Mestizo-Colonos (Sabanilla). The goals were:

- To document the indigenous and local knowledge of traditionally utilized wild and cultivated plants (the ethnobotanical inventory was undertaken following the “Code of Ethics”);
- To analyze current forms of land use including the cultivation of forest and home gardens;
- To evaluate ethno-specific life-support strategies as well as strategies for natural resource management.

The ethnospecific plant knowledge was documented using various ethnobotanical techniques of unstructured and semi-structured inquiry, like participant observation techniques, artefact interviews, plant interviews, checklist interviews and group interviews (cf. Alexiades 1996). The “ethnobotanical inventory technique” was the main procedure to collect ethnobotanical information. An inventory of wild and cultivated plants was compiled, including botanical names as well as indigenous Shuar, Saraguro and Spanish names. The use of forest products such as food, medicine, fodder, construction material etc. was documented. Empirical fieldwork also encompassed the agro-geographical analysis and cartography of land use with special consideration of traditional forest gardening. Information was gathered by semi-structured and thematically focused interviews with residents and local experts. In addition, a multi-temporal analysis of aerial photographs was undertaken to identify and quantify the change in forest cover and land use.

25.5 The Significance of Plant Use for the Shuar, Saraguros and Mestizo-Colonos

The Shuar of the Nangaritza valley have a comprehensive knowledge of plants and their utilization. All households make extensive use of forest products. According to the ethnobotanical survey¹, the actual inventory of traditionally used wild plants of the Shuar includes 211 species (Fig. 25.1). Most of the wild plants are used to supplement the diet (74). Given the lack of state health care, medicinal plants also assume great significance (63). Many plants, too, are used as construction

¹ The ethnobotanical survey in sample communities of the Shuar, Saraguros and Mestizo-Colonos was conducted by Andrés Gerique.

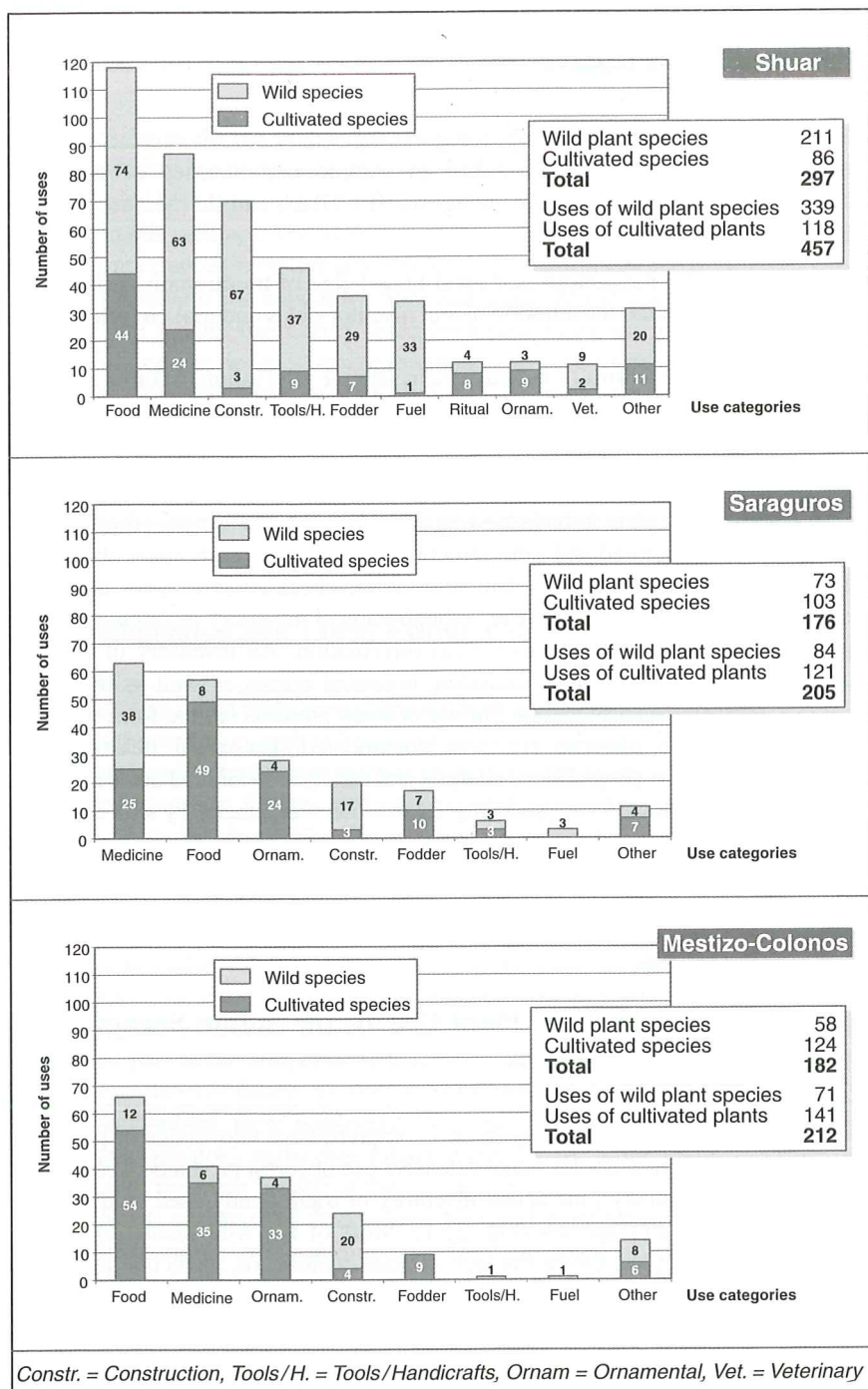


Fig. 25.1 Wild and cultivated plant species used by the Shuar (Chumbias, Napints, Shaime), the Saraguros (El Tibio) and the Mestizo-Colonos (Sabanilla) according to use categories. Note: one species can be found in more than one use category

material (67), as tools and for handicrafts (37), as fuel, fodder or as ritual plants. The Shuar use forest products exclusively for their own needs, there is virtually no commercialization.

The Saraguros from El Tibio have a far less comprehensive knowledge on wild plant species and their utilization. The actual ethnobotanical inventory includes only 73 wild plant species (Fig. 25.1). Most of them are ruderal plants used as medicine (38) or plants used for their wood (17). As agro-pastoralists they have converted most of the primary forest into pastures, home gardens and fields, leaving forest remains only along mountain ridges or in river ravines. Their actual plant knowledge reflects this traditional way of life. They have a comprehensive knowledge of cultivated plants (103) mainly pasture and crop plant species – even more than the Shuar (86) – but they are less familiar with forest plant species. The latter knowledge is mainly reduced to woody varieties which they extract and sell before clearing the forest.

The Mestizo-Colonos of the surrounding areas of Sabanilla base their economy on cattle ranching. They have converted large areas of forests into pastures. As settlers from the western and most arid area of Loja Province they seem not to be familiarized with the local flora and hence make only little use of it. The actual ethnobotanical inventory – although not completed yet – includes a total of only 58 wild plant species (Fig. 25.1). Timber is the main forest product (20), while some ruderal plants and the fruit of a few tolerated tree species are used as food (12) or as medicine (6). However, the Mestizo-Colonos cultivate 54 different species for food and 35 species for medicinal purposes and have a comprehensive knowledge of pasture species.

25.6 Agrobiodiversity in Shuar and Saraguro Tropical Home Gardens

The tropical home gardens of indigenous and local communities are generally regarded as places of great agrobiodiversity and refuges of genetic resources (Watson and Eyzaguirre 2002). Furthermore, they contribute significantly to securing and diversifying food supplies. This applies wholly to Shuar and Saraguro gardens, which feature a large number of both wild and cultivated species and which play their part in providing subsistence needs. Staple crops, such as maize, tubers and beans, may be cultivated primarily in *chacras* (fields), but home gardens (*huertas*) have an essential role to play in supplementing the diet with fruits and vegetables, furnishing households with medicinal plants and spices, and fodder and timber.

The forest gardens of the Shuar (Fig. 25.2) are characterized by an especially great diversity of species and breeds. In five *huertas* studied (size: approx. 600–1000 m²), a total of 185 wild and cultivated plant species and breeds were registered. For the most part they serve as nutritional items (58%) or medicines (22%). The main products cultivated are starchy tubers like manioc (*Manihot esculenta*) and taro (*Colocasia esculenta*), along with various breeds of plantains (*Musa* sp.).

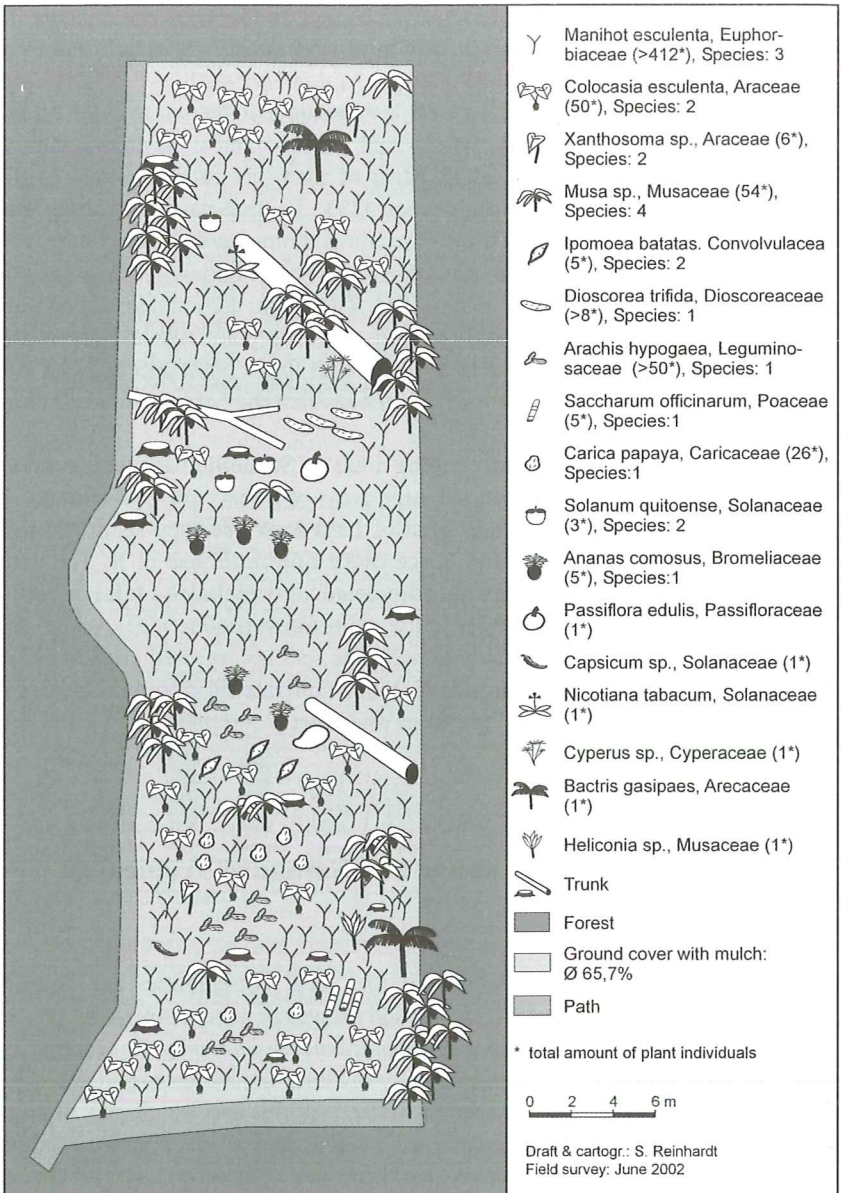
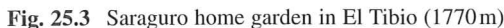


Fig. 25.2 Shuar forest garden (*huerta*) in the Nangaritza valley

Moreover, the planting of a large number of traditional local breeds was documented: e.g. 29 breeds of manioc and 21 breeds of *Musa* sp. – a further indication of the crucial significance that home gardens have for the in situ conservation of botanical genetic resources (Münzel 1989, p. 434).



The *huertas* of the Saraguros likewise display a great diversity of useful plants. In one sample home garden studied in El Tibio (Fig. 25.3), 51 species of cultivated plants were identified. In total 95 cultivated plants were registered among the Saraguros of El Tibio. Again, the majority are plants that supply nutritional value (41%), followed by medicinal and ornamental plants (each 20%). The most important cultivated products are plantains, tubers and various types of fruit. Given their relatively dense and tall stands of trees, the multi-tiered arrangement of plants and the great diversity of species, the gardens of the Saraguros can be seen as an optimal form of exploitation in the region of tropical mountain rainforests.

25.7 Indigenous Concepts of Biodiversity Management

– Their Contribution to a Sustainable Land Use Development

If the hypothesis is accepted that a multi-faceted economic and cultural interest in the forest on the part of indigenous and local communities offers effective protection against destruction, then a key role must be assigned to the analysis and evaluation of the ethno-specific knowledge about tropical mountain rainforests and their potential uses. Both indigenous groups have developed natural resource management strategies that could be used and expanded, in line with the concept “preservation through use”, for future biodiversity management, but this should be done only in an ethno-specific way.

The Shuar traditional way of managing biodiversity is based on a sense of being closely bound culturally, spiritually and economically to the forest. The sustainability of their form of land use has long since been put to the test (Münzel 1977, 1987). As traditional forest-dwellers, sustainable elements of biodiversity management can be found in (Fig. 25.4):

- Their regulated practice of shifting cultivation, which – given the correspondingly long time for regeneration – is thought to conserve the soil and the vegetation. The system of cultivation and fallow on small rotating plots as shown in the sketch map (Fig. 25.5) has much in common with ecological succession in that it uses the successional process to restore the soil and the vegetation after use for farming (Kricher 1997, p. 179). In the Shuar forest gardens the fallow periods last for about 24–30 years while the cultivation periods covers four years.



Fig. 25.4 Napints (1000m): scattered settlement of the Shuar in the tropical rainforest at the eastern periphery of the Podocarpus National Park. Photo by A. Gerique

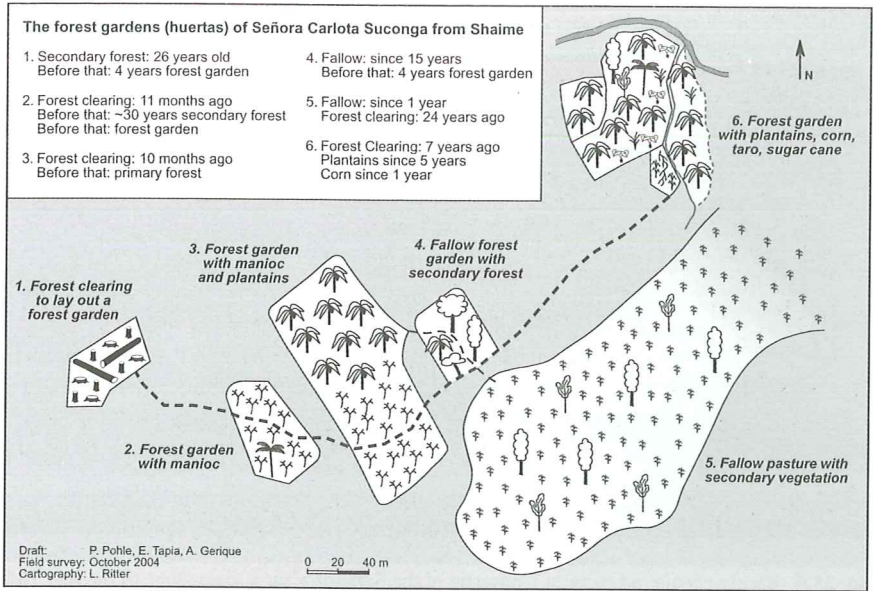


Fig. 25.5 The forest gardens (*huertas*) of Señora Carlota Suconga from Shaime (920 m)

- Their tending of forest gardens according to principles of agroforestry and mixed cropping with a high agrobiodiversity and a particular high breed variety of cultivated plants. As is commonly known, polycultures are more resistant to insect attacks and plant diseases;
- The natural fertilization of soils by mulching and the use of digging sticks and dibbles as a suitable form of cultivating the soil;
- Their sustainable use of a broad spectrum of wild plants in small quantities, satisfying only subsistence needs and avoiding over-harvesting.

If the Shuar's traditionally practiced and clearly sustainable plant biodiversity management is to be preserved, then this is possible only by the following preconditions: the legalization of their territorial claims and, along with that, a comprehensive protection of their territories by demarcating reservations for example. The establishment of a so-called *Reserva Shuar* is indeed currently being planned (Neill 2005). Additionally it is necessary to respect and support the Shuar's cultural identity, not only to avoid the loss of traditional environmental knowledge especially traditional plant lore. To improve livelihood in an economic sense, additional sources of financial income are essential. In this line the promotion of ecotourism, support of traditional handicrafts and the cultivation of useful plants for a regional market could be discussed.

While the Shuar's forest management can be evaluated as preserving plant biodiversity, the sustainability of the Saraguros' use of the environment has yet to be rated. Market-oriented stockbreeding has particularly led in recent decades to the rapid increase of pastures at the expense of forest. In spite of ecological conditions



Fig. 25.6 Richly chequered cultural landscape of the Saraguros on a steep slope of the Río Tibio valley with the scattered settlement of El Tibio (1770 m). Photo by P. Pohle

unfavorable to agricultural pursuits (steep V-shaped valleys, acidic soils, extremely high precipitation) these Andean mountain farmers have at least, by means of their intensive form of pasture management, succeeded in generating a sufficiently stable agrarian and cultural landscape (Fig. 25.6). In contrast to many completely deforested and ecologically devastated areas settled by Mestizo-Colonos (Fig. 25.7), the richly chequered agrarian landscape of the Saraguros presents, not only aesthetically but also ecologically, a fundamentally more positive picture. The comparison of the land use mosaic of El Tibio in the aerial photograph taken in 1969 and the land use map of El Tibio mapped in 2003 shows that changes according to forest cover have taken place, particularly at the slope opposite to the village, whereas the slope of the village site itself shows no dramatic change (Fig. 25.8).

Among the Saraguros, initial attempts have also been elaborated to manage biodiversity in line with the concept “preservation through use”. The first thing to be mentioned in this context is the keeping of home gardens with a wide spectrum of wild and cultivated plants, particularly woody species. With regard to the diversity of species, the remnants of forest still largely preserved in ecologically unfavorable locations are significant (Fig. 25.8). In order to stem the further loss of biodiversity, however, it will be necessary to convince the Saraguros that in particular scrub- and wasteland (*matorral*) should be replanted with native tree species. The pressure on the tropical mountain rainforests caused by the pasturing economy will only be reduced, though, when the Saraguros can be shown a profitable alternative to it. As examples of promising endeavors in this context may be regarded:



Fig. 25.7 Deforested and overused agrarian landscape of the Mestizo-Colonos north of Loja.
Photo by P. Pohle

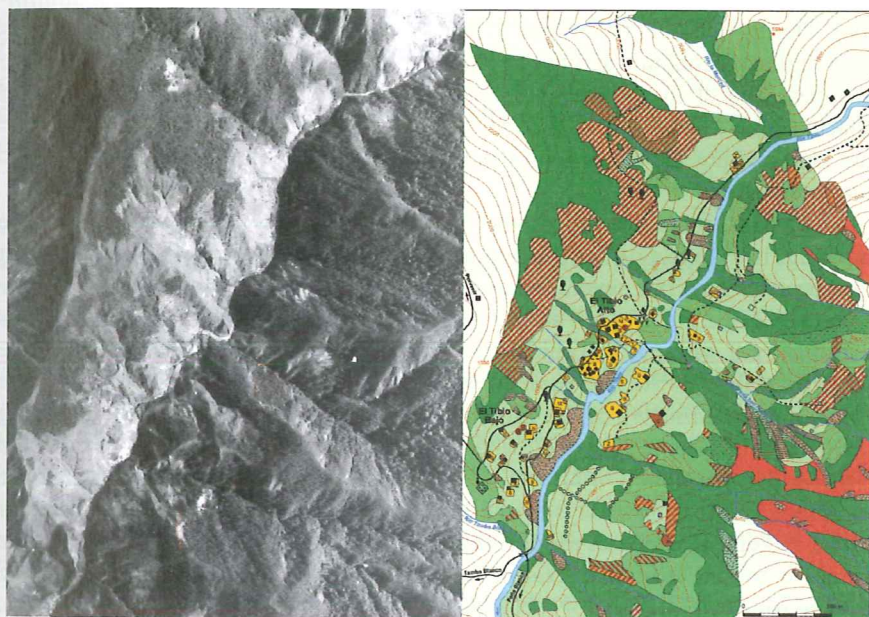


Fig. 25.8 Aerial photograph of El Tibio 1969 and land use map of El Tibio 2003 (Pohle and Tuttillo 2003)

- The selective timber production and replanting with native tree species as proposed by foresters (Günter et al. 2004);
- The introduction of silvipastoral or agroforestry systems;
- The market-oriented gardening;
- The cultivation and marketing of useful plants, e.g. medicinal herbs;
- The promotion of "off-farm" employment opportunities;
- The payment for environmental services to protect the watershed area of Loja.

25.8 The Overexploitation of Natural Resources by the Mestizo-Colonos

The Mestizo-Colonos living today in the northern buffer zone of the Podocarpus National Park arrived from the 1960s onwards, encouraged by the national land reform of 1964. Most of the Mestizo-Colonos settling along the road between Loja and Zamora arrived only during the past 25 years. As colonizers they converted large areas of tropical mountain rainforests into almost treeless pastures (Fig. 25.7). To sustain livelihood they were forced to use even very steep and marginal areas for cattle ranching. Fire was the most common (easy and fast) way of clearing the forests to gain pasture land and as a consequence, large areas of forest were burned up, often in an uncontrolled way. The abandoned and scorched areas were immediately taken by the *llashipa* or bracken fern (*Pteridium aquilinum*). During the late 1970s and in the 1980s cattle ranching was displaced as main regional economic activity by timber extraction. This provoked the selective disappearance of many tree species with economic value and the alteration of adjacent forest areas, but as Wunder (1996a) pointed out, the need for new pasture land and not the extraction of timber was the principal reason for deforestation in this area.

At present, the economy of the Mestizo-Colonos is again based on cattle ranching, but the use of fire to open new pastures has declined, even though not disappeared. This has several reasons: First, many areas belong to the *Bosque Protector Corazón de Oro* or are part of the buffer zone of the Podocarpus National Park where it is forbidden to clear large forest areas and peasants face penalties if they do so. The road allows an easy control by the police and by the officers of the Ministry of the Environment in this area. Second, the remaining forests are today under private ownership. Therefore, uncontrolled fire can be a problem for peasants if it affects the neighboring private properties. Since the remaining forest is nowadays further away from their housing and good quality timber is getting scarce in the forests, the Mestizo-Colonos are becoming more receptive to the idea of tolerating a variety of tree species in order to have shadow for cattle, timber for repairing fences, fuel, or material for construction. *Tabebuia chrysantha*, *Cedrela* spp, *Piptocoma discolor*, *Inga* spp and *Psidium guayava* are among the most common tolerated species. Thus, the new pastures

with tolerated tree species are easy to distinguish from older ones, which have almost no trees growing on them.

Among the Mestizo-Colonos, the low profitability of the extensive form of cattle ranching has led to a high in- and out-migration and a correspondingly high fluctuation in land-ownership and possession. To avoid poverty most of them have an alternative income, e.g. from a small shop near the road, or a second occupation as day labourers. As a consequence, in marginal areas the pasture management is obviously neglected, mainly because of the limited availability of labor. Compared with the indigenous ethnic groups, the Mestizo-Colonos are much more heterogeneous. Extreme overexploitation is especially typical for newcomers and colonizers of the first generation mainly living in scattered *fincas* along the road between Loja and Zamora. In contrast, colonizers of the second or third generation living in village communities like in the upper Río Zamora valley have developed a more adapted and sustainable form of land use, in many respects similar to that of the Saraguros.

To avoid a further loss of biodiversity and to reduce the pressure on the tropical mountain rainforests caused by cattle ranching, profitable alternatives have to be offered. Similar measures as those presented above for the Saraguros are necessary: e.g. timber production in the form of reforestation with native tree species, market-oriented gardening, cultivation of medicinal herbs, payment for environmental services. These measures should also take into account an improvement of the carrying capacity of existing pastures by introducing legumes (Leguminosae) and other fodder plants and improving the cattle breeds and the veterinary services. In any case, measures to stop the loss of biodiversity in the area should take into account the difficult economic situation of most Mestizo-Colonos households. The prohibition of using fire and the establishment of protected areas have surely reduced the deforestation rate, but such measures do not face the real causes of deforestation and have increased the animosity against conservation.

25.9 Protecting Biological Diversity – from National Park to Biosphere Reserve

The Podocarpus National Park, covering a total of 146 280ha, was established in 1982 as southern Ecuador's first conservation area, whose goal is to protect one of the country's last intact mountain rainforest ecosystems, one particularly rich in species and largely untouched by humans. The creation of a national park in the middle of a fairly densely populated mountain region necessarily gave rise to numerous conflicts of interest and use rights, e.g. agrarian colonization, illegal timber extraction, conflicts about landownership and possession, mining activities, tourism.

The experience in international nature conservation during the past decades has shown that resource management, if it is to be sustainable, must serve the goals of both nature conservation and the use claims of the local population. The strategy is one of "protection by use" instead of "protection from use", a concept that has

emerged throughout the tropics under the philosophy "use it or lose it" (Janzen 1992, 1994). In the following, strategies are presented that show a way how people can benefit from the national park without degrading the area ecologically: the implementation of extractive reserves, the promotion of ecotourism and as the most promising approach the establishment of a Biosphere Reserve.

Given the high biodiversity of tropical rainforests and the fact that indigenous people in general have a comprehensive knowledge of forest plants and their utilization, it seems possible according to Kricher (1997, p. 357) to view the rainforest as a renewable, sustainable resource from which various useful products can be extracted on a continuous basis. In view of the high number of plant species that are currently collected by extractivists in the surroundings of the Podocarpus National Park (e.g. the Shuar) the preservation of large areas of rainforest would make economic sense as well as serve the interests of conservation and preservation of biodiversity. Thus, the establishment of an extractive reserve could be suggested as an alternative to deforestation.

In line with the concept "protection by use" ecotourism can be structured such that it is compatible with conservation interests and serves the local economy as well. This is also the experience around Podocarpus National Park. The attraction of the park is clearly the tropical rainforest with its specific wildlife, particularly tropical birds, fewer visitors have botanical or eco-geographical interests. However, compared with other national parks in South America (e.g. the Manu National Park of Peru), southern Ecuador and the Podocarpus National Park are not a major tourist destination.

The most promising approach, in which conservational protection and sustainable development are the guiding principles, is the integrated concept of conservation and development exemplified by UNESCO's Biosphere Reserve (UNESCO 1984). The idea behind it is to mark out representative sections of the landscape composed of, on the one hand, natural ecosystems (core area) and, on the other, areas that bear the impress of human activity (buffer zone, development zone; Erdmann 1996). In Ecuador, three biosphere reserves have already been drawn up (Ministerio del Ambiente 2003). The establishment of such a reserve would also be desirable for southern Ecuador, and this was recently submitted for approval. Alongside a strictly protected core area comprising Podocarpus National Park, it might encompass in a buffer zone cultural landscapes that have arisen historically (e.g. Vilcabamba) together with sanctuaries of indigenous communities (e.g. the proposed *Reserva Shuar*) and, in a development zone, areas of recent agrarian colonization.

Biosphere reserves are strongly rooted in cultural contexts and traditional ways of life, land-use practices and local knowledge and know-how. In the buffer and development zones of the Podocarpus National Park measures to be taken could rely on the rich ethno-specific traditions in forest- and land-use practices by indigenous and local communities. In a first step it would be desirable to develop with the participation of the local communities' environmental management plans. On the one hand they could support the ethno-specific cultural tradition and strengthen the social identity of local communities. On the other hand these plans should com-

prise regulations for hunting, fishing, timber and plant harvesting, for the exclusion of human-created fires but also for house and road construction. In southern Ecuador management plans are still in various phases of discussion and implementation. However, there is still a big gap between vision and reality. An intensive discussion was started about the participation of the population and local NGOs for assigning environmental competence to the regional–local administration. But, the realization of concepts like “cooperative management structure” could not consolidate and find political acknowledgement. According to Gallrapp (2005) it failed to create effective platforms for participation and negotiation, to build a common vision of the participating persons and to create a social awareness in order to implement new structures.

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