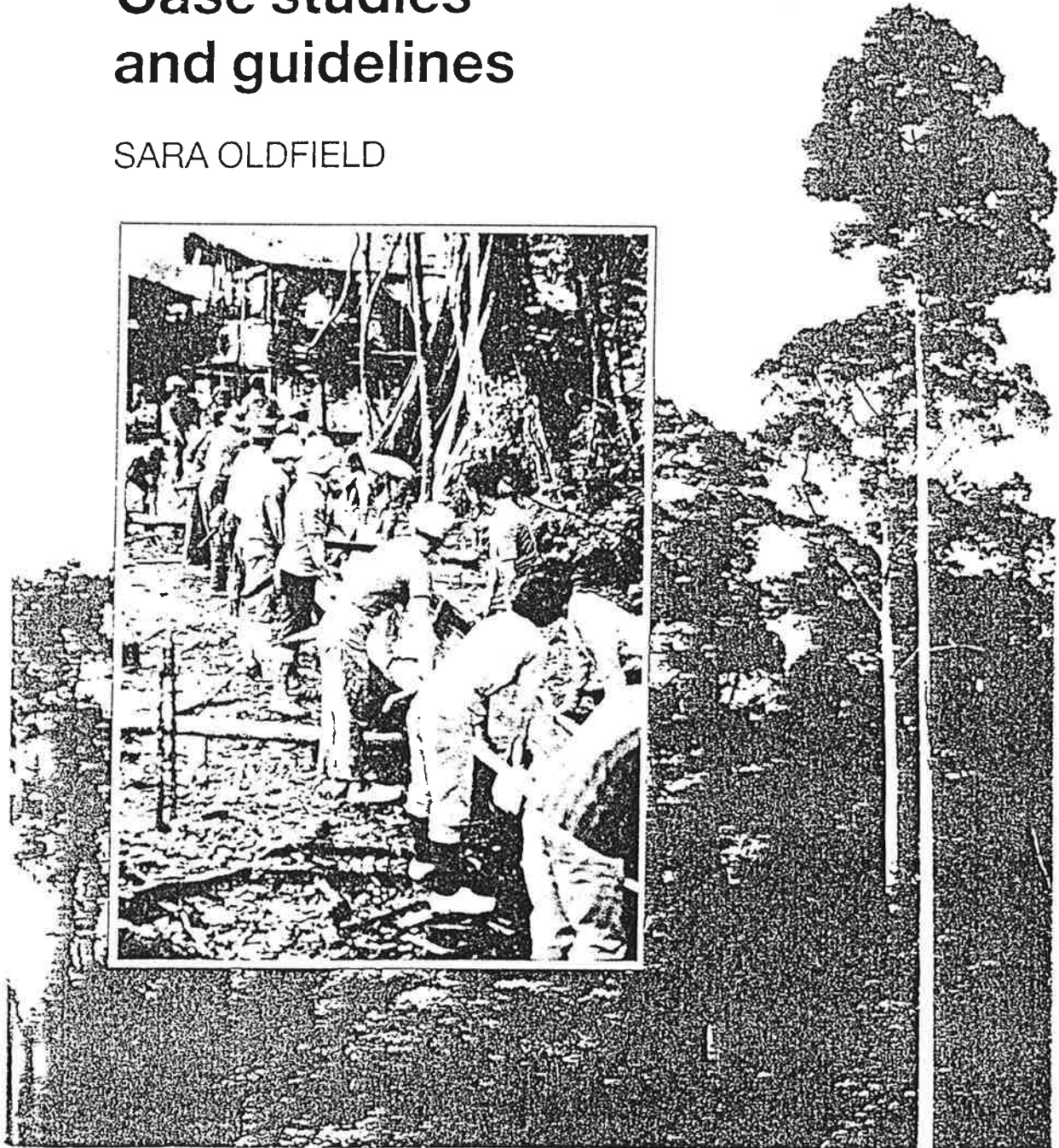


Buffer Zone Management in Tropical Moist Forests

Case studies and guidelines

SARA OLDFIELD



IUCN

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Founded in 1948, IUCN has more than 500 member governments and NGOs in over 100 countries. Its six Commissions consist of more than 3000 experts on threatened species, protected areas, ecology, environmental planning, environmental policy, law and administration, and environmental education.

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The IUCN Tropical Forest Programme coordinates and reinforces activities of the IUCN Secretariat and members which deal with tropical moist forests. The Programme focuses on the conservation of species and ecological processes, and on investigating and promoting means of sustainable use of forest resources. Data on species of plants and animals, and on tropical forest sites which are important for biological and ecosystem conservation, are held by the IUCN Conservation Monitoring Centre.

The Programme includes strategic and policy initiatives as well as on the ground projects tackling the problems of managing some of the World's most important tropical forests. The field projects put the philosophy of IUCN's World Conservation Strategy into action by reconciling the requirements of conservation with the needs of people living in forest areas. Special emphasis is given to the development of compatible uses of buffer zones around national parks and reserves.

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This series of publications from the Tropical Forest Programme enables IUCN to communicate policies and technical guidance to governments, major international institutions, development planners, and conservation professionals.

The Tropical Forest Programme receives generous financial support from the Government of Sweden. It is coordinated by Jeffrey Sayer at IUCN Headquarters in Gland, Switzerland. Mark Collins is responsible for tropical forest monitoring at the IUCN Conservation Monitoring Centre in Cambridge, UK.

The IUCN Tropical Forest Programme

BUFFER ZONE MANAGEMENT IN TROPICAL MOIST FORESTS

Case studies and guidelines

by

Sara Oldfield

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and Natural Resources**

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EXAMPLES

	Page
1. Rural development programme for Korup	10
2. Forest conservation activities supported by the World Bank in Madagascar	11
3. Indigenous people of Manu National Park, Peru	14
4. Management of tropical forest by Kuna Indians in Panama	15
5. Local opposition to the Loagan Bunut National Park, Sarawak	16
6. Parc National de Taï - human pressures from new settlers	17
7. Forest product utilisation in Sarawak	20
8. Important forest plant products harvested in Sinharaja Biosphere Reserve, Sri Lanka	21
9. Medicinal plants of Gunung Leuser National Park	22
10. Shifting agriculture and rain forest management in north-east India	27
11. Agroforestry and conservation at Bawang Ling, Hainan	28
12. Mango conservation in Kutai National Park	29
13. Tree crops in buffer zones in northern Sumatra	30
14. Impact of logging on forest adjacent to Rio Tefe Forest Reserve, Amazonas, Brazil	35
15. Logging and Wildlife in the Sungai Tekam Forestry Concession, Pahang, west Malaysia	36
16. Development of West African timber plantation species	37
17. Small-scale forestry plantations planned for buffer zone of Dumoga Bone National Park, Indonesia	38
18. Social forestry in the management of the Cyclops Mountains Nature Reserve, Irian Jaya, Indonesia	38
19. Forest management in buffer zones in Madagascar	40
20. <i>Cephalosphaeria</i> plantations in the Usumbaras, Tanzania	40
21. Research at Dumoga Bone National Park, Indonesia	43
22. Sinharaja Research Programme	44
23. Butterflies pay for research in Belize	44
24. Research and scientific tourist at La Selva Reserve, Costa Rica	45
25. Tourist trekking in Khao Yai National Park, Thailand	48
26. Tourism and education values of the Orang-utan Rehabilitation Centre at Gunung Leuser National Park, Sumatra	48

TABLE OF CONTENTS

	Page
Introduction	
Why buffer zones?	1
The IUCN guidelines	1
Legal considerations	1
	3
Management	8
Indigenous People	12
Alternative Forest Products	18
Tree Crops and Agroforestry	25
Forest Management	31
Research, Tourist, Education	41
References	49
Boxed features	
1. Benefits of Buffer Zones	5
2. Biosphere Reserves	6
3. Tropical Forest Land Use	9
4. Rattan Cultivation	24
5. Benefits of Agroforestry in Buffer Zones	27
6. Natural Forest Management Systems	33
7. The Effects of Logging on Wildlife	34
8. Tropenbos Programme	47

INTRODUCTION

Why Buffer Zones?

Buffer zones are "Areas peripheral to national parks or reserves which have restrictions placed on their use to give an added layer of protection to the nature reserve itself and to compensate villagers for the loss of access to strict reserve areas." (MacKinnon, 1981)

Tropical moist forests probably harbour over 50 per cent of the world's species of animals and plants, but they are being opened up by logging, and converted to agriculture so rapidly that there is widespread concern that the entire biome will be irredeemably damaged in the next few decades. The best way of ensuring the conservation of moist forest species and ecosystems is the establishment of protected areas. So far, however, the future of only about three per cent of tropical moist forests has been assured in this way. The Tropical Forestry Action Plan prepared by FAO, WRI, UNDP, and the World Bank, with collaboration from IUCN, calls for a much larger area to be given protected status.

Experience has shown, however, that legal protection is often not enough to guarantee the continuing integrity of conservation zones. Even patrolling by guards, demarcation of boundaries and provision of tourist facilities are insufficient, and in most cases even such minimal management is not present. Local people all too often see parks as government-imposed restrictions on their traditional rights; protection has no basis in their social systems. Agricultural encroachment, illegal hunting and gathering of forest products continue, the laws are broken, control breaks down and the park is gradually destroyed. Clearly, laws that have no popular support cannot, in the long term, be enforced. New systems and new ideas are needed to bridge the gap between the immediate needs of local people and the long-term objectives of protected area systems.

The message that protected areas should respond to the needs of local people emerged from the World National Parks Conference at Bali in 1982 and was reinforced by the MAB/Unesco Biosphere Reserves Action Plan adopted at Minsk, in the USSR, in 1984. In addition to these international initiatives, day-to-day realities have forced many park managers to consider the needs of local people, and most management plans now include "buffer zone" activities that involve an interaction with local communities. In reality, however, plans for such activities beyond physical and legal protection and provision of infrastructure for patrolling and tourism have rarely been implemented.

An important reason for this is that protected area managers rarely have jurisdiction over land outside the legal limits of their park or reserve. Moreover, they rarely have training in the skills which are needed to work effectively with local communities. The park manager's job is not helped by the fact that the people responsible for agricultural and forestry development planning rarely understand that land adjacent to protected areas should be treated any differently to similar land elsewhere.

The IUCN Guidelines

Ideally, all land in the tropics (and elsewhere) would be managed with far more attention to the maintenance of biological diversity and ecological processes. Protected areas would only be needed in areas of very special significance or where even the slightest disturbance would result in loss of species or damage to ecological processes. In reality, we are very far from that situation. The approaches to land management advocated in these guidelines are, however, of the fragile land in the humid tropics.

These guidelines were intended to be based upon examples of successful buffer zone management programmes. It soon became apparent, however, that there are very few examples that can really claim to have succeeded in establishing stable and compatible land use systems around a protected area in such a way that the local people are genuinely reconciled to the conservation function of the area.

Buffer Zone Management in Tropical Moist Forests



Intact forest vegetation
in the Gunung Leuser
National Park, Sumatra.
Photo: J.R. MacKinnon



Agriculture and conservation in harmony. Dumoga Bone National Park, Sulawesi, Indonesia. Photo: Mark Collins

Nevertheless, many examples of projects where people are beginning to attempt to tackle these problems were discovered. The guidelines, therefore, are a state of the art account of what is being tried, how people are setting about it and what sort of approaches appear promising.

These guidelines were conceived mainly to address the needs of the staff of protected area management services who wish to embark upon buffer zone programmes. However, most of the biological diversity in the tropics will only be conserved if production forests are also managed sustainably. One obstacle to their sustainable management has been clearance by settlers who move in along logging roads and occupy the land. Many of the approaches to stabilising the use of land around protected areas which are described in this book could and should also be applied to buffer zones around production forests.

The fundamental conclusions that emerge from our review is that we should not simply be thinking in terms of rigid demarcation of buffer zones on the ground. The solution lies more in the development of a process of dialogue between park managers and local inhabitants. This will, in many cases, require a fundamental re-orientation in the attitudes and programmes of park staff. Our proposals have implications for the type of training that park staff receive and for the types of specialists who are hired. In production forests, foresters will similarly need to develop new skills and approaches if productivity is to be sustained.

IUCN is developing a series of projects to put these guidelines into practice and to serve as models for similar projects to be undertaken by national protected area authorities and development assistance agencies.

We hope that this publication will stimulate more thought amongst protected area managers about this crucial subject and that it will encourage further exchanges of information between conservation practitioners in the field.

IUCN would be interested to hear from people in the field who are engaged in buffer zone activities. We expect this publication to be part of a series of activities which will help to promote the successful integration of tropical forest protected areas into local development. We will therefore continue to monitor buffer zone management programmes and will place this issue on the agenda of technical meetings of park and reserve managers and development planners at all levels.

Legal Considerations

The scope for designating buffer zones depends to a large extent on legal provisions within protected area legislation. Ideally there should be legal control over the land use policies and activities of buffer zones within the national protected area legislation, but such integration rarely exists. An exception is to be found in Zaire where the protected area authority (The Institut Zairois pour la Conservation de la Nature) is legally empowered to regulate human activities within 50 kilometres of the boundary of gazetted protected areas. More usually, human habitation and other activities are specifically prohibited within all areas under the jurisdiction of the national protected area authority. In such cases, alternative legal means must be found for defining buffer zones and their functions.

A fundamental question is whether or not a buffer zone falls within the legally-defined boundaries of a protected area. Ideally, the buffer zone should be covered by the same legislation, not least for simplifying management planning and procedures. Where a buffer zone falls outside the legal boundaries of the protected area, other forms of legislation or regulations (such as forestry, agriculture or planning controls) must be drawn on to implement suitable policies and controls. In such instances integrated management will be a more complicated procedure.

The legislation in Cameroon is a good model for buffer zone control. Provision is made for defining the legal limits of the buffer zone as "a protection zone situated at the periphery of each national park, nature reserve or wildlife reserve, intended to mark a transition between these areas and the areas where hunting and agriculture can be freely practised". The buffer zones are subject to the same protection as parks and reserves, except that the Director of the protected area authority may authorise agriculture and habitation.

Buffer Zone Management in Tropical Moist Forests

The protected area authorities in Indonesia believe that on the crowded inner islands of Java and Bali the only realistic approach to management is to include inhabited areas in gazetted protected areas. These are then managed as "internal" buffer zones. This effectively means that the zonation applied to protected areas includes a variety of categories of partial reserve where the objective of the protected area authority is restricted to imposing certain conditions upon the activities of the resident population. This is analagous to the situation in the national parks in the United Kingdom.

In countries where national park legislation is at the drafting stage, or revision is contemplated, it may be appropriate to include provisions allowing for buffer zone designation. The purpose of the buffer zone can then be legally stated and appropriate land use activities and management structures defined - at least in broad terms. The legislation should be sufficiently flexible to allow for evolution of buffer zone policy, particularly where this is a new development which has yet to demonstrate its benefits.

National protected area legislation will overlay various systems of land law which often owe more to traditional rights than from introduced legislation on land tenure. The ownership of land will obviously be a major influence in determining the nature of buffer zones. Where the land is state-owned, legal designation of its functions may not be controversial. The setting aside of communally-owned or private land for buffer zones will involve more complex negotiation - including questions of compensation - and may result in the use of management agreements.

Rights of land acquisition often depend on clearance of tropical forest land, particularly in countries where settlement of forest areas is officially seen as desirable or necessary. Uncontrolled clearance is, however, inappropriate in land peripheral to forest areas set aside for conservation. Legislation to negate such rights in specified buffer zones would normally be necessary. However, customary rights of indigenous people in buffer zones must be respected. Rights to use land in certain ways and to collect specified resources will usually be more easily accommodated than rights to claim ownership of the land.

The rights of tribal and indigenous peoples to the ownership of their traditional lands are protected by international law most specifically in Article 11 of Convention No. 107 of the International Labour Organisation. In many countries these rights may be expressly guaranteed in constitutional and domestic legislation. In areas inhabited by such peoples buffer zones should be established by vesting title to the lands with the local communities at the level of either the village or ethnic group. The exact nature of the title will depend on the preferences of the local people and the legal provisions that exist in domestic law. New legislation may be needed where domestic law has not been developed to accommodate these rights.

The United Nations Environment Programme (UNEP) has recently promoted the establishment of extractive reserves for areas inhabited by non-indigenous communities practising sustainable systems of forest use such as tapping wild rubber and nut gathering. Novel legislation is necessary to allow the creation of these reserves through vesting title perhaps with local cooperatives of extractivists. Collective titling of land for peasant cooperatives has been applied with some success by the Agrarian Reform Institute in Zenezuela.

It may be possible to integrate conservation needs into regional planning whether or not specific areas can be created as buffer zones by legislation. In Thailand, for example, the Rural Development for Conservation Programme is seen as a more appropriate alternative to the delineation of buffer zones. The aims of this programme - to improve the living standards of rural communities at the same time as enhancing protection of national parks - fulfil the same objective as the buffer zone concept. Above all, the link between wildlife conservation and rural development should be seen as an attractive goal in all environmental and social planning in and around protected areas.

Examples exist of buffer zones which are not under the control of the protected area authority. In Indonesia, it has been proposed that industrial tree crop plantations owned by a parastatal enterprise should fill a valuable buffer role function around the Gunung Leuser National Park in Sumatra. In the Côte d'Ivoire a recent World Bank structural adjustment loan has stipulated that five per cent of the national agricultural development budget must be applied to intensifying and stabilising agriculture around moist forest conservation sites identified as priorities by IUCN.

Box 1: Benefits of Buffer Zones

Biological Benefits

1. Provides extra protection, from human activities, for the strictly protected core zone.
2. Protects the core reserve from biological changes.
3. Provides extra protection from storm damage.
4. Provides a larger forest unit for conservation, with less species loss through edge effects.
5. Extends habitat and thus population size of large, wide-ranging species.
6. Allows for more a natural boundary, relating to movements of species.
7. Provides a replenishment zone for core area species.

Social Benefits

8. Local people have access to traditionally-utilised species.
9. People are compensated for loss of access to the strictly protected core zone.
10. Local people participate in conservation of the protected area.
11. More land is available for education, recreation and tourism.
12. Wildlife conservation becomes a part of local and regional rural development planning.
13. Traditional land rights of local people are safeguarded.
14. Conservation-related employment is increased.

To achieve these benefits the following basic criteria must be observed:

- The tree cover and habitats should be maintained as far as possible in their natural state.
- The vegetation of buffer zones should resemble that of the protected area, both in species composition and physiognomy.
- Buffer zones should be as biologically diverse as possible.
- The physiognomy of the vegetation should be as heterogeneous and as stratified as possible.
- The capacity of the ecosystem in the buffer zone to retain and recycle soil nutrients should be retained as far as possible. Similarly, buffer zone activities should not have negative impacts on the physical structure of the soil or on its water-regulating capacity.
- Exploitation of buffer zones should, as far as possible, make use of traditional, locally adapted lifestyles and resource management practices.

Box 2: Biosphere Reserves

Biosphere reserves are internationally important protected areas established under the Unesco Man and Biosphere Programme (MAB). The areas are chosen and managed as natural or minimally-disturbed representative examples of the world's ecosystem types. They are also selected to demonstrate the relationship between conservation and development.

Biosphere reserves often consist of a core area of the relatively intact ecosystem with a surrounding buffer area. The core area may also represent centres of endemism (or genetic richness) or unique natural features of exceptional scientific interest. The buffer zone may consist of areas suitable for research into methods of sustainable development, examples of harmonious landscapes resulting from traditional land-use patterns, and examples of modified or degraded ecosystems suitable for restoration. A variety of agricultural activities, settlements and other uses take place in the buffer zones, managed in ways compatible with conservation.

The following list of tropical forest biosphere reserves is not exhaustive in that some reserves with mixed vegetation are not included.

Tropical moist forest biosphere reserves

Country	Reserve	Total area (ha)	Major land user	Buffer zone (ha)
Bolivia	Pilon-Lajas	100,000	Human settlement	--
Cameroon	Reserve Forestiere et de Faune du Dja	500,000	None	--
Central African Rep	Basse-Lobaye Forest	18,200	Human settlement	--
China	Dinghu Nature Reserve	1,200	Tourism	950
Congo	Odzala National Park	111,000	None	--
Gabon	Reserve naturelle integralle d'Ipassa-Makokou	15,000	Human settlement	5,000
Ghana	Bia National Park	7,770		22,800 outside the park
Guinea	Monts Nimba Ziama Massif	17,130 116,170	Engineering works Human settlement Forestry, Agriculture	7,130 56,170
Côte d'Ivoire	Tai National Park	330,000	None	--
Indonesia	Gunung Gede-Pangrango Lore Lindu Tanjung Puting Gunung Leuser Siberut	14,000 231,000 205,000 946,000 56,000	None Settlement Logging, Agriculture Settlement Logging	proposed proposed None proposed proposed
Mexico	Montes Azules	331,200	Agriculture	--
Nigeria	Omo Reserve	460	None	--
Panama	Parque Nacional Fronterizo Darien	597,000	Settlement	180,000
Peru	Manu Reserve	1,881,200	Human settlement Prospecting Canal construction	--
Philippines	Puerto Galera	23,545	Tourism	--
Sri Lanka	Sinharaja Forest Reserve	8,850	Forestry, Agriculture	--
Zaire	La Luki Forest Reserve Reserve Floristique de Yangambi	33,000 250,000	None Traditional Agriculture	-- --

MANAGEMENT

Management systems for buffer zones should be developed in the context of:

- the plan for the protected area as a whole;
- regional planning and development policies;
- traditional land use systems operating in the area, and
- appropriate and sustainable use of land and biological resources.

DRAW UP A MANAGEMENT PLAN FOR THE BUFFER ZONE, PREFERABLY AS AN INTEGRAL PART OF THE PLAN FOR THE PROTECTED AREA AS A WHOLE

Management objectives for the buffer zone should be clearly stated. Management decisions should be compatible with and, as far as possible, enhance the protection of the core area of land set aside for conservation.

The management plan may involve elements of traditional legislation, conservation legislation and statutory planning requirements. On the ground, management decisions should be guided by the conservation rationale for the protected area as a whole and the well-being of local people.

MANAGE THE BUFFER ZONE IN ACCORDANCE WITH REGIONAL PLANNING AND DEVELOPMENT POLICIES

Buffer zones provide a link between the strictly protected core forest area and the land-use systems outside the protected area. As such, management of buffer zones should take account of regional policies guiding land-use and development. The protected area management authority should develop a good working relationship with local management and planning authorities.

PROMOTE APPROPRIATE AND SUSTAINABLE LAND AND RESOURCE USE

Management will involve the development of appropriate and sustainable utilisation systems, which are discussed in more detail below. "Appropriate" management will depend very much on an understanding of biological and cultural factors, the management resources available and skills of the local people. Local people should be integrally involved in management decisions. Involvement of local people in practical management will help to provide conservation-related jobs and make the best use of the available workforce.

Management should encourage environmentally sensitive types of land use. In order to do so it is important to have a clear idea of what kind of activities are most harmful - and which are least harmful - to the overall objective of the buffer zone. It would be useful to establish a grading of activities appropriate to local conditions ranging from least harmful, through compatible to incompatible. As far as possible, activities in buffer zones should not involve the removal of forest cover.

ADOPT TRADITIONAL LAND USE SYSTEMS

In general, management should favour traditional activities, as these tend to be least destructive. Gathering of local plant and animal products where human pressures are not too intense should, for example, allow the maintenance of forest cover and be sustainable over a sufficiently large area. Locally adapted systems of farming may likewise be in harmony with forest conservation.

Box 3: Tropical Forest Land Use

CORE PROTECTED AREA	- Strict preservation of natural ecosystem
BUFFER ZONE	- Modification by human activities allowed though land remains forested and managed according to local conditions.
LAND OUTSIDE BUFFER ZONE	- Forest managed or removed for other predominant land use activities.

The predominant activities selected as appropriate will depend very much on existing land use. Where the forest is in a near natural condition, and used primarily for extraction of local products, it may be unnecessary to introduce new forestry or agricultural techniques. However, where population pressures are great, intensification of forestry or agricultural activities in buffer zone areas may be the only means of reducing threats to the protected area itself. If the land designated as buffer zone is already heavily utilised and modified through intensive forestry and agricultural techniques, practices which lead to environmental stabilisation and restoration should be encouraged.

DEVELOP ECONOMIC INCENTIVES AND IMPROVED COMMUNAL FACILITIES

Financial and technical resources for buffer zone management are likely to be limited, since traditional sources of conservation funding are directed to species conservation or areas of total protection. However, managing the buffer zone for the benefit of local people, as part of regional rural development, may attract funds from alternative sources such as development agencies. In order to do so, the conservation rationale of the buffer zone must be seen as attractive to the needs of local people.

Aid money for rural development in land adjacent to protected areas has already been agreed for conservation schemes in the proposed Korup National Park, in Cameroon (see Example 1), and Khao Yai National Park, in Thailand (See Example 25). In addition, as Example 2 explains, a forthcoming World Bank forestry project in Madagascar includes provision for improving agriculture on land adjacent to protected areas, in order to take the pressure off the forest resources.

An essential element of improved park protection on Khao Yai is the development of economic incentives to encourage villagers to refrain from illegal exploitation of park resources. An "Environmental Protection Society", funded by rural development agencies, has been established to help alleviate poverty in Ban Sap Tai village near the park. The Society, run as a pilot scheme for similar village programmes, operates as a credit cooperative, informal education centre and collective business enterprise, as well as being a base for conservation activity.

Provision of improved facilities for rural life in buffer zones can clearly help to increase local support for conservation. Social amenities may include improved transport facilities, housing, community buildings, electricity and water supply. Wherever possible, these should draw on local resources to show the benefits of conservation. This can, for example, be achieved by providing clean water derived from the intact forest of the reserve.

COMPENSATE FOR PROHIBITING INCOMPATIBLE LAND USE ACTIVITIES

Certain activities such as excessive burning of vegetation and poisoning or hunting of protected species are generally inappropriate in buffer zones and should be prohibited.

Conflicts, however, will be inevitable in buffer zones because they are, by definition, areas of multiple use. Management will therefore be an exercise in conflict alleviation, as well as in more practical aspects of environmental protection. Compensation or aid should only be required when conflicts are otherwise irreconcilable.

Example 1: Rural development programme for the Korup National Park area

Korup National Park, in Cameroon, covers 125,900 hectares in an area of forest that has never been logged. A total of 252 bird species have been observed in the park and its immediate vicinity, which is also exceptionally important for primate conservation and very rich botanically. Korup was declared Cameroon's first rain forest national park on 30 October 1986.

612 people live in the immediate vicinity of the new national park, and 1,042 people live within its boundaries, in six villages. According to the legal decree under which the park was established, these villagers will have to be resettled.

It is accepted that the long-term future of the park can only be assured if efforts are made to carry out this resettlement with minimum disturbance to the population. Rehabilitation will need to take into account social and economic problems which could result from resettlement.

Resettlement will be based on knowledge of the socioeconomy of the villages of Korup and the surrounding area, resulting from survey work now being carried out. At present the main land use activities of the people living within the park differ according to the traditions of the two major ethnic groups, their tribal affinities outside the park and local soil conditions.

The east of the national park is inhabited by Bantu tribes: the Bima, the Bakoko and the Ngolo. They live on richer, older volcanic soils, which are more extensively cultivated. Cocoa and coffee are grown together with perennial tree crops such as mango and avocado pear. Shifting cultivation has made relatively little impact on the park as a whole and conditions have not been suitable for the establishment of plantation agriculture.

In the western portion of the park the population is made up of two non-Bantu tribes: the Korup and the Ejagham. The Korup constitute 61.5 per cent of the population of the park as a whole. The soils of the area they inhabit are extremely infertile; consequently, the Korup people have traditionally subsisted by hunting and fishing. Today they tend to be professional hunters and the main Korup village of Erat is the centre of the bush-meat trade. The majority of the Korup tribe lives in Nigeria and cross-border trade and wildlife smuggling are features of the local life. Forest products traded with Nigeria include dried endocarps of seeds of *Ricinodendron heudelotii*, *Panda oleosa*, and *Irvingia gabonensis*. Fermented sap from raffia palm *Raphia monbuttorum*, is distilled to make illicit gin.

The rural development programme for the Korup region incorporates the protection and management of the park and its development as a tourist attraction. The needs of the people living in and close to the park are seen as a priority. This aspect of the programme has been most attractive to international assistance agencies.

Potential areas for resettlement have been identified: two regions adjacent to the park, through which new roads are planned. Nurseries, to provide seedlings of indigenous food crops, cash crops, fruit trees and fuelwood, will be set up in these resettlement areas and near Mundemba. Villages will be resettled as the necessary socioeconomic studies are completed and new infrastructures such as roads, village sites, nurseries and farms are developed.

The Korup project involves cooperation between an unusual number of different government departments, as well as NGOs and bilateral aid agencies. National parks in Cameroon are under the official jurisdiction of the Secretariat of State for Tourism but, because of the development nature of the project, other ministries have also been involved. Significantly, the Ministry of Planning sees the project as a model for similar rural development and conservation schemes elsewhere in the country.

Source: Stephen Gartlan

Example 2: Forest conservation activities supported by the World Bank in Madagascar

A forthcoming World Bank forestry project in Madagascar contains a substantial component to support a protected area programme.

In the moist forests of east Madagascar the protected areas are mainly threatened by the encroachment of shifting cultivators. Steep hillsides are commonly cleared of forest in order to plant two crops of low yielding hill rice. The land is then abandoned to fallow for up to 15 years.

The World Bank project will support the improved management of the Andasibé reserve located 130 kilometres east of the capital, Antananarivo. A new national park will be established nearby. A major component of the project will be to provide the reserve management authorities with the materials and equipment needed to help local communities develop irrigated rice cultivation on alluvial soils in the valleys. Yields here will be much higher than on the poor soils of the hillsides and sustained cropping will be possible. The local people have themselves expressed the desire to move into irrigated agriculture. In the past, they have been unable to do so unassisted because of the initial cost of the dams, water control sluices and other equipment.

It is proposed to make seedlings of tree crops available to people around the reserve who wish to cultivate fruit for sale to cities. Recent improvements to the road giving access to the reserve will facilitate the marketing of the produce, and hence the economic incentive to care for the trees.

Research into methods of stabilising agriculture on steep slopes is also being supported. Anti-erosion hedges of nitrogen-fixing species are being planted on contours, with rice inter-cropped between them. This approach is still at an experimental stage.

INDIGENOUS PEOPLE

Tropical moist forests are commonly thought of as pristine environments unchanged by human influence during their evolution. In reality, however, virtually all moist forest ecosystems have been modified to some extent.

Traditional lifestyles of indigenous people have often evolved in harmony with the local environmental conditions in such a way as to minimise disruption and maintain ecological processes (see Example 3), but, destruction of the moist forests has, more recently, been caused by external commercial exploitation of their valuable resources, inappropriate methods of clearance for agriculture and settlement, and increasing pressures of urbanisation, transportation and industrialisation.

Some of the principles that should guide the elaboration of plans for buffer zone management may be found in Resolution 15/7 of the 1975 General Assembly of IUCN regarding the "Protection of traditional ways of life", and the Declaration of the World National Parks Congress, 1982 regarding "Protected areas and traditional societies".



Veddah children, forest dwellers of Sri Lanka. Photo: J.R. MacKinnon

RECOGNISE THE LIFESTYLES AND TRADITIONS OF INDIGENOUS PEOPLE AND INCORPORATE THEIR RIGHTS INTO MANAGEMENT POLICIES

Retaining the traditional lifestyles of indigenous people in buffer zones, where this is possible and appropriate, will encourage the long-term conservation of tropical forest protected areas. Protecting the rights of local communities ensures that they remain as guardians of the land and prevents the incursion of immigrants with less understanding of the local environment. The value of preserving rights of specific named communities has been recognised, for example, by the National Parks and Wildlife Office of the Sarawak Forest Department, in the planning of buffer zones for the Lanjak-Entimau Wildlife Sanctuary. Here the local Iban will benefit from legally-recognised rights of exclusive access to the natural resources of substantial areas of forest. They therefore have a vested interest in excluding other groups.

Buffer Zone Management in Tropical Moist Forests

It is unrealistic, of course, to expect local people to remain immune to modern influences on their lifestyles and to be unimpressed by all social and technological advances. Buffer zones should therefore allow for sympathetic rural development in harmony with local traditions and cultures.

BASE BUFFER ZONE MANAGEMENT AND PLANNING ON PARTICIPATION BY LOCAL COMMUNITIES

It is essential to involve local people in the planning of protected areas and their associated buffer zones. Participation in protected area management is important from the design and formulation stages right through to implementation and long-term protection. Without such involvement, it is unlikely that park regulations will be respected. An example of opposition to national park development resulting from lack of local involvement is given in Example 5.

It is necessary to gain community support from the earliest stages in protected area planning. In order to ensure this, the benefits of protected area development and the aims of buffer zones should be clearly demonstrated to the local people. The designation of a buffer zone is an important mechanism for maintaining traditional rights as an element of national park management and for ensuring that immediate benefits resulting from the protected area are enjoyed by local people.

Public participation in achieving the objectives of buffer zone management can be through informal consultation, by inviting village representatives to meetings, by showing representatives the benefits of conservation schemes elsewhere, by forming local advisory or management committees, and, where appropriate, through the general media. It has been found, in Indonesia, that a direct approach to villagers is the best means of putting across conservation ideas. Mobile education units showing slide programmes and film shows have been well received in villages.

DEVELOP AN UNDERSTANDING OF THE SOCIAL AND POLITICAL INSTITUTIONS OF LOCAL GROUPS

An understanding of, and respect for, existing social and political institutions is crucial to the successful involvement of indigenous people in national park planning and buffer zone management. Traditional systems of representation must be respected in order not to disrupt local processes of decision making. Such institutions and processes should be incorporated into planning and management to ensure that decisions accord with the real aspirations of the people. It is, of course, desirable for the initiation of protected area planning to originate with the indigenous people themselves. This is happening in Panama, for example, with the Kuna people (see Example 4).

CONSIDER RELOCATION AND THE DEVELOPMENT OF ATTRACTION ZONES CAREFULLY

Planning for buffer zone management must be sufficiently flexible to allow for changing needs of the indigenous people and the increasing pressures on natural resources which may arise from population growth. Obviously, buffer zone design must incorporate a sufficiently large land area to provide for local needs on a sustainable basis.

Indigenous peoples have strong ties to their lands and relocation should only be considered as a last resort. Where it is unavoidable - for example if relocation of indigenous people is a legal prerequisite for national park designation - it must be subject to very careful planning and consultation. Where removals are agreed to, those relocated should be provided with full compensation with land for land lost.

The development of attraction zones away from the protected area itself is one means of reducing the pressures from overcrowding. As with buffer zones these attraction zones may themselves act as magnets for increased immigration and it is important that the land tenure system be elaborated and legally enforced. Resettlement of immigrants from the Parc National de Taï, Côte d'Ivoire, is now considered an urgent conservation requirement (Example 6).

Example 3: Indigenous people of Manu National Park, Peru

Manu National Park, declared in 1973, is situated in the Upper Amazon basin of Peru. It is a Biosphere Reserve.

The park covers 1,532,806 hectares of mountains and lowland moist forest, as yet largely unaltered by modern man. It has the highest diversity, abundance and density of wildlife found in the Amazon basin outside the major river valleys. Threatened species such as giant otter, jaguar, ocelot, black caiman and river turtles are abundant. Species such as the tapir, Brocket deer, capybara and a variety of primates remain common.

Manu National Park is inhabited by groups of at least three different tribes: the Machiguenga, the Yaminahua and probably the Amahuaca. The Machiguenga is the largest group. Relatively little is known about the lifestyles of the remote groups living within the park. The forest Indians are generally nomadic and live in harmony with the environment. They subsist on rootcrop agriculture (carried out along river banks and lakes) and on hunting, fishing and the collection of turtle eggs. There are various traditional mechanisms to help avoid over-exploitation of wildlife, such as taboos for killing or eating certain species. All material for tools, clothing and housing is provided by the forest.

In contrast, there is one settled Machiguenga community within the park. This is at Tayakome, the site of a former mission station, and was established around 1960. The missionaries introduced rifles, leading to commercial hunting and smuggling of skins out of the park. Conflicts arose between the missionaries and park personnel when the park was declared, and the mission withdrew in 1971.

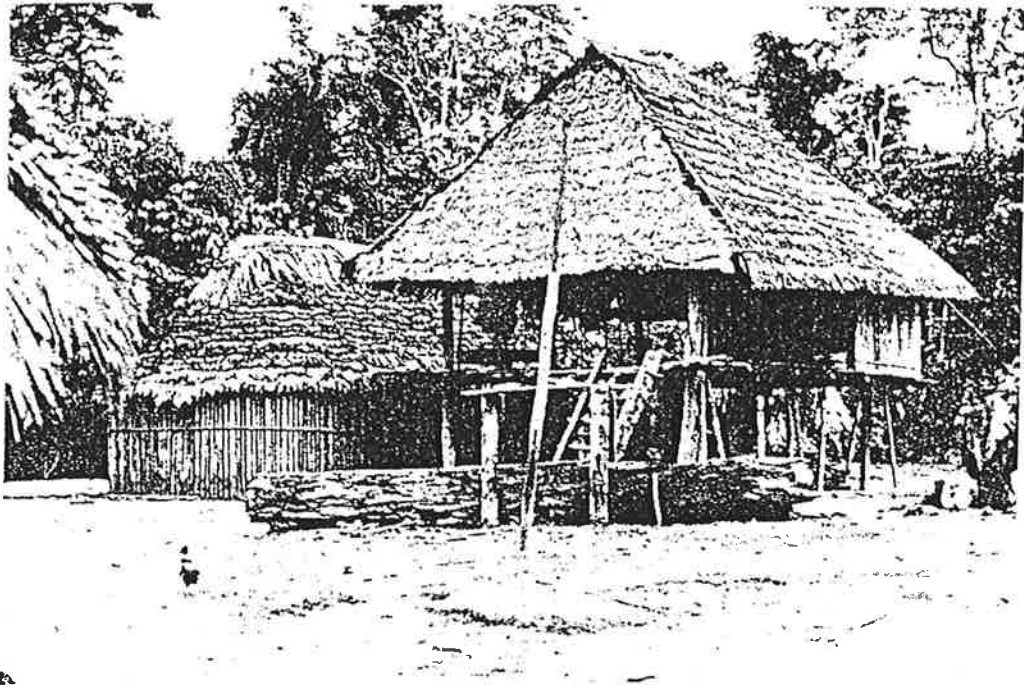
According to park regulations, indigenous people are allowed to hunt (with traditional weapons) all wildlife for their own consumption. Commercial hunting is prohibited. There are signs of over-hunting around Tayakome, for example with the decline of the black spider monkey *Ateles paniscus*, taken for food, and of birds such as guans Cradidae and macaws *Ara spp.*, which are hunted for food and feathers. Settled agriculture, coupled with increasing population growth is also causing problems around Tayakome.

Legal land ownership for tribes in Peru does not extend to national parks, but where the indigenous communities adhere to traditional lifestyles, their traditional rights should be respected. For Manu National Park the following options have been suggested:

- To leave these people inside the park, as long as they follow their traditional way of life without disrupting Manu's natural ecosystems. The unknown (but small) groups of Machiguenga - and probably Amahuaca - would remain in a wilderness area, north-east and south-east of Manu. These zones, as well as the Machiguenga hunting area around Tayakome should be exclusively reserved for indigenous people.
- To set aside alternative land along the park boundary as buffer zones for groups who wish to leave the park and adopt new lifestyles. These areas should be under the authority of the park, to enable the guards to prevent intrusion by colonists and other exploiters, and to ensure that the fauna, flora and ecology remain intact.

Indigenous people of Manu National Park have minimal impact on the protected area as a whole. By contrast, new pressures of road development, prospecting, settlement and canal construction, threaten the natural habitats, endangered species and traditional lifestyles alike.

Source: Jungius, H. (1976). National parks and indigenous people - Peruvian case study. *Survival International Review* 1(15): 8-14.



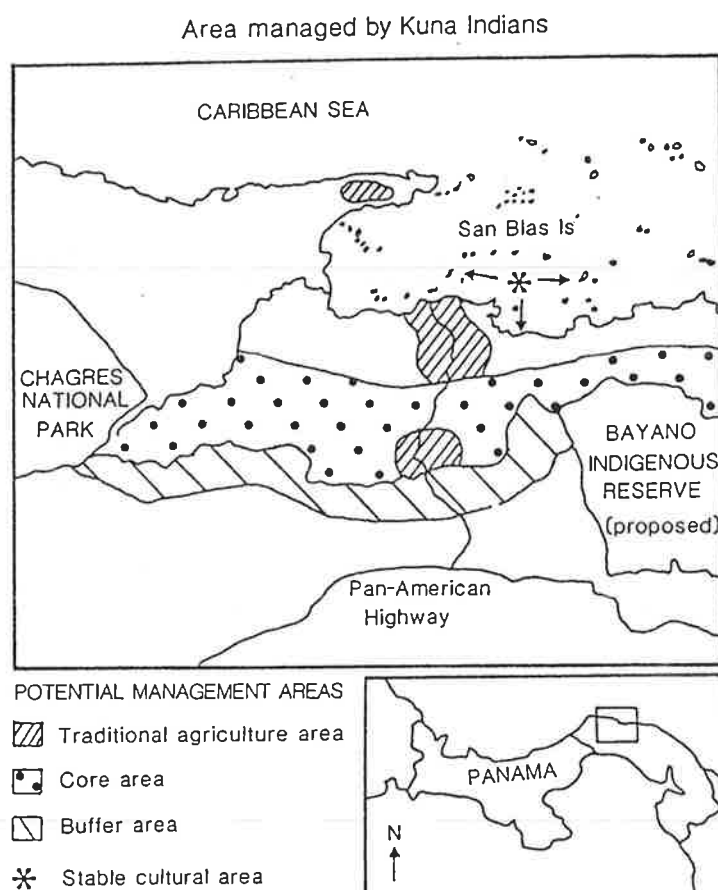
Machiguenga settlement at Tayakoma. Photo: H. Jungius

Example 4: Management of tropical forest by Kuna Indians in Panama

The Kuna Indians inhabit a reservation which consists of one of the few remaining wet tropical forests in Central America, together with offshore coral islands where the villages are situated. The Kuna have exclusive rights to live in the area and are directly in charge of the conservation of natural resources in the reservation.

Construction of a new road provided a much-needed communication link for the local people in the 1970s - but also brought the risk of illegal squatters. In order to develop a management regime for the sensitive area of the reservation, the Kuna decided to use the land for tourism, scientific research and habitat protection, enlisting the support of outside agencies. A protected area is being developed which may be designated as a biosphere reserve and incorporate a buffer area along the vulnerable inland margin of the traditional reservation.

Source: Wright, M.R., Houseal, B. and De Leon, C. (1985). Kuna Yala: indigenous Biosphere Reserve in the making? *Parks* 10(3): 25-27.



Example 5: Local opposition to the Loagan Bunut National Park, Sarawak

The Berawan people of Long Teru, Sarawak are opposed to the creation of the Loagan Bunut National Park on their traditional lands. They have announced in a public appeal that, "Our land is our survival and to take it away from us would mean the extermination of our people".

Loagan Bunut is Sarawak's only natural lake. It is rich in fish and other wildlife. The proposed national park would cover 10,740 ha of land and the boundaries may include undisturbed peat-swamp forest. The lake itself cannot be expected to survive in its present form if the surrounding catchment areas are radically altered. At present road-building and logging are threatening natural habitats in the area where competition for land is intense.

The traditional economy of the Berawan is based on hunting, gathering, fishing and shifting cultivation. The people are clearly aware of the loss of the natural resources on which they depend but also resent any interference with their customary rights to utilise the land.

Announcement of the new National Park in an official Proclamation noted that the erection of buildings, hunting, the cutting of vegetation and the clearing of land were all to be prohibited within the park. Unfortunately the Berawan had not been consulted about the restrictions and, as a consequence are not prepared to cooperate in conservation plans for the area.

Sources: Kavanagh, M. (1985). Planning considerations for a system of National Parks and Wildlife Sanctuaries in Sarawak. *Sarawak Gazette* 111(1491): 15-29
 Marcus Colchester, Survival International

Example 6: Parc National de Taï - human pressures from new settlers

The Parc National de Taï is situated in south-west Côte d'Ivoire, in an area which contains the last extensive tract of dense evergreen moist forest remaining in West Africa. The park consists of 330,000 hectares of this forest, with an additional buffer zone covering 20,000 hectares. The buffer zone was added to the park boundaries in 1977 and has the legal status of a managed fauna reserve.

The buffer zone for the Parc National de Taï was created to help solve some of the pressures currently faced by the park. These are considered to be so serious that, in 1984, the park (which is of international importance as a biosphere reserve and world heritage site) was included in the IUCN list of the world's most threatened areas. The main threats come from clearance for cultivation, timber exploitation, mineral prospecting and poaching. In the buffer zone, agriculture is allowed but the development of plantations and new settlement is prohibited.

Traditional agriculture in the Taï Forest region is swidden cultivation as practised by the Bakwe people. This is based on clearance of the forest by slash and burn, followed by cultivation of one or two crop cycles and then a fallow period of at least 15 years. The main crop is non-irrigated rice. Corn, manioc, taro and plantain bananas are also grown. Food crops are supplemented by hunting and trapping of small mammals and by gathering forest products such as cola nuts, wild tubers, medicinal plants and caterpillars. During the 1970s, agricultural pressures on the land increased dramatically with the arrival of a huge influx of immigrants. The settlers, many of whom are Baoute people, practise an agricultural system based on cash crop production. Coffee and cocoa are the main cash crops. They are grown in regular succession with food crops such as yams and there is no fallow period. Agricultural practices of the Baoute people are responsible for much of the forest destruction taking place in the Parc National de Taï. Cash crops are taking up an increasing amount of park land. Illegal clearance of the forest in peripheral areas of the national park is causing more serious ecological problems than exploitation for forestry. Resettlement of the farming communities away from the park boundaries is now considered necessary.

Source: Dosso, H., Guillaumer, J.L. and Hadley, M. (1981). The Taï project: land use problems in a tropical rain forest. *Ambio* 10 (2-3): 120-125.

ALTERNATIVE FOREST PRODUCTS

Commercial exploitation of tropical moist forests has usually concentrated on the extraction of timber, often in a manner which causes or promotes the destruction of the tropical forest resource. As forests are destroyed, the whole range of other useful biological products which are available from forest ecosystems are lost. These alternative forest products have long been appreciated by indigenous people and used by them both for subsistence and local trade. Encouraging the wise use of all the valuable species found in moist forests is an important aspect of buffer zone management.



Pygmy family preparing edible oil from palm nuts. Photo: P.S. Wachtel

TRADITIONAL USE OF ALTERNATIVE FOREST PRODUCTS IS PREFERABLE TO MORE INTENSIVE FORMS OF LAND-USE

Generally, traditional methods of hunting and gathering within the moist forest do not lead to loss of species and cause minimal ecological disruption. Local harvesting of forest plant products, for example, usually leaves the forest structure intact, with little impact on ecological processes and, if whole plants are not taken, on species composition. Under traditional circumstances exploitation of the environment is often regulated by an interaction of social, economic and religious factors, which combine to limit pressure on the environment.

Some tribal communities in moist forest areas rely entirely on hunting and gathering for their sustenance. More typically, the collection of forest products supplements systems of shifting cultivation. In Sarawak, for example, traditional settlements in the valleys depend to a considerable extent on intact moist forest for wild meat and a variety of other forest products. This relationship is now being recognised in the planning of protected areas of the region, as described in Example 7.

Buffer Zone Management in Tropical Moist Forests

A wide range of wild plant products is also used by the villagers around the forest of the Sinharaja Biosphere Reserve, Sri Lanka. Of the local plants, many of which are endemic to Sri Lanka, 25 species are known to be used in indigenous medicine and 54 species have some commercial or food value. The uses of some of the more important species in the local economy are described in Example 8.

COLLECTION OF ALTERNATIVE FOREST PRODUCTS SHOULD BE ON A SUSTAINABLE BASIS

Management of buffer zones implies protection of the traditional rights of local people to collect and utilise biological resources from the forest, where this is on a sustainable basis and does not lead to threats of species extinctions. With increasing population pressures, however, sustainable utilisation of forest plants and animals may no longer be possible without the introduction of new conservation measures. A number of the useful plants of the Sinharaja Biosphere Reserve are threatened with extinction, for example, while poaching of wild animals is a universal problem in tropical forest protected areas.

A quota system may be necessary to ensure that over-harvesting does not take place. The quota for each species should be set at a low level and carefully monitored. Permits may be necessary to ensure that communal resources are harvested fairly.

DEVELOP NURSERIES TO ENHANCE UTILISATION OF FOREST PRODUCTS

Buffer areas provide appropriate sites for the study of local levels of sustainable harvesting, natural regeneration, cultivation and propagation techniques, and for research into novel forest products.

To improve the use of local plant species within buffer zones, nurseries should be established. The selection of species stocked by the nurseries should be decided in consultation with the local people. Surveys, interviews and discussions should be carried out particularly with women, who are most often responsible for collecting forest products.

Many tropical trees can be easily propagated vegetatively, including those which produce fruits, nuts, fibre, gum, and medicines. A wide range of tropical trees could thus be rapidly domesticated to produce high yields of the various products, with selection also for characteristics such as flavour and oil content.

Nurseries could provide plants for large-scale planting by governments or aid agencies, or for small-scale community forestry and agroforestry. They are an integral part of most existing buffer zone schemes, such as at Sinharaja and Korup.

LOCAL NEEDS SHOULD TAKE PRECEDENCE

Benefits resulting from such studies and propagation of forest species should, as far as possible, be distributed within the local community. This may, for example, be in the form of restoring populations of useful species which have been locally depleted by long-term use, or by enrichment of the buffer zone with local crops.

Local needs should take precedence in the development of alternative forest products, with species providing food a general priority. Utilisation of a diverse range of species should be maintained and encouraged, both for ecological stability and to satisfy the diverse needs of the local community.

CAREFULLY CONTROLLED TRADE IN ALTERNATIVE FOREST PRODUCTS SHOULD BE PROMOTED

With the introduction of propagation and farming techniques - and with appropriate safeguards - increased commercialisation may be possible for indigenous species. Trade can, in fact, be an element in species conservation programmes. Great care needs to be taken, however, to prevent over-collection and poaching of commercially attractive species. Assistance may be necessary with marketing where market experience is lacking in the local community.

The range of forest products which may be suitable for trade include seeds of decorative and other useful plants, rattan products (see Box 4), propagated orchids and other houseplants, and attractive insects such as butterflies, raised by farming methods (see Example 23). Indigenous species should always be utilised in preference to introduced species in local farming and wildlife production within the buffer zone.

Example 7: Forest product utilisation in Sarawak

The indigenous people of the interior of Sarawak are still largely dependent on shifting cultivation, the nature of which varies according to the particular ethnic group involved. Hill rice is the main cultivated crop though, in addition, some groups grow irrigated rice.

Patchworks of cultivation tend to follow the river valleys. In between these are forest expanses, showing no sign of agricultural disturbances. The shifting cultivators and farmers in the longhouse communities of the valleys and nearby slopes depend on the intact moist forest hinterland to a startling degree, for a range of wild species. Recent studies have estimated that wild animal meat contributes almost 150 grammes per person per day. The single most important prey species is the bearded pig *Sus barbatus*, a species of the undisturbed forest.

Riverine fish represent another important subsistence resource which is largely dependent on intact forest, since fish stocks are strongly influenced by water quality. Other forest products harvested primarily for longhouse use include canes or rattans, from which are made mats, baskets and numerous other items; belian *Eusideroxylon zwageri*, an ultrahard wood used for special construction and roofing; edible fruits, herbs and palm-hearts; and the various feathers, skins, antlers and tusks used for decorative or ritual purposes.

Surplus fish, wild meats and other products are traded for cash in many areas, and gathered mainly for this purpose in some. Engkabang or illipe nuts (oil-rich seeds of the family Dipterocarpaceae); damar or dipterocarp resin; gaharu or incense wood; rattan for processing into marketable goods; and a range of other resins, gums and fruits are harvested from the forest specifically to be sold. Engkabang varies greatly in availability from year to year, but good harvests make for substantial influxes of cash. These allow the purchase of goods such as generators, outboard motors and chainsaws. Damar and gaharu are locally more predictable in supply and are often the primary source of cash for a community.

The legal regulation of hunting and gathering rights is a central theme of wildlife resource management in Sarawak. The National Parks Ordinance 1986 makes provision for this by allowing for special rights to hunt and gather to be granted to particular communities when a park is declared. Identified groups of Penan people have, for example, been given the right to continue hunting and gathering in sectors of the Gunung Mulu National Park.

National Parks are one of only two kinds of totally protected area in Sarawak, the other being Wildlife Sanctuaries as constituted under the Wildlife Protection Ordinance 1958. A new approach to land use by indigenous people within a protected area is currently being developed for the Lanjak-Entimau Wildlife Sanctuary which was gazetted in 1983. Buffer zones are proposed for the inhabited river valleys which run between the arms of the starfish-shaped sanctuary. These areas will now be brought within the boundaries of the sanctuary but exclusive farming, hunting and gathering rights for the local Iban communities will be retained.

Sources: Julian Caldecott and Francis Gombek

Example 8: Important forest plant products harvested in Sinharaja Biosphere Reserve

1. *Caryota urens* (Palmae), locally known as "kitul", is a species confined to South India and Sri Lanka. It is a rare understorey tree found in moist forests. The young inflorescence is tapped for its sugary phloem sap which is either fermented, to obtain an alcoholic drink known as "Toddy", or concentrated to prepare a crystalline sugar candy known as "Jaggery". Kitul tapping is a well-established cottage industry in some parts of the country and the traditional methods used are often handed down from generation to generation. Jaggery is a popular sugar substitute and is a readily marketable product, particularly at times when the price of sugar is high. However, no concerted effort has so far been made to bring *Caryota urens* into domestication. Many centuries of tapping of wild plants is thought to be the cause of current rarity.
2. *Calamus* sp. (Palmae) Rattan or cane, known locally as "wewal", is much sought after by the villagers for the manufacture of a variety of products. Cane thrives best under partially disturbed forest conditions, in which it often reaches the canopy of the tallest trees. At present, the Forest Department is engaged in propagation and cultivation of cane for plantation in disturbed forest sites and in forest plantations.
3. *Blettaria ensal* (Zingiberaceae), known as wild cardamom, is indigenous to South India and Sri Lanka. It is a herb commonly found in primary forest. The seeds are harvested as a source of the condiment and, during the fruit ripening period from August to September, large groups of villagers scan the forest for their collection.
4. *Coscinium fenestratum* (Menispermaceae) is a widespread vine of forest edges, thickets and gaps. The woody stems contain Berberine, which is one of the commonest indigenous medicinal ingredients found in rural, as well as urban households. It is usually taken in combination with other medicinal plant products for the treatment of a variety of ailments, from fever to tetanus. Exploitation is on a substantial scale, threatening the species with extinction. The species is not yet cultivated.
5. *Shorea* species (Dipterocarpaceae), the common canopy trees often logged for their medium density timber also provide a source of food from their rather infrequent mast fruiting. The seeds are traditionally collected and cooked as a vegetable by villagers. Another minor product obtained from some *Shorea* species is resin, which is used in the preparation of varnish and incense.
6. *Vateria copallifera* (Dipterocarpaceae) is a sub-canopy tree, endemic to Sri Lanka and usually found in isolated stands along stream banks. The large seed is pulped and used as a gruel. The bark is used for arresting fermentation of the phloem sap of *Caryota* during the preparation of the sugar candy.

Sources: I.A.U.N. Gunatilleke and C.V.S. Gunatilleke

Example 9: Medicinal plants of Gunung Leuser National Park, Indonesia

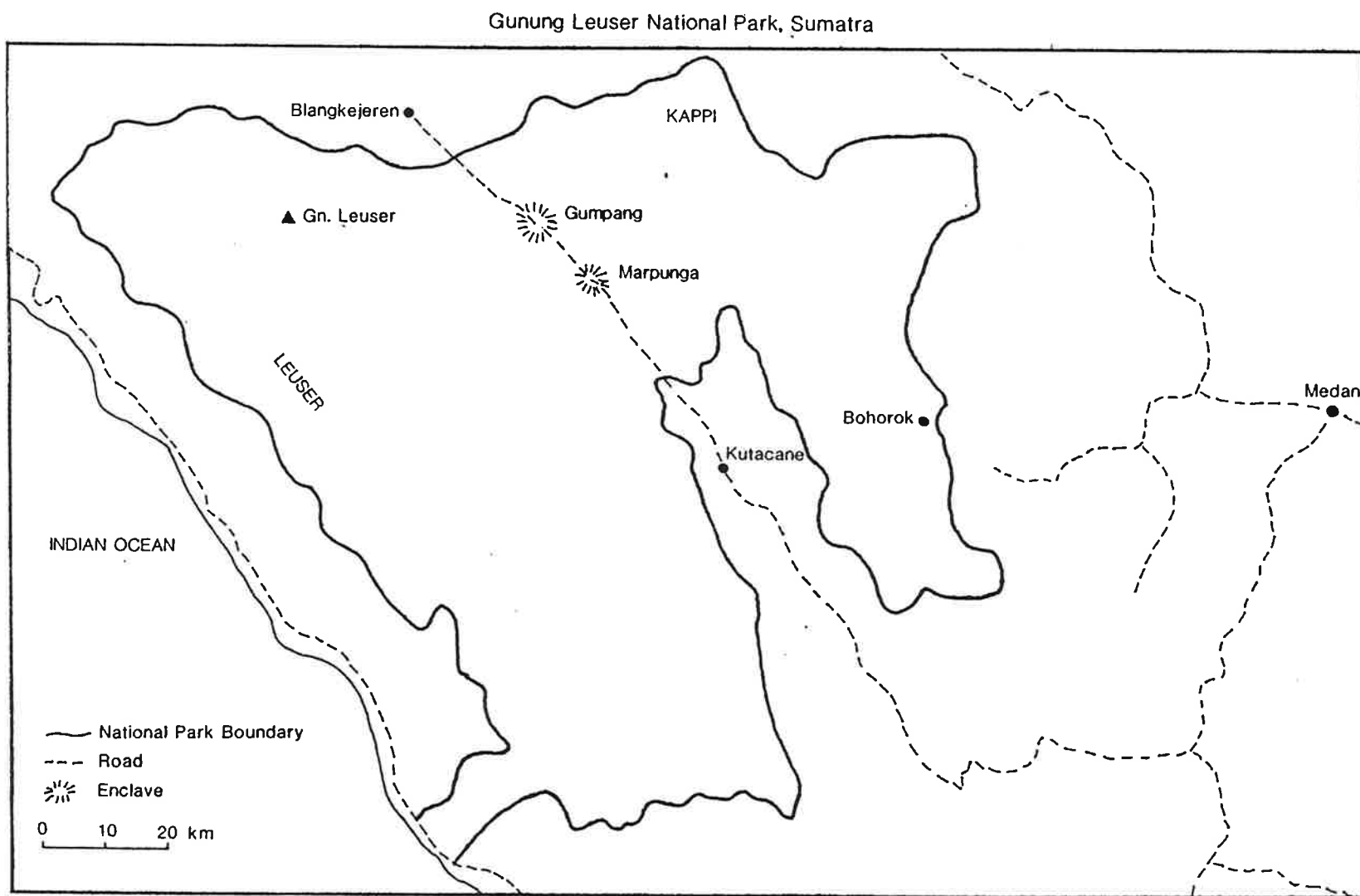
Gunung Leuser National Park covers 8000 square kilometres of tropical moist forest and is probably the most species-rich of all Indonesia's national parks. The park consists of two major mountain ranges, the Leuser-Mamas range to the west and the Kappi-Aras range to the east; they are separated by the heavily-populated Alas-Ranun rift valley, which bisects the park from north to south. The best areas of species-rich lowland forest within the park occur in the Alas valley.

When the park was established in 1980, two populated enclaves were allowed to remain within its boundaries. People who had previously been living elsewhere within the park were translocated into these enclaves. The two settlements Marpunga and Gumpang are both situated in the Alas valley and are surrounded by lowland forest.

Marpunga has a population of about 1,700 people, of Gayo and Alas origin, and Gumpang has 2,500 people, nearly all of whom are Gayo. The economy of the villages is based entirely on agriculture. The valley bottom is used for wet rice cultivation and the lower slopes produce a wide range of crops in gardens known as "kebuns". Forest products are still a source of income for many families, although they are now of declining importance. Over the years, there has been a gradual shift from subsistence to a market economy. This was accelerated by the completion of a through-road, connecting the villages with the market towns of Kutacane and Blangkejeren.

The people of Marpunga and Gumpang have virtually no access to modern medicine and rely almost entirely on medicinal plants administered by native doctors, called "dukuns". It is generally believed that most illnesses are caused by evil spirits which can be overcome by the good spirits contained in plants. A recent study has recorded 171 different plants - including both indigenous and introduced species used in traditional medicine in the villages. 15 species are used in remedies for malaria alone. Some have widespread medicinal application throughout south-east Asia and are worthy of pharmaceutical investigation. Of the indigenous species some are still collected exclusively from the forest, for example konyel bark from *Ficus* sp., which is claimed to be effective against abdominal pain and diarrhoea. Others are both cultivated and gathered from the wild. One of these is the red sugar palm *Arenga pinnata*, which is used mainly to sweeten unpalatable medicinal preparations, but may have curative properties in its own right and is added to a wide range of remedies. Medicinal plants provide a source of income for the villagers and are collected for sale on traditional medicine stalls in the markets of Kutacane and Blankejeren.

Source: Elliott S. and Brimacombe J. (1985). The medicinal plants of Gunung Leuser National Park, Indonesia. WWF Report.



Box 4: Rattan Cultivation

In south-east Asia, climbing palms, or rattans, are commercially the second most important forest product, after timber. Their main commercial use is in furniture production, though they are extremely versatile with a wide range of traditional uses. Raw cane currently has roughly the same value as coffee in Singapore, one of the main centres of rattan processing; about 100,000 tons of raw cane are consumed internationally each year. Indonesia accounts for around 90% of the trade in raw rattan.

Rattans occur naturally in the tropical forests of south-east Asia; a few species are also found in West African forests. Virtually all the rattans in trade are collected from the wild. Increasing demand for canes, together with high rates of logging, are leading to useful species becoming more and more scarce. In Indonesia, for example, many forest areas near rural settlements have been overcut, leaving almost no commercial rattans. Indonesia, the Philippines and Thailand now ban the export of raw canes; and the export of semi-processed and processed canes from Peninsular Malaysia is prohibited, so as to sustain the supply for domestic industry. In general, there is a need to process raw rattan into manufactured goods within the producer countries to generate increased incomes, higher revenue earnings and create employment.

Rattan collection, cultivation and processing provide important possibilities for buffer zone schemes around protected areas. Planting indigenous species can help to rehabilitate logged forest and justify the maintenance of forest cover. Already, rattan plantations are being established in the Sinharaja Biosphere Reserve, Sri Lanka (See Example 8) and are planned for Dumoga Bone National Park, Sulawesi.

Propagation and cultivation of most rattan species are still at the experimental stage. The two main species grown commercially are the small-diameter rattans *Calamus trachycoleus* (rotan irit) and *Calamus caesius* (rotan sega), used for weaving, binding and mat-making. The largest area of cultivation for these species is in Central Kalimantan Province where a plantation was established over a hundred years ago. Other species should also be considered for buffer zones, to supply local needs, expanding trade and as a conservation measure.

The usual method of propagation for rattans is to raise plants from seed. Fruits of nearly all rattans contain only one seed and direct sowing usually leads to heavy losses of seed and newly germinated plants. It is more efficient to plant out seedlings, raised in nurseries, which have been protected from predation and the direct effects of weather. Naturally-occurring rattans within protected areas and buffer zones should be protected as "seed orchards", to conserve seed for planting. Mother plants to provide seed are generally located in increasingly remote and inaccessible forest areas. Indigenous people often know where to find the ripe fruits and are skilled in harvesting them from the forest canopy. Rattan schemes in buffer zones should draw on such local skills.

The collection of rattans to meet basic local needs should be allowed in buffer zones. Rattans can be very important in traditional cultures and in India, for example, some species have immense ethnobotanical value. They are particularly important to tribal people in remote areas of the country, providing medicinal treatments, material for bows and arrows, thatching, bridge construction, cordage and dragline for fishing, and as a source of soft drinking water.

Manufacture of traditional rattan products should be encouraged in buffer zones where there is a sustainable supply of the raw material. Basketware and matting using traditional designs could, for example, be an appropriate form of rattan use. In Malaysia the Accelerated Village Industry Development Programme is promoting the development and marketing of high-quality rattan handicrafts through village co-operatives.

Information on rattans can be obtained from the Rattan Information Centre, Forest Research Institute, Kepong, Malaysia.

Source: Wong, K.M. & Manokaran, N. (eds.) *Rattan: report of a meeting held in Kuala Lumpur October 1984*.

TREE CROPS AND AGROFORESTRY

Agroforestry is a collective name for land-use systems and technologies in which woody perennials (trees, shrubs, bamboos etc.) are deliberately combined on the same management unit with herbaceous crops and/or animals, either in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economic interactions among the different components. (After B.O. Lundgren)

One of the most pressing threats to protected areas in humid tropical forest regions is the clearance of land for agriculture. Steady encroachment into the boundaries of national parks is an understandable human response to shortage of land for subsistence farming, but one which can seriously undermine the status of areas set aside for conservation. The designation of buffer zones can be a means of easing the agricultural pressures on national park boundaries and of promoting methods of farming which are compatible with conservation.



Cardomum growing in an agroforestry scheme. Photo: J.R. MacKinnon

MODIFICATION OF AGRICULTURAL SYSTEMS REQUIRES AN UNDERSTANDING OF EXISTING SYSTEMS

Shifting agriculture is the traditional practice in tropical moist forest regions, where it has in the past been operating in an environmentally sustainable way. Ecologically stable shifting cultivation systems do, however, presuppose a low human population density so that the periods of forest fallow are long enough to allow natural processes of regrowth and regeneration. Unfortunately, with increasing population pressures and the resulting short fallow periods, shifting agriculture usually leads to environmental deterioration (see Example 10). Modifications to shifting cultivation systems, or the introduction of new, more settled and intensive forms of agriculture, will usually be required in the sensitive areas adjacent to national parks. Modification of the land use calls for an understanding of existing systems and a programme of research. Changes should not be uncritically imposed as management solutions.

CONSIDER THE DEVELOPMENT OF AGROFORESTRY IN BUFFER ZONES

Agroforestry systems are those which integrate farming and forestry. They are relevant for buffer zones, particularly where local population densities call for relatively intensive utilisation of resources. Shifting cultivation itself has involved some elements of agroforestry by leaving certain trees in cleared areas and by encouraging the growth of soil-enriching trees and plants. More complex forms of agroforestry - such as home gardens - have developed as a traditional response to increased population pressures on the land. The management of buffer zones allows for the enhancement of whatever local cultivation systems exist and, where appropriate, for the introduction of new ideas and techniques. Agroforestry involves the retention or planting of trees in an integrated farming system and is thus highly appropriate in a forest environment.

USE INDIGENOUS SPECIES

Wherever possible, indigenous trees should be used in buffer zones associated with tropical forest protected areas. Where some clearing is necessary to introduce agroforestry, the trees that provide maximum benefit to the local people should be retained. A wide range of forest products may be supplied from the indigenous trees (as outlined in the last section) and multi-purpose trees are generally the ones more favoured by local people. Naturally-occurring species are likely to be those offering most ecological benefit.

The use of indigenous crops in buffer zones can be a very important way of conserving wild relatives and locally-adapted land races of commercially important species. Wild mangoes are, for example, being conserved in the Kutai National Park in Kalimantan. Successful conservation is dependent on the knowledge of the local Dayak people, as Example 12 explains.

The introduction of new crops into an agroforestry system may be necessary, but exotic species should always be introduced with great caution into national park buffer zones, and avoided wherever possible.

ENCOURAGE NATURAL SYSTEMS AND DIVERSITY OF CROPS

As far as possible, agroforestry systems should reflect natural conditions, both in terms of species composition and structural characteristics. In general, the greater the diversity of plants within the farming system, the more environmentally stable the managed land will be.

As with any other managed system, however, "naturalness" will of course be lost; agroforestry is a compromise between the undisturbed forest and intensive agriculture or forestry land. The development and management of agroforestry in buffer zones requires decisions on what the appropriate levels of compromise are. The overall goal should be to combine maximum efficiency of production with minimum ecological disruption, for the benefit of local people. The gradation between undisturbed forest and agricultural land is seen in the buffer zone associated with Bawang Ling Nature Reserve in Hainan, China. Agroforestry systems are being studied in this area as part of an integrated ecosystem research programme carried out by Academia Sinica and German research institutes. This is described in Example 11.

ENCOURAGE PRODUCTION FOR LOCAL NEEDS

The production of cash crops would depend on the needs and aspirations of local people. Cash crop production, although providing financial incentives and local employment, usually requires the introduction of agrochemicals associated with agricultural intensification which would be ecologically undesirable in buffer zones. In general, it is preferable to encourage production for local use and to endeavour to provide employment more directly appropriate to the conservation aims of the protected areas.

Box 5: Benefits of agroforestry in buffer zones

Environmental benefits

1. Retention of trees minimises changes in local climate and provides shelter for annual and perennial crops.
2. Retention of trees helps to enrich soil fertility and maintain soil structure.
3. Retention of trees helps to prevent soil erosion.
4. Trees provide habitats for wildlife, which may include predators of harmful insects and rodents.
5. Utilisation of local tree species can help in their conservation

Social benefits

1. Diversity and seasonal spread of farm products increases stability of the farm system.
2. Retention of indigenous trees allows the continuation of traditional harvests.
3. Local collection of wood, food and medicinal products from trees reduces the need to transport or buy them from other sources.
4. Economic insurance is provided by the store of saleable wood.

Example 10: Shifting agriculture and rain forest management in north-east India

Shifting agriculture, known locally as "jhum", is the main land use in the tropical forest areas of the hill regions in the north-east of India. The jhum system is a highly complex form of land use, involving up to 35 crop species. Pig husbandry, based on crop residues and grazing, is an integral part of the system.

Jhum is extremely energy-efficient and also allows for an efficient recycling of nutrient resources. Increasing population pressure has, however, led to shortening of the fallow phase in the system which, in turn, is leading to "desertification" of the landscape, despite high rainfall. Research on the jhum system has shown that a 10 year cycle is the minimum length for jhum to function successfully, both ecologically and economically. This time span allows for secondary forest succession to build up soil fertility lost through forest clearance. It also helps in weed control; after about five years of secondary succession weeds are suppressed by larger shrubs and trees.

Alternative land use strategies have failed to provide a satisfactory replacement for jhum. Valley cultivation, although a successful alternative, is limited by topography. Terracing has led to increased leaching of the fragile soils and total degradation of the land after 6-8 years of continuous cropping. High inputs of expensive organic fertilisers and herbicides would be necessary to maintain terrace cultivation. Additionally, social considerations do not favour terracing, as the land is held under communal tenure rather than by individuals.

Generally, development strategies for tribal people of tropical north-east India have failed because they have been based on value systems imposed from outside. Development strategies must be based on an understanding of the traditional ecological and social systems. Research on the agricultural practices of north-east India has led to the following recommendations for development:

1. Development of valley cultivation, where appropriate using improved crop varieties.
2. Development of a plantation/horticultural economy on a cooperative basis.
3. Improvement of jhum by varying species composition in crop mixture.
4. Strengthening of agroforestry and ecological principles in the jhum system, for example by introducing nitrogen-fixing trees and shrubs and planting a shelter belt of forest and fruit trees along the jhum plot boundary.
5. Development of animal husbandry, particularly for pigs and poultry, to supply protein needs and a source of income.
6. Promotion of more efficient energy use, such as improved cooking stoves and biogas technology.

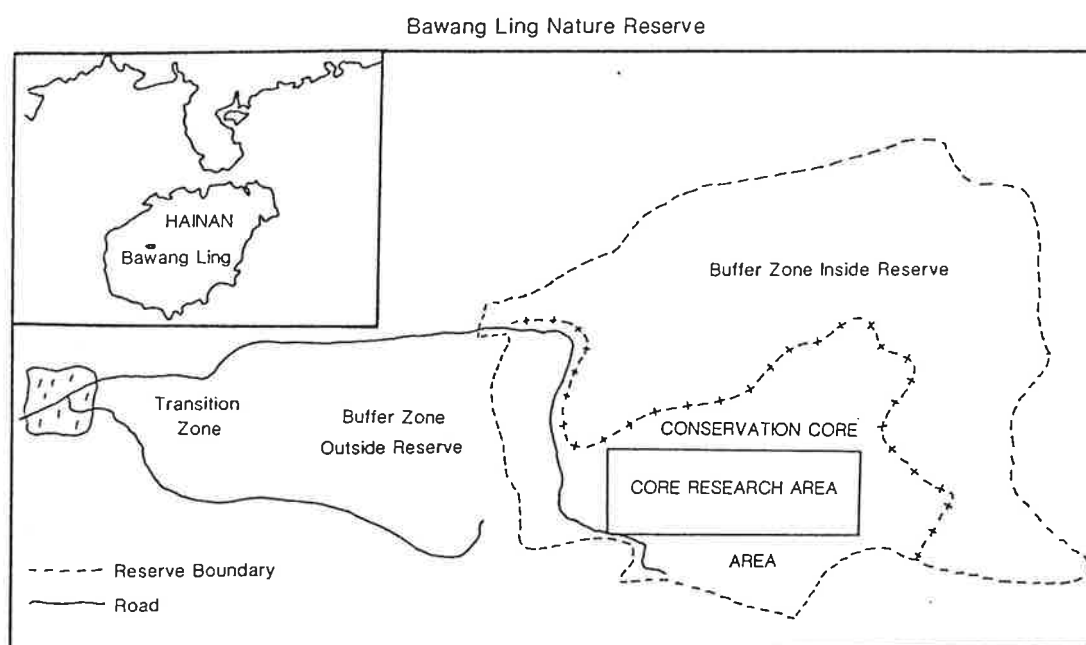
Source: P.S. Ramakrishnan

Buffer Zone Management in Tropical Moist Forests

Example 11: Agroforestry and conservation at Bawang Ling, Hainan

In Hainan, China, shifting cultivation, rubber plantation establishment and timber exploitation for export to the mainland have reduced tropical moist forest to a few remnants in the upper lowland and montane zones. Bawang Ling Nature Reserve, situated in the west of the region, is one of the best remaining areas of intact natural forest of the region. It is of outstanding conservation importance.

Around Bawang Ling is a transitional zone of different vegetation types which buffers the intact forest core. The transitional zone links the core area to cultivated land through a series of vegetation and crop types of increasing simplicity and intensity of human impact. The buffer zone consists of selectively logged oak-dipterocarp forest, forest enriched with *Litchi chinensis* and degraded scrub and grassland partly planted with *Cunninghamia* and *Pinus*. A little further away (about 2 km from the core forest) are agroforestry plantations and agricultural land of Bawang Ling village.



The agroforestry plantations are experimental schemes being developed by local Forestry and Agricultural Stations. They consist mainly of teak under-planted with *Amomum*, *Cinnamomum camphora* and other species including *Lanea grandis* used for growing mushrooms. The experimental programme is being further developed to produce mixed crops of trees, shrubs and perennial and annual field crops.

The core and buffer areas of Bawang Ling are being used as an integrated ecosystem research programme under a MAB scheme carried out by Academia Sinica and German research institutes. The long-term objectives of the research programme are to determine:

- the critical factors and functional key elements which control ecosystem function, stability and productivity in terms of human needs;
- how durable the ecosystems of different design are and how they can be sustained;
- the results of any kind and intensity of reduction of species richness, diversity and complexity;
- optimal biocybernetic designs for sustained management of ecosystems at the level of natural or man-made forest stand, ecoform, village, region or economic sector.

Source: Eberhard F. Bruenig and Huang Ya-Kwen

Example 12: Mango conservation in Kutai National Park, Kalimantan

Kalimantan is the centre of origin for a number of important tropical fruit trees, including species of mango, durian and breadfruit. A recent study has shown that of 16 species of mango *Mangifera* which occur in East Kalimantan Province, 13 are edible. Individual mango trees are widely scattered throughout the forest, and the conservation of species in the wild requires large undisturbed areas. Some species have been recorded in Kutai National Park.

Conservation of wild mangoes within protected areas can only form part of a programme to preserve the full diversity of edible forms. Most of the edible species have been brought into semi-cultivation and are grown in the ladangs or surrounding secondary forest near to settlements. The semi-cultivated species and primitive cultivars, together with wild relatives of cultivated species, represent a unique gene-pool which is closely linked to traditional life-styles. Local Dayak people are a rich source of knowledge on the genetic variety of mangoes and the conservation of the breeding potential of the fruit is dependent on the wise use of this knowledge.

Traditionally, shifting cultivators in Kalimantan did not cut down fruit trees or other useful species when clearing the forest for agriculture. Other groups, such as the Punan nomadic hunter-gatherers, planted wild fruit trees along their migration routes, both for food and to attract wild animals. The sedentary groups of Dayaks, settled along rivers, still set up temporary encampments in the forest during the fruit season to collect wild mangoes and other fruits. Sadly local knowledge of the wild fruit resources is being lost as life-styles change; at the same time, increasing pressures on the forest lead to the loss of valuable fruit trees. Newcomers to Kalimantan, such as the settlers from Java, have no knowledge of the different mango species.

Buffer zone schemes, with their emphasis on meeting local needs, provide ideal opportunities for the conservation of semi-cultivated plant resources and land races which may not be possible in strictly protected natural reserves.

Source: J.M. Bompard and A.J.G.H. Kostermans. Preliminary results of an IUCN/WWF sponsored project for conservation of wild *Mangifera* species in situ in Kalimantan.

Example 13: Tree crops in buffer zones in northern Sumatra

An FAO/World Bank proposal for buffer zones around the Gunung Leuser and Kerinci National Parks in Sumatra includes provision for the establishment of tree crop plantations. These are seen as creating a psychological and physical barrier against encroachment and also creating local employment. Tree planting activities will be concentrated in specific areas along the boundaries of the national parks such as in the Alas Valley, permanently settled arable land penetrating Gunung Leuser (see Example 9).

Forest plantations will be grown within the buffer zones to provide fuelwood, poles, and sawlogs and to establish protective cover on exposed critical lands. In the Alas Valley, for example, fuelwood and construction wood plantations are necessary. Illicit felling of trees for building material has been a particular problem in the valley with the wood sold to small local sawmills. In addition, a selection of cash crops have been recommended for planting as part of agroforestry development within the buffer zones.

Cash crop selection was based on plantation species which are already grown locally or are proven successes in similar conditions, availability of seed, ability to coppice, rates of growth and end-use prospects. Cash crops include robusta coffee *Coffea canephora*; kemiri *Aleurites moluccana*, the fruit of which yields oil used in the manufacture of medicine, paint and varnish; durian *Durio spp.* and cinnamon *Cinnamomum burmannii*. Further possible crops suggested are cocoa, rubber, cloves, nutmeg, rattan, and ipil ipil. These will be grown experimentally in plantation demonstration areas which are proposed primarily for training purposes.

Each proposed planting site for tree crops will require a small village nursery to rear planting stock. Nurseries would be approximately one hectare in size, with very simple equipment, and capable of producing 400,000 seedlings per annum. Each nursery would require one officer-in-charge preferably recruited from the local village.

It is hoped that the development of agroforestry with improved techniques of reforestation and cash tree crop farming will improve the livelihood of farmers and improve understanding of national park objectives in the adjacent communities. Previously these communities, who rely on the forests, had derived no direct benefits from national park designation.

Source: Anon (1981). Indonesia forestry project pre-preparation national park buffer zone development. Working document 4. FAO/World Bank Cooperative Programme Investment Centre.

FOREST MANAGEMENT

The forest management system adopted for a particular buffer zone will depend on the legal status of the land, its biological characteristics and species composition, and the nature of existing land use. In some cases, maintenance of forest cover for watershed protection will be the most important objective. In other areas, reforestation may be necessary to restore degraded areas.

Frequently there will be pressures on the land to exploit the forest for timber. Commercial forestry practices in the tropics have generally had totally different objectives to those of wildlife conservation. Increasingly, however, management systems for conservation and for timber production are not seen as mutually exclusive and common ground is being recognised.

Sufficient areas of undisturbed moist forest must be legally reserved for conservation purposes - but surrounding areas of logged forest can provide a buffer function - provided the modified forest cover is maintained. Controlled logging is often likely to be more acceptable to governments than restricting use of buffer zones to "traditional harvesting". Management which allows some logging of valuable timbers may enable larger areas to be retained as forest in the long term.



Deforestation near the Taï National Park, Côte d'Ivoire. Photo: J.R. MacKinnon

AVOID CLEAR FELLING AND THE ESTABLISHMENT OF INDUSTRIAL PLANTATIONS IN BUFFER ZONES

Wherever possible, timber cutting in buffer zones should be restricted to that required for local use. Where commercial forestry is already being carried out this should be managed so as to minimise damaging ecological effects. Commercial extraction of timber from tropical moist forests varies in its intensity and the degree of disturbance to the ecosystem. Although selective logging of valuable timbers at a low level of extraction may be acceptable in buffer zones, clear felling and replacement with industrial forest plantations is unsuitable.

Buffer Zone Management in Tropical Moist Forests

The development of uniform single-species plantations for commercial timber production is generally not an appropriate land use option for buffer zones of protected areas because of the impact on core forests. The chemical inputs and mechanisation used in intensive management of industrial timber plantations can have wide-ranging effects on soil structure, nutrient balance and soil stability, and the use of pesticides will be detrimental to the species diversity of adjacent undisturbed forests.

TIMBER PLANTING FOR LOCAL USE MAY BE NECESSARY

There may be instances where small plantations of tree species to supply local needs are necessary and desirable. As far as possible, indigenous species should be used. The proposed buffer zone function of areas adjacent to Dumoga Bone National Park in Sulawesi, Indonesia, includes the establishment of plantations of firewood, timber and rattan for local use (See Example 17).

There are some situations where small-scale planting of exotic species may be beneficial. In densely-populated areas planting can supply local timber needs, provide employment and create a protective barrier around the natural forests. In Rwanda, for example, an effective barrier against illicit exploitation and encroachment into the Nyungwe forest has been created by the establishment of plantations of Eucalyptus and other fast growing species as a buffering band around the relict natural forest. The conservation status of the Kakamega forest in Kenya is likewise thought to have been enhanced by the establishment of industrial wood plantations around the outside of the natural forest.

Local tree planting programmes should be based on an understanding of existing tree cultivation or management systems and, where appropriate, incorporated into agroforestry schemes. In heavily-forested areas however, traditional tree management systems may be absent because of the abundance of naturally-occurring resources. In such areas tree cultivation may be necessary to supplant gathering from the wild of species which have been over-exploited.

BASE TIMBER PRODUCTION IN BUFFER ZONES ON NATURAL FOREST MANAGEMENT

The aim of forest management in areas close to national parks should be to manage timber resources in a sustainable way based, as far as possible, on an understanding of ecological principles. Systems of natural forest management have been tried in many tropical areas but rarely maintained for any length of time; the urgency for more widespread application is now apparent. Buffer zones, whether formally designated areas of forest or ill-defined areas adjacent to national parks, provide ideal locations for natural forest management to be established. The necessary requirements for successful natural forest management are outlined in Box 5. Examples 14 and 15 show how commercial logging and wildlife inter-relate.

USE INDIGENOUS TIMBER SPECIES IN BUFFER ZONE PLANTATIONS

As a complement to natural forest management, plantations of indigenous species could make a valuable contribution to sustaining supplies of forest products from buffer zones while increasing the habitat available to native non-timber species (see Example 20). Indigenous species could be used as pure stands on sites which are already deforested, or for enrichment planting of degraded forest. Large-scale monocultures of local species are likely to result in ecological imbalance and serious problems of pests and diseases. In the past a small number of exotic species have usually been used in tropical plantation forestry. The reasons for this are as follows:

1. There is a tendency to model forest plantations on temperate forestry, where exotics are paramount.
2. More is known about the silviculture of exotics and the best choice of provenance. Hence the risks of failure are smaller than for lesser-known species.

Buffer Zone Management in Tropical Moist Forests

3. Exotics are generally faster-growing than local species and are thus suitable for industrial plantations for pulp and paper, though they do not provide the quality timbers on which the timber trade of many tropical countries has been based.
4. The slower growth and long rotations of local species has discouraged investment in plantation establishment and research.
5. Seed supplies of many local species are irregular, difficult to collect, heavily attacked by pests, pathogens and predators, and frequently of low and short viability.
6. The seedlings and young trees of some of the most desirable quality hardwoods, like the mahoganies, have severe pest problems that stunt growth and result in trees of poor form.
7. The management of young plantations can be difficult and expensive.

Despite the immediate economic advantages of planting exotics, there is a growing realisation that, as tropical forests are cleared, the stocks of prime species are becoming so low that the export trade is no longer sustainable and serious attempts are needed to replant these valuable species. This was the situation, for example, with obeche *Triplochiton scleroxylon* one of West Africa's most valuable timber species, which is now being established as a plantation species (see Example 16).

Box 6: Natural forest management systems

Natural forest management systems are based on techniques to promote natural regeneration of desirable timber species. Five conditions have been identified for successful forest management programmes; these are essential for timber extraction adjacent to protected areas:

1. The land must remain in forest use after the harvest of the existing timber crop.
2. Harvesting operations must not impair the ability of the forest to maintain or re-establish a "natural" structure composition.
3. Harvesting operations cannot impair the environmental and social functions of the forest.
4. Harvesting methods must ensure that adequate regeneration is induced or adequately released if present.
5. The rate of timber harvest must not exceed the sustained yield capacity of the forest being managed.

Source: Ralph Schmidt, FAO

Box 7: The effects of logging on wildlife

- Any level of forest damage during logging may result in the loss of species.
- Selective elimination of large trees of particular taxa will eliminate their specialised canopy insects and epiphytic plants.
- Specialist mammals of timber trees will suffer through logging. Bearded saki monkeys *Chiropotes*, for example, are lost in the eastern Amazon through logging of their food trees which are valuable timbers.
- The decomposer fauna and flora of tropical moist forest soils can be seriously effected by microclimatic changes caused by fragmentation of the canopy. In a study of termites, one of the most important groups of decomposers in tropical environments, the species richness of a selectively logged forest in Sarawak was only half that found in an unlogged forest. In cleared forest the fauna was further reduced to 25 per cent.
- Smaller vertebrates are also intolerant of microclimatic changes associated with logging; understory insectivorous birds may be physiologically stressed in the harsher environment of secondary forest; and small insectivorous bats may lose suitable roost sites through logging.
- Most large mammals, however, are resilient to the effects of logging. Large wide-ranging vertebrates are rarely lost where a mosaic of primary forest and logged areas is created. Browsing species such as elephants and deer typically congregate within the food-rich, recently logged patches.

Sources: Andrew Johns, Mark Collins



Mountain Anoa, a species endemic to Sulawesi, occurring within the Dumoga Bone National Park. Photo: J.R. MacKinnon

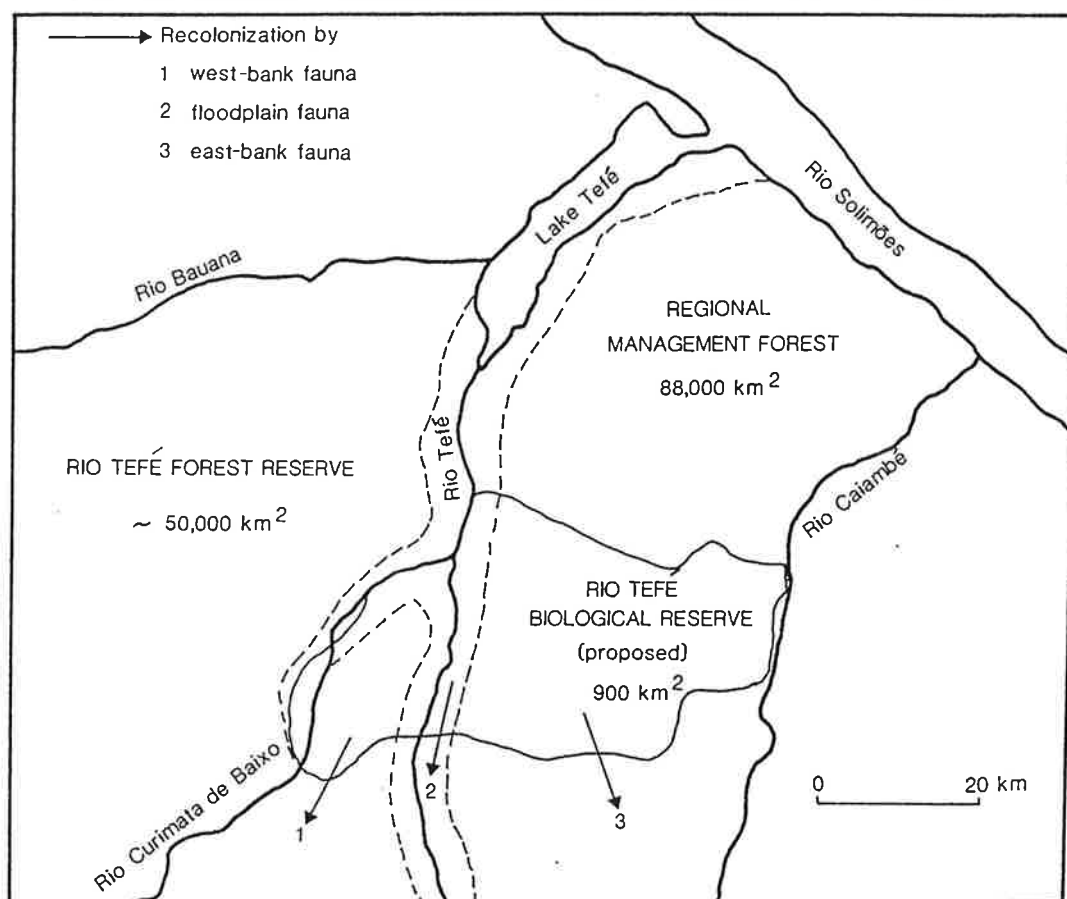
Example 14: The impact of logging on forest adjacent to the Rio Tefe Forest Reserve, Amazonas, Brazil

A study was carried out in 1985 to look at the use by vertebrate species of selectively-logged forest along the edge of the primary forest reserve at Rio Tefe, Brazil. Logging had been carried out 11 years previously, in a rather careless way; while only 3-5 trees were extracted per hectare, sixty per cent of trees were destroyed.

Of twelve primate species occurring at the site, two, spider monkeys *Ateles* and woolly monkeys *Lagothrix*, were almost entirely restricted to the primary forest areas, making only short forays into logged forest. All the smaller monkeys (tamarins *Saguinus*, squirrel monkeys *Saimiri*, titi monkeys *Callicebus*, and saki monkeys *Pithecia*) are well adapted to edge or naturally-disturbed vegetation types and were more common in the logged than in the unlogged areas.

To preserve the more specialised monkeys, such as the spider and woolly monkeys, large areas of primary forest would be required. Groups occupy ranges of up to six square kilometres, and therefore blocks of a minimum size of 500 square kilometres would be necessary to support populations of 10,000 individuals.

Rio Tefé Biological Reserve located as a pool of colonisers for fauna species



Buffer Zone Management in Tropical Moist Forests

The avifauna of the 11-year-old logged forest was quite similar to that of the primary forest. Since a canopy (mostly of *Cecropia*) had re-established microclimatic conditions close to those of the primary forest, even intolerant species such as antbirds (Formicariidae) and foliage-gleaners (Furnariidae) were observed using the logged forest. Mixed-species foraging flocks may well range extensively between both primary and logged forest.

Evidence from elsewhere in Amazonia suggests that recently-logged forest may be colonised by a group of non-forest species, but that these are temporary additions to the fauna. Providing a primary forest refuge - or areas of old logged forest - remain in proximity to recently-logged blocks, these species are replaced as a stable seral community is established. In isolated logged forests, or in small primary forest "islands" suffering faunal relaxation, these species are retained. To preserve the natural fauna in this case, large blocks of primary forest would be preferable, but a mosaic of primary and logged would suffice if the former is impractical. This has been recommended, for example, in a recent report on the Rio Tefe Forest Reserve.

Source: Andrew Johns

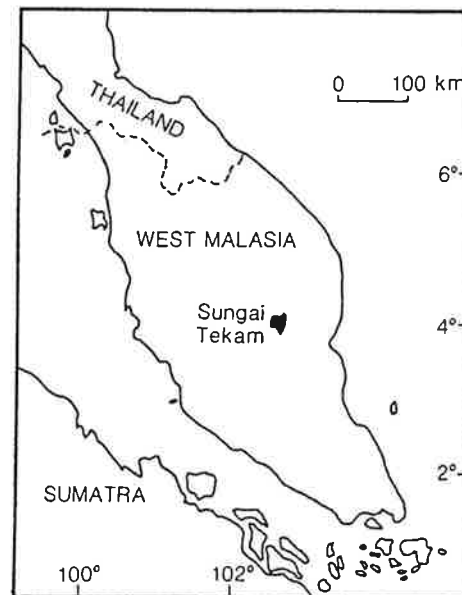
Example 15: Logging and wildlife in the Sungai Tekam Forestry Concession, Pahang, West Malaysia

The Sungai Tekam forestry concession is a 315 square kilometre commercial, sustained-yield logging concession which has been the site of various studies. It is not part of a protected area but provides information relevant to buffer zone management.

The concession is a typical hill dipterocarp forest, of which 3-5 per cent is unloggable. These patches, located on steep slopes, plateaux or waterlogged areas, act as wildlife refuges. They contain a number of vertebrates, such as babblers Timaliidae which are largely lost from recently-logged forest. Populations of such intolerant species are able to move outwards from the small refuges to recolonize older logged forest. Evidence from another site, Pasoh Forest Reserve, Negeri Sembilan, suggest that all species have recolonised within 25 years of logging.

Undisturbed patches at Sungai Tekam are used as concentrated food source by various frugivorous birds such as hornbills Bucerotidae and green pigeons *Treron*, but these birds also range widely over logged areas. They feed on only a few kinds of fruit produced by early-successional trees, but appear able to travel between whatever fruiting canopy trees remain. Most mammals have sufficiently variable diets that they are either able to adjust their foraging to take account of the differing availability of food types, as with monkeys and squirrels, or, as with elephants, tapirs and gaurs, they make use of the regenerating undergrowth itself. Gaurs are wide-ranging and able to travel between both primary and logged patches; they may retreat to the primary refuges to avoid human disturbance, but are more commonly seen in logged than in primary forest.

Location of Sungai Tekam
Forestry Concession



Studies are continuing at this site but results so far indicate that few vertebrate species are lost by logging of 18 trees per hectare, causing a total damage level of 51 per cent trees destroyed. Almost all the vertebrates that avoid recently logged areas are retained in the primary forest patches left due to difficult terrain. Whether the 3-5 per cent left unlogged is sufficient to maintain populations in the long-term is unclear. Nevertheless, the fact that such a large proportion of the vertebrate fauna currently persists in recently-logged forest with very small primary forest refuges is significant.

Source: Andrew Johns

Example 16: Development of West African timber plantation species

Obeche *Triplochiton scleroxylon* is one of West Africa's most valuable commercial hardwood species. Although quite widespread it has been heavily logged in natural forests. Obeche has been used in a major research programme, initiated in 1971 with research projects in Nigeria and Britain. This has implications for the development of commercially-important timber plantations in West Africa. The development of indigenous species plantations should help to reduce the pressures on remaining natural stands.

As a case study, the work with *T. scleroxylon* has illustrated that problems of irregular production and poor seed viability can be circumvented by the application of vegetative propagation, and that this is a relatively easy process, even in a species originally thought to be difficult to root. Perhaps more importantly, however, the establishment of rooted cuttings in clonal field trials in Nigeria has demonstrated the enormous intra-specific genetic variation that exists in out-breeding tree species. For example, from a sample of only 100 unselected clones, eight-fold variation was revealed in volume production over the first five years in plantation, with similar levels of variation in stem form. It is likely that similar variability exists in other important characteristics like wood quality and disease/pest tolerance. Insect attack is a serious problem in obeche plantation trials at present. Nevertheless, the prospect of forestry based on selected clones with high productivity, good timber quality, and insect resistance would overcome many of the reasons for limiting reforestation with indigenous species. Large genetic gains of 30-80 per cent (perhaps even 200 per cent as in *Eucalyptus*) should increase profitability and allow shorter rotations. The uniformity of the product can reduce the need for thinning, and allow wider spacing and hence mechanised plantation maintenance. This, in *Eucalyptus*, has resulted in cheaper plantation establishment with clonal planting stock. As the profit-motive is frequently the best means of promoting any cause, the application of clonal techniques to indigenous tree species (for any of a wide range of forest products) should greatly encourage their use in reforestation and promote tropical forest conservation. This could be enhanced by the application of these techniques to buffer zone planting for parks and reserves.

The approach developed for obeche could be beneficially applied to a much wider range of species, throughout the tropics, so providing an alternative resource of commercially-important species and taking the pressure off natural forests. With regard to local species for plantations, interest tends to be centred on those which have been either: (i) of commercial importance as constituents of the natural forest, or (ii) relatively fast-growing pioneer species which are easily grown in plantations. With the option of clonal forestry, it is possible to think of growing uncommon or even rare species, for which seed is scarce. Very little is known about the commercial potential of these. It may be preferable to choose species that are quick to establish on disturbed sites (i.e. pioneers), or which are able to grow at relatively high stocking density. Species which are only represented by one or two trees in a large area may be more prone to pests and disease if grown in close proximity. In other words, ecological suitability needs to be considered. At the Institute of Terrestrial Ecology near Edinburgh, UK, several dozen tropical timber tree species are being vegetatively propagated experimentally. The West African species undergoing research include:

Ceiba pentandra
Cleistophilis glauca
Chlorophora excelsa
Entandrophragma angolense

Buffer Zone Management in Tropical Moist Forests

Khaya ivorensis
Nauclea diderrichii
Terminalia ivorensis
Terminalia superba
Triplochiton scleroxylon

Source: Roger R.B. Leakey

Example 17: Small-scale forestry plantations planned for buffer zone of Dumoga Bone National Park, Sulawesi

Small-scale plantations of tree species for various uses are planned for the buffer areas of the Dumoga Bone National Park, Sulawesi. One zone will form an experimental forest plantation on formerly encroached cultivated park land. Around 500 hectares have been earmarked for the experimental forest with the use of tree species growing in the park and other species indigenous to Sulawesi. Growth rates and use of timber, fruit and firewood species will be studied.

Some exotics will be planted in the buffer zone to fulfill specific functions. For example, species such as *Calliandra* and *Acacia* will be grown for firewood in strips along the boundary with the park, thereby also providing a low maintenance boundary path. Boundary strip planting is planned for a total of 237 kilometres avoiding areas where the forest remains in a relatively undisturbed state. The planting programme will be implemented in cooperation with farmers owning adjacent land. They will be given the right to extract firewood and will be expected to maintain the boundary planting strip, working with the park personnel. Rattan plantations are proposed for a belt around the park in secondary forest and areas of forest re-growth within easy reach of settlement.

Source: Wind, J. (1984). Management Plan 1984-1989. Dumoga Bone National Park

Example 18: Social forestry in the management of the Cyclops Mountains Nature Reserve, Irian Jaya, Indonesia

The Cyclops Mountains Nature Reserve is an area of officially protected forest, ranging from sea level to approximately 1,880 metres, on the north coast of Irian Jaya. The reserve covers about 31,600 hectares, not all of which is officially gazetted. It has been recommended that the size of the protected area be increased and that a new boundary be defined in consultation with village communities along its periphery. The management plan drawn up in 1984 designates a system of zones within the reserve that allow for various activities other than strict protection. The plan forms the basis for community land use planning and management in the Cyclops region.

Social forestry is being developed to stabilise the reserve boundaries and assist the local communities. Four locations have been selected for social forestry projects. Farming, combined with hunting, sago harvesting and fishing, are the main occupations of the local people in the region. Gardens are planted on a rotational basis with crops including cassava, taro, sweet potatoes and tree crops such as mango, lime, jack fruit, coconut, nutmeg, cloves and betel nut. Details of the land ownership and land use systems differ at the four locations.

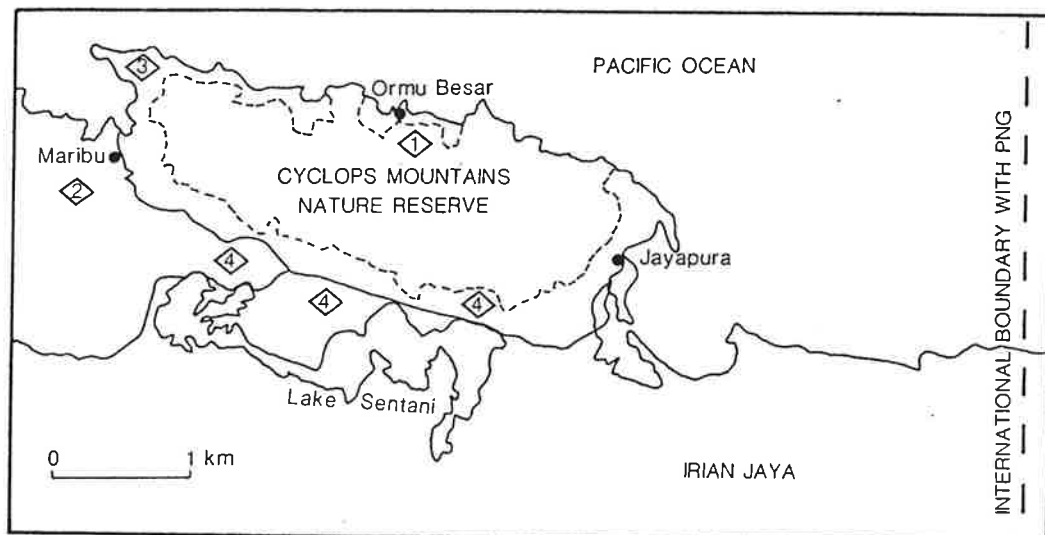
Two of the locations, Yawena and Ormu, are situated on the northern boundary of the reserve, between the edge of the steep mountains and the sea. Agreement on the reserve boundary, which has been fixed at 300 metres above sea level, has been signed by the village and adat leaders at Yawena. All the existing and future gardens will be below the 300 metre level. Between 300 metres and 500 metres is a buffer zone separating the cultivated land from the protection area of the reserve. Hunting and felling of wood for village use are allowed in the buffer zone and are controlled by the community. Tree planting is planned with timbers suitable for building and canoe construction, and commodity crops such as coffee in the former

Buffer Zone Management in Tropical Moist Forests

gardens, to prevent soil erosion on the steep slopes. Existing trees will be carefully managed. The buffer zone and protection area boundaries will be made by planting the variegated ti plant, *Cordyline* sp., and using natural markers such as boulders and streams.

The land use situation and zone boundaries at Ormu are similar to those at Yawena. The other two locations chosen for social forestry, on the southern border of the reserve, have been settled by immigrant groups and have more complex land use patterns. Slightly different social forestry solutions are proposed to ease pressures on the reserve. At Maribu cultivation, tree felling and unregulated orchid collection take place within the present reserve boundaries. Three land use zones have been identified in this area. Zone 1 is the strict protection reserve. Zone 2 is also within the reserve but is intended to serve as a buffer zone where hunting and sago harvesting would continue under controls set by the community. Zone 3, the outer buffer zone, is outside the reserve. It includes gardens, now mostly fallow, mixed with forest that could be managed for forest products. This multiple use zone contains five proposed social forestry sites. Suggested tree crops are rambutan, durian, and petai *Parkia speciosa*.

Location of Cyclops Mountains Nature Reserve



Ancestral lands of tribal groups - approximate location

- | | |
|--------|-----------|
| ① Imbi | ③ Tabla |
| ② Moi | ④ Sentani |

Four sites have been chosen for social forestry at the Sentani location. The land ownership and tenant situation in this area is complex; some land is owned by local Sentani people and some by recent immigrants mostly from south Sulawesi. Also several hundred people have been re-settled from the interior highlands by the Social Affairs Department and by mission groups. New gardens in and along the boundary are mostly being cleared by the immigrants from the highlands. Some rent the land from the Sentani whereas others do not. Problems are arising between the various groups and there are serious problems of forest protection. An agroforestry scheme has been suggested for this area. This would entail intercropping of fast growing crops with longer term tree crops such as kemin, acacia and possibly teak.

Source: Mitchell, A.H. (1987). Community managed buffer zone development in Irian Jaya. Social forestry pilot projects at Cyclops Mountains and Biak. Progress Report No.1. WWF/IUCN Project No. 1528

Buffer Zone Management in Tropical Moist Forests

Example 19: Forest management in buffer zones in Madagascar

The forests in and around the Andasibé reserve in the eastern humid forests of Madagascar are threatened by exploitation for charcoal. Legal restrictions on cutting are almost impossible to enforce because demand is so great and the financial incentives to contravene the law therefore high. A World Bank study has concluded that the only feasible solution is to legitimise the situation and then bring it under control to make it sustainable. Amongst the options being considered is that of harvesting small blocks or strips of forest which are small enough to be recolonised from adjacent forested strips. Natural regeneration would reconstitute the forest on the cut strips. The entire area would be harvested in this way on a long rotation cycle. It is believed that many of the species indigenous to the area and the ecological functions of the forest would be conserved under such a system.

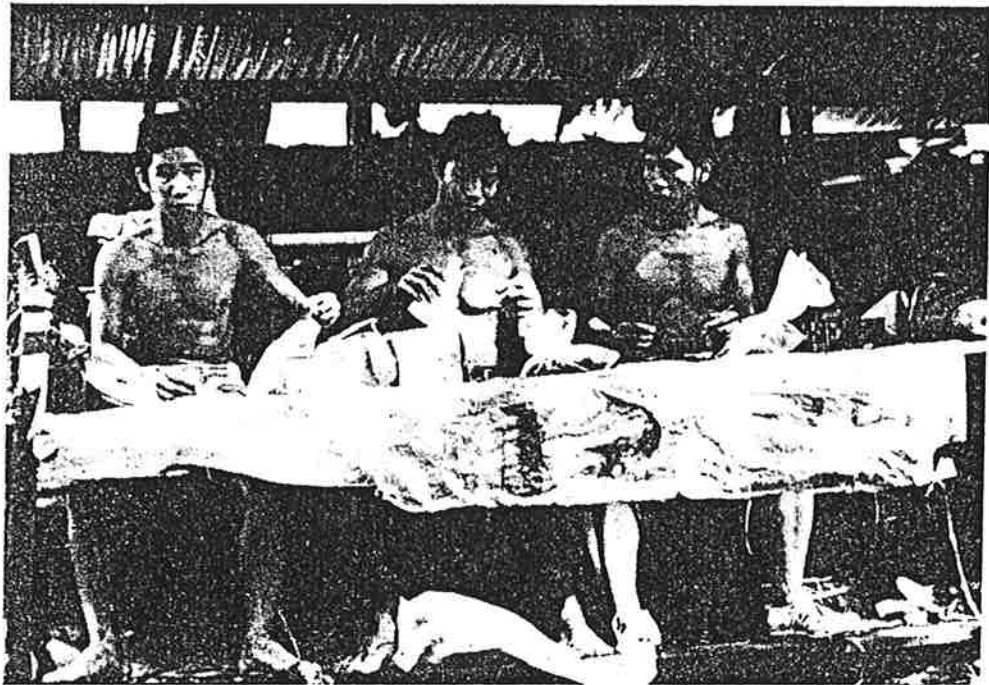
*Example 20: *Cephalosphaeria* plantations in the Usambaras in Tanzania*

Successful plantations of the monotypic endemic genus *Cephalosphaeria* - which produces valuable timber - were established several years ago in the Usambara mountains in eastern Tanzania. The extension of these plantations to rehabilitate degraded forest land around the relict patches of natural forest on the mountains could serve a useful function in taking pressure off these forests, and in ensuring the survival of this valuable endemic. *Cephalosphaeria* plantations will presumably constitute better habitat for the numerous endemic animals and plants of the area than would plantations of exotic species.

As a precondition to the establishment of the Uzungwa Mountains National Park the authorities in Tanzania have insisted on a commitment from aid agencies to establish fuelwood plantations in buffer zones, to compensate the local people for the loss of access to the forest which will follow national park gazettelement.

RESEARCH, TOURISM AND EDUCATION

The main aim of management in tropical forest buffer zones should be to provide for the needs of local people in a sustainable way, complementary to the conservation of the protected area as a whole. As well as fulfilling the immediate needs of local societies, however, buffer zones can be used to put into practice some of the ideas in the wider justification of protected areas. In situ conservation of potentially useful genetic resources is an important argument for setting aside large areas of tropical moist forest. The study of these resources could become an important component of buffer zone use. At the same time, education and tourism facilities could be appropriately sited within buffer zones, restricting the need for disturbance in core protected forest areas.



Sorting zoological specimens in the field. Gunung Mulu National Park, Sarawak. Photo: Mark Collins

Buffer Zone Management in Tropical Moist Forests

RESEARCH, EDUCATION AND TOURISM PROGRAMMES SHOULD PROVIDE LOCAL EMPLOYMENT

The provision of research, education and tourism facilities should help to provide local employment in jobs beneficial to conservation and to involve local people in the running of the protected area.

Research

All management in buffer zones will involve an element of research, because zoning in tropical forest protected areas is a new, relatively untried concept. In addition, specific research programmes could be established covering both pure and applied research. Applied research may be best directed at:

- sustainable utilisation of local species;
- propagation and breeding of endangered species;
- regeneration of disturbed habitats.

These three general categories will promote both the overall conservation aims of the protected area and help to satisfy the needs of local people.

Research into the propagation and breeding of endangered species should primarily facilitate conservation programmes for these species and the potential restocking of core areas of the protected forest. Examples of breeding programmes for tropical forest endangered species, carried out in their natural habitat, include the study and reintroduction of the golden lion tamarin *Leontopithecus rosalia* into the Pocos das Antas Biological Reserve, Brazil; and the Bohorok Rehabilitation Centre in the Gunung Leuser National Park, Sumatra. The value of the Bohorok Centre for orang-utans as a tourist attraction is outlined in Example 26.

Obvious benefits of carrying out such research in buffer zones is the availability of stock material in optimal environmental conditions. With plants, for example, natural pollinators will be at hand and expensive attempts to recreate natural temperature and light conditions will be unnecessary. A botanical research project being carried out in Sinharaja Biosphere Reserve shows the kind of research which will yield useful results for buffer zone management. This is outlined in Example 22.

Propagation and breeding research may ultimately provide the basis for sustainable utilisation of previously over-exploited species. This is particularly so for plants and invertebrates, where propagation is relatively rapid and can lead to a large surplus. Butterfly farming has, for example, been successfully established in a number of tropical moist forest areas. A new scheme in Belize, which integrates research, is described in Example 23.

Applied research may be particularly attractive to funding bodies - both those involved in maintenance of biological diversity and those involved in rural development. The establishment of research facilities should also be beneficial in attracting scientists working in pure research and this may indirectly generate funds for protected area management.

Current plans for the Dumoga Bone National Park, in Sulawesi, include the development of an international centre for tropical moist forest research. This will be located - along with experimental forest plantations - in an area of former encroachment into park boundaries. The scheduled research facilities and research programme are outlined in Example 21.

RESULTS OF RESEARCH SHOULD BE WIDELY DISSEMINATED

The results of research carried out in buffer zones should be widely disseminated so that ideas can be modified for use elsewhere.

International programmes have been established to coordinate research work in tropical forest ecosystems. Of particular relevance for management of buffer zones in these areas are the Unesco Man and Biosphere Programme (see Box 2) and the Tropenbos Programme (see Box 8).

Example 21: Research at Dumoga Bone National Park, Sulawesi, Indonesia

The plans for Dumoga Bone National Park include the development of research facilities at Toraut for scientists and students. These will include a laboratory, guest house, recreation building, kitchen and a small medical centre.

Successful development of the research programme will be based upon the following strategies:

1. Appointment of a research station manager able to correspond with local and foreign scientists and scientific institutions.
2. Close integration of the Toraut Research Centre with the local university Sam Ratulangi, Manado (UNSRAT), and other Indonesian universities and institutions. UNSRAT may be authorised to coordinate all research programmes, and to use the station for their field research.
3. Establishment of a research programme with UNSRAT, for experimental farming, buffer zone development and provision of park land to implement this programme. The proposed location is about 500 metres from the research station.
4. Establishment of experimental forest plantations with Litbanghut (Forestry Research Institute). These will be in the formerly- encroached river plains of Kosinggolan and Toraut, within close distance of the research station.
5. Programmes to attract scientists to the park and its research facilities by:
 - Distribution of information about the park, its wildlife, unique features and established facilities.
 - Exchange of information and cooperation with international conservation organisations.
 - Continuous updating of the list of park species, with details of their distribution and population.
 - Systematic recording of visiting scientists; including their research subjects, collections, and reports.
 - Training of guides to assist scientists with their fieldwork surveys, and inventories.
 - Establishment of long-term monitoring schemes, vegetation plots, marking of trees, reference collections.
 - Access to park areas; establishment of forest trails mountain huts, camping areas and local transport facilities.

During 1985 the Royal Entomological Society of London fielded a team of scientists at Dumoga Bone. Known as "Project Wallace", the venture was joint with the Indonesian Institute of Scientists and included over 100 Indonesian and European scientists. A team from UNSRAT joined the project and a number of training seminars for Indonesian students were held during the year. The vast number of publications now accruing from this project will make Dumoga Bone a scientific focus in years to come.

To encourage continuity of research at Dumoga Bone, Project Wallace provided funds for renovation of disused buildings originally put up by the Toraut irrigation scheme, which are now suitable for visiting scientists. A laboratory for 20 or so students has been erected nearby using money from the World Bank, and the Royal Entomological Society paid a generous sum towards equipment for the laboratories. The Indonesian government has since erected a new guest house for visiting scientists.

Sources: Wind, J. (1984). Management Plan 1984-1989 Dumoga Bone National Park.
Mark Collins

Buffer Zone Management in Tropical Moist Forests

Example 22: Sinharaja Research Programme

Botanical studies are being carried out in the Sinharaja Biosphere Reserve to provide basic information for future programmes of propagation and breeding and to provide a scientific base for management and conservation of the forest's genetic resources.

- Population Structure. Phytosociological surveys are being carried out to describe the population structure of each species, and to measure mortality, from flower bud initiation to seedling establishment, establishing causes of mortality where possible.
- Reproductive Biology, Pollination biology, mating systems and embryology of plant species are being studied to establish their intrinsic potential for gene exchange under forest conditions, and also their amenability to breeding. This will be useful in selecting variants for domestication under a variety of climatic and soil conditions.
- Genetic Diversity: Using evidence provided by allozymes, combined with biometric studies, patterns of genetic variation are assayed between and within wild populations.

It is envisaged that the results from this study will (a) facilitate the exploitation of native plant species in village home gardens or agroforestry systems; (b) provide estimates of genetic erosion due to current exploitation practices; (c) identify the principal biological and environmental needs for the survival of the species chosen and (d) contribute towards the development of a rational strategy for conservation and management of the species in the wild and in cultivation.

Ecological studies are also being carried out, looking at the contribution of primary production and nutrient cycling to soil fertility in the natural forest, deforested lands and forest plantations. This work includes a survey of mycorrhizal associations, in the various natural and modified forest habitats. Information collected on soil conditions will be useful in planning reforestation.

Source: I.A.U.N. Gunatilleke and C.V.S. Gunatilleke.

Example 23: Butterflies pay for research in Belize

Shipstern Reserve is a 9,600 hectare forest reserve in northern Belize, situated on the coast near the border with Mexico. Sustainable use of the tropical forest is a major objective of the reserve, with the aim that it will become financially self-supporting. The first sustainable yield to be harnessed is that of live butterflies. Butterfly breeding facilities being set up on the reserve include ten netting enclosures covering about one hectare of land, and gardens to produce food plants. Live pupae will be produced for the export market - mainly destined for the increasingly popular butterfly houses in Britain (see below).

Marketing of the captive-bred butterfly pupae will be a major source of funding for further development of the park's facilities. A visitor centre and research centre are planned. Research will concentrate on multi-disciplinary studies of ecology, applied land use and mariculture techniques compatible with local conditions.

Butterfly houses

Butterfly houses are heated greenhouses where tropical butterflies are flown for the education and amusement of paying visitors. The industry in Britain has a turnover in excess of £5 million per year from about 50 establishments, using half a million butterfly pupae per year. The interest is spreading rapidly in other European countries. The main suppliers of pupae are in Malaysia, the Philippines, India, Taiwan and USA, but growth is also expected in Central America, Indonesia and possibly Africa. Butterfly breeding is clearly an economic operation which can help in species conservation, provide funds for conservation programmes and create jobs associated with tropical forest protected areas.

Sources: Collins, M. (1987). *Butterfly houses in Britain: The conservation implications*. IUCN, Cambridge, UK, 60 pp and Annexes.

Zoe Walker (in litt.) Shipstern Reserve - Background Information.

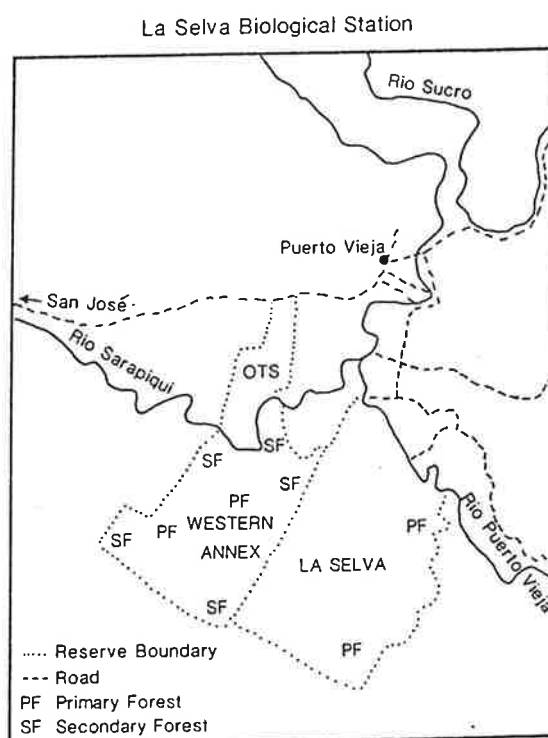
Example 24: Research and scientific tourism at La Selva reserve in Costa Rica

La Selva Reserve is an area of moist forest in the Atlantic lowlands of Costa Rica, with a total area of 1366 hectares. About 90 per cent of the reserve is undisturbed species-rich forest. There are over 1800 plant species, 388 birds and 143 butterflies in the reserve together with a wide range of other species. The remaining 10 per cent of La Selva was planted some years ago with cacao, peach palm and laurel. Parts of the disturbed areas have been converted to an arboretum and a rotational series of successional strips.

Research facilities at La Selva include a laboratory completed in 1983. This has air-conditioned work space for 30 researchers, a wide range of field and laboratory equipment, a library and taxonomic reference collections. Living accommodation is available for visitors. Access to the forest is facilitated by an extensive system of trails and bridges. Three permanent four hectare research plots were established in 1970 on the major soil types (residual, swamp and old alluvial). Computerised data are available on all trees 10 centimetres or more in diameter which occur in these plots.

Proposed research projects at La Selva are subject to the approval of the Organisation for Tropical Studies, Inc. (OTS) which has offices in Costa Rica and the USA. The conservation importance of La Selva is paramount and researchers are required to submit full details and scientific justification for any proposed collecting. Cooperation with local scientists is encouraged through OTS.

Researchers are given preference for the use of La Selva's facilities but other visitors may stay when space is available. Daily and weekly rates for accommodation, use of laboratory facilities and access to the forest vary according to the purpose of the visit. Preferential rates are offered to Costa Rican students and researchers.



Buffer Zone Management in Tropical Moist Forests

Education

It is most important that results of research are presented to local people in an accessible way and that any associated changes in management policy should be clearly explained. Provision of information and education are vital elements in any tropical forest buffer zone management plan.

EDUCATION SHOULD BE ACCESSIBLE TO ALL LOCAL PEOPLE

Education for local people should use whatever means are appropriate to reach all age groups and sectors of the community. Information should be relevant to local needs and emphasise the practical advantages of conservation policy. Education should also encourage local participation in management decisions and provide practical training related to conservation objectives. As far as possible local people should be trained for conservation-related employment.

TRAINING IN NEW SKILLS IS ESSENTIAL

Training for buffer zone management will be an important consideration for all protected area personnel. The multi-purpose aims of the buffer zone must be understood by all park staff. Training may be required to supplement wildlife and forest management skills with training for working with local people and administering novel research and tourism schemes.

BUFFER ZONES SHOULD BE USED TO EDUCATE VISITORS ABOUT CONSERVATION

Buffer areas provide the opportunity for education of the wider public, particularly where related to recreation and tourism.

Tourism

Buffer zone areas provide a suitable location for tourism facilities either related to the wildlife of the buffer zone itself or for carefully controlled visits to the core area. In general, extensive tracts of tropical forest may have limited appeal to visitors and imaginative schemes may be necessary to enhance the tourist interest. Activities within the buffer zones may add to the tourist potential of protected areas, either through the creation of attractive rural landscapes, or the development of captive breeding and propagation centres.

LOCAL KNOWLEDGE, SKILLS AND TRADITIONS SHOULD BE USED IN TOURIST PROGRAMMES

Local skills and traditions will enhance the tourism interest through for example, the construction of traditional buildings and gardens, and should therefore be encouraged. Locally-produced crafts, based on indigenous materials, and wildlife souvenirs can stimulate tourist interest and the rural economy. Sale of wildlife products must, however, be very carefully controlled to avoid any possible stress on wild populations.

Local knowledge of the flora and fauna can be usefully employed in the provision of visitor guides. A wilderness trekking programme associated with Khao Yai National Park in Thailand is, for example, using the knowledge of local villagers to bring tourism money to the rural economy (Example 25). The trekking programme is one of the means of improving park protection by promoting the values of conservation to local people. Although in its infancy, the development of trekking has already led to substantial improvement in cooperation between local villagers and park authorities.

Buffer Zone Management in Tropical Moist Forests

Facilities for recreation and tourism are also envisaged as part of the management of Dumoga Bone National Park. These will be located in buffer areas, with the recreation facilities catering primarily for day visitors.

A small safari park/arboretum area is planned where visitors can see Sulawesi wildlife in semi-natural conditions. A system of nature trails, with small camping areas and education programmes, is also being developed. Intensive tourism facilities including restaurants, hotels and large camping areas, will be established outside the park.

PROVISION OF TOURIST OBJECTIVES AND FACILITIES SHOULD BE DEVELOPED IN ASSOCIATION WITH REGIONAL AND NATIONAL TOURIST AUTHORITIES

The development of tourism in buffer zones necessitates the development of visitor transport, administrative and marketing facilities. These may most effectively be organised in association with tourism and rural development authorities.

Box 8: Tropenbos Programme

New approaches to the conservation of tropical moist forests call for an understanding of both biological and social processes operating in the forest ecosystems. Understanding how these processes inter-relate, for example, is important in designing management systems for the buffer zones of tropical forest protected areas. An international research programme called Tropenbos is coordinating the study of causes and effects of tropical deforestation, and possible remedies. The Tropenbos programme recognises that biological solutions have to fit within the social and cultural framework of the local inhabitants.

The Tropenbos programme is currently coordinating research at six locations:

- *South America*: Tapajos region, Brazil; Avaracuara region, Colombia
- *Africa*: Taï region, Côte d'Ivoire; Cristal Mountains, and/or Makakou, Gabon
- *Asia*: East Kalimantan, Indonesia; Kerinci National Park, Indonesia

Research

Work at Taï, in the Côte d'Ivoire, includes a detailed study of the Parc National de Taï and its buffer zone, which will help to solve problems caused by recent human settlement (see Example 6). Land use and buffer zone management studies are also being carried out for Kerinci National Park. At all the above sites both biological and socio-economic research will be carried out to provide very valuable information for sustainable utilisation of tropical forest resources.

Publications resulting from the Tropenbos research programme will be valuable for protected area managers. Four types of publication are being produced and the guides and handbooks will be particularly useful for practical management purposes.

Example 25: Tourist trekking in Khao Yai National Park, Thailand

The northwest section of Khao Yai National Park, Thailand is an attractive area for wilderness trekking. It has mountain vistas, scenic rivers, waterfalls and forests with good wildlife populations, sufficient to attract both national and international visitors. The development of tourist trekking is seen as a way to generate income for local villagers in a manner compatible with conservation objectives. Without sufficient income, local people have previously exploited park resources out of economic necessity.

Treks are taken into Khao Yai from the village of Ban Sap Tai. The first day and night are spent in the village, allowing trekkers to experience life in a rural Thai community. The visitors are welcomed by local school teachers who introduce them to the village and briefly explain the trekking programme's objectives. The remaining days are spent hiking and camping in the Park.

In promoting the trekking programme emphasis is put on the adventure of exploring tropical moist forest in a scenic and virtually unchanged area of Thailand. The wildlife interest is not promoted strongly since wildlife sightings are relatively infrequent, due to the nature of the forest and secretive habits of the animals. The treks have attracted a wide variety of participants, most of whom have been expatriate residents of Thailand.

The villagers have benefited financially from the programme, with most of the money received for guide and porter services and for transportation. Villagers are, as a result, becoming more sympathetic to conservation, as they appreciate that the National Park can provide them with tangible benefits. The trekking programme has considerable potential for expansion but, as yet, is limited by the lack of bilingual trek leaders and inadequate administration. Solutions to these problems are being sought as part of the overall management programme for the National Park.

Source: Dobias, R.J. (1985). Elephant Conservation and Protected Area Management. WWF/IUCN Project 3001 Final Report.

Example 26: Tourism and education values of the Orang-utan Rehabilitation Centre at Gunung Leuser National Park, Sumatra

The Bohorok Rehabilitation Centre for orang-utans is situated just inside the Gunung Leuser National Park. It is one of Sumatra's major tourist attractions and each year has up to 5,000 domestic and 1,000 foreign visitors. Visitor numbers to the Centre itself are controlled and many more people visit the car park area for picnicking, swimming and camping. Education is one of the main purposes and activities of the Rehabilitation Centre.

The closest village to the Bohorok Centre is Bukit Lawang, about 1.5 kilometres away. Villagers benefit from tourism through entrance fees to the village, car parking fees, guiding and the provision of accommodation and food. The economic value of the Centre is also appreciated by the provincial Tourist Service, particularly as the area is within easy reach of the large city of Medan. Tourism developments include improvements to the camping ground and a proposed new education centre.

Unfortunately, forestry interests have been threatening the tourism potential of the Bohorok Centre and surrounding area. An area of state forest close to the Centre has been logged for large dipterocarp trees since 1981 and the forested slopes facing the Centre are now degraded, with obvious gaps in the canopy and a number of bare mud slides. The Office of Nature Conservation for Northern Sumatra has been offered this land as a tourist forest but restoration of the forest is required.

In the long term the recreation value of the Bohorok Centre is worth more to the local people than is logging. Proceeds from logging have long since dried up for the villagers of Bukit Lawang, whereas tourism provides a sustainable income.

Source: Whitten, A.J. and Ranger, J. (1986). Logging at Bohorok. *Oryx* 20(4): 246-248.

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Orang-utan with young. Photo: J.R. MacKinnon

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