ODA

OXFORD FORESTRY INSTITUTE

WESTERN GHATS

FORESTRY AND ENVIRONMENT

PROJECT

KARNATAKA, INDIA

REPORT ON PROJECT OPTIONS

AUGUST 1989

This is the report of a mission organised by the Oxford Forestry Institute on behalf of ODA to identify areas where the best interests of India and those of ODA meet with regard to their common environmental aims and joint endeavours.

Within the context of ODA's support to the improvement of the global environment, it was agreed in principal at high-level discussions between the Governments of India and the United Kingdom that a substantial portion of ODA's support to India should be reserved for environmental work.

ODA's interest focused on the forests of the Western Ghats because they are of ecological interest, the better-preserved parts of them are in Karnataka State and ODA has worked with the Forestry Department of that State for some years on research and social forestry. At the same time, the Forest Department of Karnataka, concerned at the lack of investment in the Western Ghats forests and at the permanent threat to their stability, started preparing ideas and facts and figures for putative project support aiming at stabilising the situation.

The team's Terms of Reference are given in Annex I of this report.

WESTERN GHATS FORESTRY AND ENVIRONMENT PROJECT

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0. SUMMARY OF CONCLUSIONS

* The environment value of the Western Ghats forests is considerable with a remarkable range of conditions on a world scale.
The degradation of the forest has been considerable but the rate has been greatly reduced since 1980.
Karnataka State Forest Department have pioneered the regeneration of degraded areas to the extent that their Ghats forest area is now in balance or growing.
The Department is using soil and moisture conservation techniques during new planting that are state-of-the-art.
Population pressures on the forest reserves will remain intense unless positive steps are taken to meet social development requirements.
The Department has recognised the need for a major project (advanced in the "Red Book") to improve and reclaim forest reserve lands while also meeting fuelwood and other village needs.
The Department recognises that the only way to save the environment is to render it unnecessary for people to damage it.
The "Red Book" project is of an appropriate scale with individual components that are worth while and proven.
However it is first necessary to draw the proposed activities into an understandable and understood strategy if people are to co-operate and participate; in particular the uncertainties regarding rights to land and produce must be eliminated.
The suggested strategy identifies the need for the forests to have and to demarcate:
  - a core zone for ecological conservation
  - a main forest buffer zone, unpopulated
    a main forest zone, including forest dwellers
    a forest boundary, used to meet local needs for forest produce
  - afforestation of wastelands
* All but the core zone would have commercial forestry.
* All but the first two zones would be planned and operated after consultation with relevant communities. More emphasis should be placed on planning and monitoring at Circle level and, with the communities at Village level.
Joint management contracts with Mandals or other appropriate organisations should be drawn up for care of the outer forest zones.
Priority should continue to be given to replanting degraded land wherever the necessary local agreements can be made.
The Forest Department will need to make organisational, research and training adjustments.
Environment or 'green' pricing should be developed to achieve

research and training adjustments.
Environment or 'green' pricing should be developed to achieve proper decision making.

Consideration should be given to new ways of procuring finance for forestry, e.g. through self-financing local schemes, corporate investment or dedicated trust funds.

Project options are:

- adjustments to the "Red Book" proposal
  as above, but with phased introduction of the project process approach to Western Ghats Circles over 4 years
  as above, but reaching targets in year 7, not year 5.

The last option brings the outline 5 year project cost down to £44.5 million, including substantial and necessary research and training components warranting UK support.
The report's chapters end with more findings and recommendations that should not be overlooked as the Project is appraised and refined.

1. INTRODUCTION

1.1 Background

Within the context of ODA's support to the improvement of the global environment, it was agreed in principal at high-level discussions between the Governments of India and the United Kingdom that a substantial portion of ODA's support to India should be reserved for environmental work.

ODA's interest focused on the forests of the Western Ghats because they are of ecological interest, the better-preserved parts of them are in Karnataka State and ODA has worked with the Forestry Department of that State for some years on research and social forestry. At the same time, the Forest Department of Karnataka, concerned at the lack of investment in the Western Ghats forests and at the permanent threat to their stability, started preparing ideas and facts and figures for putative project support aiming at stabilising the situation.

The present mission lies at the intersection of these two processes, its task being essentially to identify areas where the best interests of India and those of ODA meet with regard to their common environmental aims and joint endeavours. In the positive case, a project, jointly designed and funded, would be the result. The team's Terms of Reference are in Annex I.

1.2 Organisation of the Mission

The Mission, organised by the Oxford Forestry Institute on behalf of ODA, took place from mid-June to mid-July 1989. It was preceded by a few days preparatory work and followed by about 2 weeks' work for preparing this report.

The members of the Mission Team were:

David Palin	Team Leader	(Consultant)
Frank Law	Environmentalist	(Institute of Hydrology)
John Proctor	Forest Ecologist	(Univ. of Sterling
James Redhead	Forester	(Consultant)
Alan Rew	Sociologist	(Univ. of Swansea)
Dermot Shields	Economist	(Consultant)

Michael Harrison, Ecologist, University of Edinburgh, participated in writing this report.

This report is based on the shared and collective views of the Team, formulated after much reading, innumerable interviews and site visits in every division of the Western Ghats. The Team wish

to express their gratitude to the many citizens of India whom they disturbed, and to the officials of government and local government who informed them with courtesy, and especially to the officers of all grades of the Karnataka State Forest Department who were our guides, mentors, monitors and hosts and whose generosity with time and trouble has touched each member of the Team. The names of places visited and people met are in Annex II.

The Teams's approach has been to try and understand the various geomorphological, biological, economic and social processes at work in the Western Ghats, and their interactions. While this understanding is far from complete, particularly on the quantitative side, there is a convergence of the various professional viewpoints represented on the Team in respect of both the findings and the tentative conclusions set out in this Report.

Shola (hill evergreen) forest with grassland, now annually burnt

Grassy hills and shola woodland beyond iron ore waste tips

2. WHAT IS AT STAKE IN THE WESTERN GHATS

Some of the environmental arguments for investment in the forests turned out to be less conclusive than expected. Many positive factors defy computation. Yet when added to the ecological and economic factors, they argue in favour of investment in protecting, improving and maintaining the forest resource.

2.1 The forest resource and its ecological value

The main centres of interest for the environment in Southern India are the range of high hills that run along the West Coast of the Peninsula (the Western Ghats) and the forests on those hills. Together they have a major influence on climate and air quality as well as on the quantity, flow and quality of the water resources available in the coastal belt to the West of the range and in the populous food-producing plains to the East.

The nature of the Western Ghats and the forest resource is described in Annex III. Their special interest lies in the following features:

extreme variability of rainfall, according to longitude, latitude, altitude and over time.

the probably unique combination of very high annual rainfall in certain areas with long dry seasons and the consequent stress on the rain forest.

their situation between the African and Indo-Malaysian rain forest blocks.

their isolation as rain forests (comparable with those of Madagascar or Hawaii).

their vulnerability owing to their isolation and consequent limited species diversity (for a rain forest).

large numbers of plant and animal species are found only here (another effect of isolation).

interdigitation of deciduous and evergreen forest types.

the occurrence of relatively undisturbed tropical deciduous forest (now very rare on Earth).

2.2. Environmental influences of the forest

A description of the environmental influences of the Western Ghats in general is given in Annex IV. Here are highlighted some salient points relating specifically to the influence of the Ghats forests on various aspects of life.

2.2.1 Climate

The Ghats, with a highest peak in Karnataka of 1920 metres and the lowest pass at about 600 metres, would be a wet zone even if denuded of trees, as the latter add insignificantly to the barrier effect. However the trees take some energy from the weather system and the extent of climate change if the forests were to disappear is as yet unknown. At the very least they ameliorate temperature ranges and raise humidity level (close to ground level). Even if the forests do not affect rainfall totals but only cause them to cover more raindays, they will assist both agriculture and hydropower. The local belief that deforestation has been the cause of lower mean rainfall in the last decade should be discounted. The century-long rainfall record for Bangalore shows no overall trend with time. However there is a need to examine whether rainfall is occurring in a lesser number of days and the project does provide an opportunity to contribute to the group of international studies seeking the links between climate and surface vegetation cover.

2.2.2 Soil resources

In the early part of the 1989 monsoon the team observed the sediment-carrying characteristics of different mountain rivers. Those under forest were almost uniformly clear, sometimes with a slight grey cast from the wash-off of humus and forest litter. Those in the paddy valleys showed strong red discoloration, while those influenced by areca cultivation (betel) were somewhere between these two extremes.

Soil structure has been harmed by overgrazing as cattle trample the soil. Such effects are not caused by wildlife.

Comparison between adjacent degraded grassland and afforested areas in heavy downpours indicates that afforestation can and does restore soil structure and limit soil loss.

2.2.3 Groundwater supplies

It is said in the Forest Department that reforestation raises the watertable within two or three seasons, but no quantitative proof has yet been undertaken. The logic relies on the not unreasonable presumption that forest litter and root pathways improve recharge. If flood peaks are reduced, then, normally, higher infiltration occurs.

The past decade has seen a huge expansion in the number of bore wells into the hard rock horizons of the Ghats for domestic and irrigation supplies.

2.2.4 Surface water

A network of dams built over the last 20 years for hydropower and irrigation provides a high degree of regulation of surface waterflow, both to East and West of the Ghats. The Power Corporation, while not denying the need for forests to protect the environment and the ecosystem, do not see them as a better alternative to the existing grass and bush cover for keeping the dams charged and fear that they could actually reduce power. Similar arguments apply to storage for irrigation and town water supply.

However, run-of-river hydropower, irrigation and town water supply intakes all stand to gain from the longer flow season that afforestation would cause.

The initial assessment is that the main benefits to agriculture from forest restoration will accrue in the places above the major Command Authority canal schemes and within the lower rainfall contour of 900mm p.a.

2.2.5 Air quality

Utilisation of carbon/fossil fuels is modest other than for vehicles and cooking; no indicators of acid rain have been seen. The bulk of the State's power is from hydro and is expected to remain so, with positive air quality benefits.

The forests have the welcome advantage of acting as a sink for CO_2, the key 'greenhouse effect' gas. Thus the extension of forest areas is in line with international efforts to stabilise this trigger to climate change. However, such effects could be nullified by forest fire emissions and fire protection is of vital importance.

The re-establishment of forest naturally has microclimate repercussions including a rise in humidity and a possible reduction of seasonal coastal sea breeze strength or inland penetration. Neither phenomenon has great economic significance.

2.2.6 Communication

The Ghats are no longer a barrier in society's terms. They are crossed by railways, air routes and a network of roads, most of which are asphalted all-weather routes available to trucks as well as cars.

The Ghats are also crossed by an increasing number of power

transmission routes to add to the telephone rights of way. Satellite television receiving dishes are a notable addition to many townships, thus reducing previous distinctions between community facilities.

It is the intention of the Forest Department that re-afforestation should not be accompanied by the building of new access roads. Few appear to have been built in connection with the new plantations of this decade. Perhaps the extent of forest encroachment has limited the potential for further damage.

However, the programme of hydro development works already planned as far ahead as AD 2010 by the Karnataka Power Corporation will lead to considerable forest intrusion and the potential for added access - for example on pylon and penstock routes; at construction colonies, often not removed; to powerhouses and dams for operation and maintenance.

2.2.7 Health

Correlations between health and life expectancy and the forest zone have not been investigated.

However, it is probable that the prevalence of eye disease among some forest dwellers resettled on the edge of the forest is due to their being cut off from their normal food supply. Infant mortality at 150 per 1000 is also high.

Hydrodam environmental impact studies have reviewed problems from malaria, Japanese encephalitis, filaria and Kyasanur forest disease; the last of these is in decline but a localised outbreak of Japanese encephalitis was occurring south of Bangalore at the time of the team's visit.

2.3 Threats to the forests: their economic contributions

The embodiment of these rare, and sometimes unique, ecological features, the forest resource, is under attack from various quarters. A general analysis of threats to the forest is given in Annex V.

Individual officers of the Forest Department, from Range Officers, through Divisional Forest Officers to Conservators who are or have been in charge of Territorial Circles, have a good idea of the magnitude of these various threats. Yet the records do not yield the overall quantified picture which alone could form the basis for a rational, scientific, comprehensive protection policy and campaign.

Historically, forest degradation and destruction was mainly caused by excessive logging during World War II and thereafter. Today the main causes may be summarised in brief as:

removal of material
- log smuggling
- poaching
- leaves and branches (green manure)
- fuelwood
- poles, small timber, bamboo
  lichens, resins etc

intrusion of cattle leading to
- breaking and browsing of young plants
  compaction of the soil

fire, connected with
- poaching
- clearance for encroachment for food or cash crops
- encouraging fresh grass for fodder
- self-defence (against wild life)
- incendiarism
  honey collecting

alien land use
- food crop
- cash crop
- pastoralism
- hydro-electric facilities
- mines
- resettlement areas and townships
  roads and railways.

Excluding the illegal activities, these various acts demonstrate a significant contribution by the forest to the local economy and way of life. To save the forest, therefore, means finding ways:

either of lessening demands on the forest by substitution
or of increasing the forest resource so that it can meet present and future demands on a sustainable basis
or of improving forest management and exploitation so that production goes up and produce goes further
or, more likely, of doing all three.

2.4 Conclusions

The ecological value of the Western Ghats forests is considerable, containing many unique features and also providing points for contrast and comparison with places elsewhere, which will contribute to global understanding of tropical forests.

The environmental effects have some negative economic implications relating to power generation but all other environmental influences are positive, in terms both of economics and of quality of life.

While the case for preserving and developing the forest resource is clear, the chances of success have to be examined.

The forces destructive of the forest are economic in origin and may be counteracted by defensive strategies which remove the need to over-exploit the forest resources.

Such strategies are examined in the next two sections.

3 DISCUSSION OF THE MEASURES PROPOSED BY THE FOREST DEPARTMENT - THE "RED BOOK"

3.1 Objectives

The project has considerable potential to conserve a major world forest and to develop sustainable yields for a wide range of products which are very important for the welfare of rural communities. The implementation of a successful project of this kind would enhance the capability and image of an already effective state forest service and provide many lessons for environmental and natural resource projects in India.

A summary of project objectives was presented by the Forest Department at a seminar it held at Dharwad for non-governmental organisations interested in the project. The Department stated that:

"A time has come when all out efforts have to be made to check the process of degradation of our forests and reverse this trend. It can be done by implementing integrated people oriented schemes."

The central objective is 'to rehabilitate the forests in order to meet the requirements of people and cattle taking into consideration the protection of forests from fire, the regulation of grazing and the production of fodder and other products.'

Physical targets together with forest protective measures and planting models to realise these project aims have been specified in the project document prepared by the Forest Department. For example, a key criterion for phasing purposes is that districts with more than 25 per cent of their forests in a degraded state will get preferential treatment.

Evaluations of the Social Forestry Project, however, show that there is a need to have socioeconomic targets as well as physical ones and that the Department needs a planning process to meet the forestry needs of the poor. The sustainability of the forest resource and the sustainability of rural livelihoods are, at least in the long term, very firmly linked. Environmental and social objectives are mutually supporting. The Department of Forests recognises, in the words of the Principal Chief Conservator of Forests at the seminar, that "unless the fuelwood and fodder requirements of the people are met there would be no relief to the pressures on the reserve forest".

The human communities of the Western Ghats area vary significantly in their social composition and economic activities and in the demands they make on the forest resource. At the current stage of project planning these variations and their likely impact on project objectives are not specified. The satisfaction of the project's socioeconomic objectives will be left to the operational

Circles and Divisions. Further specification of social targets and of the management and planning process within the operational divisions of the Department is essential if the project's aims are to be achieved.

3.2 Forestry measures in the "Red Book"

The following activities are proposed by the Department. A more detailed resume of the components is given in Annex VI.

3.2.1 Protective measures

Consolidation of forests — Rs 250m

Re-survey and demarcation of existing forest reserves.

Protection from fire — Rs 60m

Construction of fire towers, fire lines and organisation of fire patrols.

Protection of forests from grazing — Rs 400m

Protection of 534,000 ha from grazing. The Department would encourage stall feeding by the provision of fodder.

3.2.2 Development measures

Gap planting — Rs 90m

Re-stocking of 60,000 ha of degraded forest by the planting of indigenous species.

Fuelwood plantations - Rs 1000m

Rehabilitation of 100,000 ha of severely degraded forest in the vicinity of villages by planting fuelwood, fodder, green manure, minor forest produce and fruit trees, specifically to meet the needs of local people.

Seeding, dibbling and aerial sowing - Rs 160m

100,000 ha of forest would be enriched through the dibbling of seed and 25,000 of degraded forest would be treated by the aerial sowing of seed.

Bamboo plantation - Rs 70m

75,000 ha of natural forest would be tended and re-stocked.

Sandal plantation - Rs 80m

12,500 ha of forest would be enriched by planting sandal.

Teak plantation Rs 400m

100,000 ha of degraded teak forest would be rehabilitated and fully stocked by underplanting or gap planting.

Gene-pool preservation Rs 20m

Two centres would be established each comprising a 500 ha tree collection, 125 ha for germ plasm multiplication and 50 ha seed storage, herbarium and laboratory facilities.

3.2.3 Supporting activities

Research - Rs 50m

Strengthening the Forest Department research capability in a wide range of silvicultural and ecological activities.

Training - Rs 5m

Specialist staff would receive training both overseas and in-country in a wide range of research and management activities. Technical staff would receive in-service training in supporting activities.

Public relations

Publicity and public awareness of issues affecting the Western Ghats would be provided (finances included in HQ budget).

Seedling production -Rs 470m

Specialised nurseries would be established to produce high quality seedlings, including clonal material.

3.3 Socioeconomic Measures and Effects

3.3.1 Employment

Full implementation of the programme envisaged in the Red Book would require a significant increase in casual labour employed by the Forest Department. Assuming an even distribution of employment through the year, and an average of 200 mandays per person per year, employment would increase by at least 70,000 manyears in year 1 and 100,000 manyears in year 5. In practice, because of the seasonal nature of forest employment, these figures might be double. In areas of the Ghats where employment opportunities for labourers and marginal farmers are limited, this would lead to a major boost in incomes.

Further employment on this scale, would inject significant extra cash into the local economy, with the usual multiplier effects.

3.3.2 Tribal welfare

GOI policy requires each department of government to have a tribal sub-plan to assist in the allocation and delivery of benefits to members of scheduled tribes. The project will have a component devoted to tribal welfare. It includes the planting of orchards and 'social security plantations' and the underplanting of 'minor' (that is, non-timber) species. The statement on objectives for this component recognises that forestry development will play only a small part in the improved welfare of the tribal populations of the Western Ghats area. The "Red Book" has already considered:

> improvements in quality of life as well as the creation of assets for their benefit
> intervention consistent with the tribal people's active participation and with respect for their cultural security
> the organisation of their communities by the Forest Department

- the tribals' place in the ecosystem
- provision for their health care, education and housing

The scope of this component is very multi-sectoral when compared to the other project activities and comparable to an integrated rural development programme. Liaison with, and encouragement of, non- governmental organisations with expertise in health care, education and community organisation will be extremely important. The tribal groups' relationship with the Forest Department is complex and requires very careful treatment. Many tribal families in Mysore have been displaced from the forest by the Department during the creation of national parks and wildlife sanctuaries. All tribal groups are highly dependent on the Department for labouring jobs, for concessions to cultivate on the forest margins, and on its supervision of contracts and prices for their employment in the collection of minor forest products.

3.4 In conclusion: the overall strategy proposed

The proposed project would be concerned only with Forest Reserve land. The main objective is to increase the productivity of such land through

> a rigorous harvesting system (modified selection system), not included in the project
>
> enrichment, upgrading of forested areas
>
> reforestation of denuded land.

Apart from seeding in the medium-density forests, the enrichment and upgrading work is in the open and partially open forest, which coincide mainly with the deciduous areas. Teak planting is the big item here.

Protection of the forest is through a number of measures;

evacuation of the forest area

demarcation, mapping and physical measures such as trenching, fire breaks and patrol

protection from pilfering by supplying a large number of local needs

protection from encroachment through planting up and being seen to be active in husbandry of the land.

Economic benefits from this strategy are enhanced supplies of timber to wood-based industries; of small timber and poles for construction and tools and implements; of fuelwood; of green manure; of fodder, and of materials and minor forest produce for artisans and other villagers. Permanent and temporary job creation would be considerable.

Planting-up of denuded areas would take the State closer to the target of 33% forest cover as against the present 20%.

Wildlife habitats would be improved.

These measures would require a permanent strengthening of the territorial divisions in the Western Ghats and investment in infrastructure, which the Project would provide.

Flexibility is built into the Project design through provision for micro-planning at the site level and through a Mid-Term Review in Year 3.

The Team's view is that the measures proposed accord well with the stated objectives. The objectives, however, may need to be made more specifically environmental. Also, to exclude harvesting from the purview of the project is not logical either silviculturally, organisationally or financially.

The Forest Department has a good mastery of the traditional forestry techniques involved in the measures proposed. They are being practised at present; results are visible; shortcomings are known and recognised and appropriate action is being taken. Other techniques are less perfected. Activities like fodder production, short-rotation forestry, mixed plantations and community relations will demand more attention, learning and training than is foreseen in the proposal, while the strategies relating to forest dwellers

need refinement.

In the next section, some strategic options and approaches are advanced and discussed.

4. STRATEGIC OPTIONS

4.1 The historical perspective

Although much forest has been destroyed to make way for agriculture, mining and power generation, or degraded by fire, pilfering and smuggling, strong social and political forces have recently emerged to protect the forest. The success of an environmental project or programme will depend on the protectability of the forest and on its ability to harness these forces.

4.1.1 Insouciance

In Southern India, as in most other parts of the globe, there was a long period when the forest resources seemed so massive, to people and leaders alike, that the eventuality of their exhaustion was simply not faced. There was little support, therefore, for people and policies that argued for the preservation and (by biological imperative) slow development of the forest resource. This was particularly so when good prices could be had for beautiful timber, when economic benefits from mining and railways supported these industries' demands for (cheap) timber and when land was needed to grow more food and for holding water for power and irrigation.

4.1.2 India takes stock

India was one of the first countries to see what was happening to the tropical forest and became in the 1970s a leader of world opinion on environmental matters. Her Prime Minister played a leading role in the 1973 World Conservation Strategy Meeting. At home, legislation made forestry a concurrent subject instead of a state one, thereby creating a platform for checks on individual states and for a national forestry strategy and policy. At the same time the National Committee on Agriculture came to grips with the spreading rural domestic fuel crisis and the central question of the interface between forestry and agriculture by launching nationally the concept of Social Forestry.

4.1.3 Karnataka takes action

Also in the mid-1970s, Karnataka started to come to grips with these issues. Mr K H Patil, the Forest Minister, voluntarily surrendered to both Houses of Legislature the ministerial discretionary right to release forest land for other uses. The rosewood trade was nationalised. The Forest Development Tax on sale of wood was instituted, providing the Forest Department with its own source of revenue. Confiscation was permitted of vehicles involved in forest offences, a major step in protecting the forest against organised crime. Regarding fuelwood, the prepaid licence system was abolished and fuelwood depots were opened across the

State.

The 1980 Forest Conservation Act was vigorously enforced and a striking reduction in the loss of forest took place. Although some was still being lost by the time the national State of the Forests review took place in 1986, it was minimal compared with previous degradation in most localities.

4.1.4 The Forest Department holds the line

Encouraged by these national and state-level Developments, new attitudes entered into the thinking and actions of the Forest Department. Not only have protective measures become more efficacious; the Department has also learnt about the underlying economic forces, sometimes needs, which drive people to over-exploit the forest, and has developed strategies accordingly.

They have been helped, too, by a growing body of informed opinion in the State and, most recently, by the 1988 promulgation of the National Forest Policy, in which many threads have been drawn together to form a comprehensive, integrated, basis for action. In the Western Ghats, the protection of the forest is today under reasonable control. What is lacking are the means to make the further investments in protective measures and protective plantations which are necessary to hold the position.

4.2 Strategies for the future

It is against this encouraging historical background that strategic options are advanced, which go a little further than the proposals presented, with the objective of securing environmental equilibrium in the Western Ghats over the longer term.

4.2.1 The strategies of the "Red Book"

The Team endorses the overall strategies advanced in the document prepared by the Forest Department. These may be summarised as:

to strengthen protective capacity through clear demarcation, mapping, and fencing or trench protection where necessary;

to preserve the finest forests for ecological and gene conservation purposes;

- to exploit the forest in an ecologically sound way, for both silvicultural and economic purposes;

- to be active in supplying immediate needs, both for its own sake and for taking the pressure off the natural forest.

4.2.2 A suggested over-riding strategy

The team was struck by the unusually high level of uncertainty with which the Forest Department had to cope and in order to develop the policies and procedures necessary to implement the strategies above it will be necessary to mount a deliberate campaign to reduce the uncertainty level.

Some of the uncertainties observed of relevance to an environmental project are:

- lack of inventory of growing stock.
- unclear medium - to long-term forest management objectives for many compartments.
  lack of knowledge of the demands the Zillas and Mandals will put on the Department for social forestry services.
- ambiguity in the roles of the Department as law enforcer and developer of goods for the public.
- ambiguity in the behaviour of many non-governmental organisations.
- lack of clarity regarding the Department's rights and obligations and those of forest dwellers and neighbours regarding land, trees and produce.

The strategic options advanced below address these uncertainties.

4.2.3 A strategic framework

In the remainder of the chapter (sections 4.6 to 4.10), are gathered together the strategic issues relating to the threats and potential of the Western Ghats. At the cost of some repetition, they are presented by each of the following dimensions:

a. Ecological
b. Forestry
c. Environmental
d. Social
e. Economic

Before discussing these strategies, and in order to integrate the individual disciplines, a conceptual framework, a planning approach and some organisational points are outlined in sections 4.3 to 4.5.

4.3 Land management zones

The relationship between ecological value, effective forest regulation and economic and social demand varies considerably within the Western Ghats. A first step in defining management objectives and appropriate measures to address this variation in forest and land-based activity would be to organise the Forest Department's operations according to geographical zones. Five zones are suggested, each with distinct management objectives, opportunities and constraints. They are indicated in Figure 4.1.

Figure 4.1 RECOMMENDED FOREST MANAGEMENT ZONES

Situation (km2)	Main Management Objectives		
	Ecological	Ecological-Commmercial	Immediate Needs
Least disturbed (c1,000)	I Core Zone		
Main forest (c.6,000)		II Main Zone without Dwellers / III Main Zone with Dwellers	
Forest Reserve boundary (c.5000)			IV Boundary Zone
Outside Forest Reserve (c.1,000)			V Common/ Revenue Land

4.3.1 Zone I - Core forest

The sole management objective is ecological-environmental. Only undisturbed, or very little disturbed, forests qualify for the Core Zone. They will naturally be in the remoter, less accessible, and often higher places. But for ecological purposes all types of forest (moist evergreen, semi-evergreen, moist deciduous, dry deciduous) should be represented, together with different rainfall contours and altitudes. The preserved forests should be protected in a well-thought-out system. Ideally, they would stretch the whole length of the Ghats from Nilgiri northwards, as continuously as possible with a number of belts from the lowlands stretching up

as possible with a number of belts from the lowlands stretching up and beyond the peaks of the Ghats into the drier areas.

Regarding the legal status of forests in the Core Zone, consideration could be given to basing them on the system of National Parks, Man and Biosphere reserves, or World Heritage sites. There are advantages and disadvantages to each and a decision could be based on closer examination of the case, both physically and legally. Essentially, the solution would prohibit all access to Zone I save for scientific observation. Any cutting or removal of matter would be banned in perpetuity.

4.3.2 Zone II - Main forest: unpopulated

The main management objective would be both ecological and commercial. In Man and Biosphere terminology this would be a 'manipulated zone'. Most of the forest is of good quality, although some degraded areas would be included if they are still capable of being upgraded. There would be no forest dwelling communities in this zone by definition. Subject to environmental considerations, logging and other removals are permitted, under the control of the Department.

Ideally, Zone II would be planned as an envelope around the Zone I core. As a poor second best, Zone III forest could serve this purpose.

4.3.3 Zone III - Main forest: populated

The management objectives are similar to those of Zone II but with the addition of social planning for existing forest dwelling communities, who would be allowed to remain, subject to their willingness to cooperate with the Department and develop forest use practices which minimise adverse ecological impacts.

4.3.4 Zone IV - Protected forests and reserve forest boundaries

The management objectives of Zone IV are to protect Zones I,II and III and to produce forest products for immediate needs which will help eliminate the need for people to intrude into Zones I, II and III. The Department will need to regulate both authorised privileges in the Protected Forests and to ban, restrict or substitute for, the customary concessions which have grown up allowing villagers to use the boundary areas of the Reserve Forest for grazing and for large- scale extraction to support mainly agricultural purposes.

The Western Ghats forest is composed of forests which fall into two main tenure and forest settlement types. Both are controlled and owned by the Government. The largest area is held as Reserve Forest. This is set aside for wholly forestry purposes: all other uses are banned, or illegal, unless specifically permitted by the

Forest Department. There are also Protected Forests, from which cultivators and villagers may extract most products of value for domestic use unless they are specifically forbidden to do so. In some parts of Karnataka these are also called Minor or District Forests. A third tenure type - Village Forests - which was managed by village committees is now of only historical significance.

The Protected Forests have been used to grant regulated privileges to growers of crops such as arecanut, cardamom, pepper and paddy rice and for grazing purposes. These privileges, or the lands for which they are granted, are known as sopinabetta, gemmamalais, kumki and bena lands. They have usually been granted to those who are now the larger and richer farmers and the grants have led to the large-scale degradation of the Protected Forest and of the edge of the Reserve Forest. Management tasks would be to: withdraw privileges if good management practices for the relevant forest tract are not adhered to; provide compensation or alternative sources of fuel, fodder and green manure; arrange management contracts subject to forest legislation so that the farmers and their organisations can participate in the rehabilitation and maintenance of the lands they have helped to degrade.

4.3.5 Zone V - Plantings on Common and Revenue land

This Zone is outside forest lands. It is included within the project's management objectives because commonland or Revenue Department 'wasteland' may need to be planted with fuelwood, smallwood or fodder to provide a substitute for the loss of privileges or concessions withdrawn or curtailed in Zone IV or simply because of the absolute demand for these products. Successful implementation of schemes will require prior consultation and agreements between the Forest Department and community and Local Government institutions. Management contracts between the Department and community groups should be explored wherever possible. The Department would have a technical extension and tutorial role and also be involved as the administrator, on behalf of the Revenue Department, of many lands unsuitable for cultivation (C and D lands) but which have a potential forestry use. These are lands also used as common grazing lands by villages and are often highly degraded. The central task of the Department within this Zone is to provide advice and services.

4.4 The planning approach

4.4.1 Consultation and levels of activity

Consultation with local organisations and with units of the panchayati raj would be required throughout the project. The Forest Department is contemplating major changes to land use, to animal husbandry behaviour and to forest products collection. Individuals, local groups and local government units also need to

plan if they are to accommodate these changes, realise opportunities and avoid difficulties. Consultation will allow Forest Circles to judge how their proposals are received and to make amendments where necessary. It will provide valuable information on the choice of species and regime for local needs and indicate the complexities and scale of local demand for project outputs.

Two levels of planning are involved. The first is microplanning, at or below the span of the Mandal Panchayat which is the lowest level of Karnataka local government with specific financial responsibilities. This local level planning would focus on the identification of units of local organisation with forest management potential. Departmental staff would prepare agreements and contracts to permit them and local communities to determine the forest management process together.

The second level of planning is at the Forest Circle level. It would aggregate and consolidate the results of micro-planning but also add the regional land use and distribution considerations.

4.4.2 The concept of 'microplanning'

The central objective of the microplanning approach is to help evolve local institutions able to assist the Forest Department to manage forests and plantings in Zones III, IV and V and to do so within the context of existing local government systems. Mandal Panchayats are relatively new institutions and they will have their own social biases. Nonetheless, it is inadvisable to bypass them: their support for environmental forestry and for greater clarity in the administration of privileges and concessions will greatly assist the project.

4.4.3 Local land use planning

The first priority for a Circle's staff engaged in microplanning would be to discuss ideas for project works, new assets and regulation at Mandal Panchayat level. This should lead to an **outline land use plan** (with purely advisory status) for the Mandal's villages and hamlets. Its aim would be to facilitate discussion and comments by Mandal Panchayat members and by Gramsabha meetings where appropriate. The Circle staff would need, in the initial stages, guidelines and assistance from a coordinating team based at headquarters, to ensure that local views had been expressed and recorded in a consistent way and a clear agenda for subsequent action arrived at.

4.4.4 Local organisations and administrative planning

At a further stage, the Department would need to prepare an administrative plan detailing how it intended to administer privileges and concessions and the procedure for adjudicating

rights which may have been abridged in some way. This plan should lead to a series of well-advertised public announcements and advisory visits to ensure that villagers understand the Circle's plans for their local area.

Parallel to this activity, the Department would need to identify appropriate individuals, local groups and organisations with management potential for discussions prior to the agreement of a management contract. The results of the social development research programme recommended in Annex IX may be used for this. Committees and wards of the Mandal, hamlet associations, women's groups, tribal associations and voluntary organisations would all have a potential role to play.

4.4.5 Distribution systems

The micro-planning work would need to consider the efficiency and equity of the distribution systems for fuelwood, fodder and related products being produced from the new forestry assets. The strategic choice is between systems based on physical allocation and compensation in kind and those based on the development of the market and shared management rights and responsibilities in the forest area. One system or the other may suit particular products or localities.

4.4.6 Community participation and process management

These novel and potentially heavy workloads to ensure that new consultation procedures and distribution systems are in place reinforce the need for community participation in the management of the new schemes. The Forest Department will not wish to take on so many new management tasks that its efficiency suffers, while responsibility for forest management becomes even more removed from the everyday experience of villagers. If that happened environmental protection would further weaken, with disastrous consequences for ecology and society in the longer term.

A flexible, open-ended approach to community participation is suggested. Long-term achievements in this part of the programme will be greater if the planning and Circle management process can accommodate local variations in forest resource and social structure. Individual staff need time to acquire new skills, and planning quality will evolve with growing practical experience of social variation and negotiation. Local institutions and groups also need time to assess the new information and opportunities. Any new analyses and solutions they may offer should be taken up and reviewed within the planning process both to take advantage of additional insight and to acknowledge the value of local perceptions.

4.4.7 Management contracts

A system of **Management Contracts** is envisaged. This would provide villagers with a stake in the new assets. It also avoids any weakening of the Forest Department's ownership of forest land. If the land and asset are subject to a management contract it will be quite clear to both parties that the services provided are specific and related to the maintenance of the asset, to the harvesting of products, or to their distribution depending on local circumstances. The effect of the agreement will be analogous to that of tree patta rather than the encroachment or unsupervised village use which the Forest Department fears.

The form of management contracts would evolve throughout the project. In time an independent process of agreement and contract could be developed which would safeguard the separate interests of both parties. In the initial stages, however, the Forest Department may need to propose the form of agreement. It should clearly define the land in question (Zone IV or V) and the management objectives, specify the rights and obligations of all parties and state how the agreement may be reviewed.

The management contract would in particular, be precise about the following points:

- rights over produce and its distribution
- compensation to the Government Department (Forest or Revenue) for use of land
- the organisation and reward of labour
- day-to-day management responsibilities
- provision of technical advice, extension services and inputs
- performance monitoring and review.

Specific terms will vary from one locality to another and also between Zones IV and V. The capacity of the local organisation to carry out its contractual obligations would be a condition of entering into the contract and of adhering to the programme launched by the Project.

4.4.8 Regional planning

Coordinating the microplanning work of the individual Circles leads to a regional dimension in the overall planning approach.

The collected results of the microplanning work would serve as inputs for advisory plans for Circle land uses. Cartographic and other support could be provided at Forest Department headquarters so that these Circle land use plans were produced according to a common format and could be aggregated for departmental and project planning purposes.

The dialogue that the Department has been holding with voluntary organisations could be continued and widened. This would add a regional dimension to the consultation process.

4.4.9 Manpower and training implications

Such planning activities would require a reorientation of field staff and the acquisition of new skills. Staff would be expected to support and facilitate the development of systems of joint management. They should act as salesmen for the Forest Department, not only as the enforcers of regulations or as technical specialists.

It is suggested that planning and programme management and monitoring activities should be organised at Circle level by DCF and ACF cadres. The details of Circle staffing could be calculated for the Appraised Project Document. These more senior Circle staff will also need to reinforce the training to be given to Range Officers, Foresters and Guards to make them aware of their roles in the project and of its distinctive and unfamiliar features.

4.4.10 Circle implementation manuals and management information system

A management implementation manual system is suggested, which would outline the procedures to be followed at each human settlement and for each village plantation, the information to be collected and the way in which it is to be recorded and analysed. It could give guidance on how to hold discussions with villagers when deciding their preferred choice of species, details of the silvicultural systems to be followed, and examples of simple contracts and their execution.

Information on each Mandal Panchayat, human settlement or village would include records of discussions held, copies of contracts and records of population, social composition and records of areas and species planted, site conditions, yields, payments, distribution of produce etc. It could also include a map (on a scale of 1:25,000 or larger) such as that prescribed in the Forest Manual, which would be brought up to date each year. Certain data could be transferred annually to maps and computer informations systems held in the DFO's and Conservator's offices. The Management Information Systems would be used for Circle level monitoring of project implementation - and later of regular programme implementation.

4.5 Organisational strategies

4.5.1 New demands on the Forest Department

During the 1980's the Forest Department has changed considerably in response to the new types of demand being put on it. In outline, these new demands result from two factors: the new forest policies, national and state-level; and new roles.

The new policies include a reduction in the production of timber (commercial species) in favour of more concern with the environment and with what are traditionally classified as minor forest produce. These changes have implied changing relationships with logging contractors on the one hand and with the local population on the other.

The latter factor has been of particular importance, since it has meant:

- introducing multi-purpose plantations of mixed species, the development of which is largely unknown;
  passing from a passive stance in regard to produce for local consumption to a more active one; from simply allowing access for collection purposes to planning production against demand and organising delivery systems;
  changing law enforcement policies: tightening up on some aspects, while loosening a little on others without big changes in the laws regarding what is allowed or forbidden or falls within the discretion of the forest officer;
  much more interaction with the local population either on an individual basis or collectively.

The Western Ghats Project will, if anything, reinforce these new demands on the Forest Department.

4.5.2 New organisational emphasis

As a result of these new demands, the balance or emphasis between different tasks and functions of the Department needs adjustment. In particular, the functions of planning and monitoring, community relations, research and training would acquire more prominence, while operations would also undergo some change. Details are given elsewhere.

4.5.3 Organisational change

The success of the Western Ghats Project will depend upon the capacity of the Forest Department to manage the new tasks - a capacity it has already demonstrated to a great extent.

The appraised project document should contain a plan showing how organisational developments would be undertaken, and some points are discussed in Section 5.5.

4.6 **Ecological strategies**

The ecological strategy suggested rests essentially upon the preservation of Zone I, the Core Zone, the sole management objectives of which are ecological-environmental and address the following:

- the maintenance of ecological stability (in water, soil, forest regeneration, wildlife, etc)

the preservation of natural biodiversity as an intact genetic resource base (for potential research in sources of drugs, disease-resistant crops, forest products, etc)

the maintenance of an intact forest ecosystem for both applied and pure ecological research.

As such, the core zone should cover examples of all major forest types, which include low, medium, and high elevation evergreen and semi-green forest moist deciduous and dry deciduous forest (see Annex III). These would cover a representative range of rainfall gradients and altitudes. Only undisturbed or very little disturbed forests would qualify for the core zone, although for practical and ecological reasons some disturbed forest may need to be included for geographical continuity.

The extent and location of the core zone cannot be assessed without extensive survey. Ideally, it would grow out of the existing pattern of National Parks and Wildlife Sancturies (Map 2) and stretch from north to south in a systematic network of regions, connected by corridors, for the whole length of the Ghats in Karnataka, from the Dandeli Wildlife Sanctuary south to the Brahmagiri Wildlife Sanctuary and Nagarhole and Bandipur National Parks. This would maintain the integrity of the Ghats forests, and allow opportunities for similar ecological zones to be established by extension into Kerala and Maharashtra.

A number of lateral belts could then stretch from east to west from the coastal lowlands over the evergreen peaks of the Ghats, and into deciduous forest in the drier areas. This would ensure that all forest types, altitudes and rainfall contours were represented, that the preserved areas were not isolated, and that larger animals with seasonal or local migrations could move between them.

An area of at least 1000 km^2 may be required to meet the objective of zone I, but should be based on an inventory, field surveys of habitat, and initial research on patterns of movement of large mammals (see Annex IX : such information is particularly limited for evergreen forest fauna). Consideration should be given to turning this zone, with some of the existing National Parks and Wildlife Sanctuaries, into Biosphere Reserves and perhaps some elevated to World Heritage Site status. On ecological grounds this is fully justified. A Biosphere Reserve already exists in the Ghats at Nilgiri and consists of a largely deciduous forest area which falls in Karnataka, Kerala and Tamil Nadu, and is jointly administered by all three States.

The management objectives in Zone II are both ecological and commercial, but still exclude forest dwelling communities or access by people outside Forest Department control. As such, Zone II should serve as a buffer to Zone I, and be located as an envelope

around its boundaries. This would allow for animal movements outside the core zone and its connecting corridors, and at the same time diminish the pressures on the pristine forest from outside. The juxtaposition of untouched and commercially exploited forest would also allow careful monitoring of the long term impact of forestry practices.

While the priority of management objectives for Zones II - V is given to environmental, forestry, social and economic strategies, decisions should also be made subject to ecological considerations. The strategy here should be to maintain a level of research into the ecological effects of logging, afforestation, grazing etc, that will guide management decisions without jeopardising primary management objectives.

4.7 Forestry strategies

Details of the strategies for forest management are given in Annex VI and are closely related to the five zones proposed in Section 4.3. The first priority is to map the forests and choose the location of Zones I to V.

Zone I comprises areas chosen from the least disturbed forests in each of the major forest types: evergreen, semi-evergreen, moist deciduous and dry deciduous. Permanent monitoring plots would be set up in each of these types for routine measurement of growth parameters, seedling recruitment and development, and soil changes. These will serve as controls for a similar series of plots in Zones II and III which will receive normal management treatment associated with harvesting, regeneration and tending operations. In Zone I additional studies will be made of plants other than trees, of the dynamics of nutrient cycling, together with interactions between the flora and fauna.

Management of Zones II and III attempts to maximize the sustained productivity of the forest through application of the Selection System, with the ultimate aim of developing a complete selection size-class distribution (Figure 1, Annex VI). Since many of the deciduous forests are only 25 percent stocked and the richer teak forests less than half-stocked, with 75 percent of areas devoid of sapling regeneration, the project proposes a major programme of gap planting and underplanting (Section 3.2.2 and Annex VI).

As management plans are prepared for Zones II and III, detailed inventory would be carried out to enable logging schedules to be prepared. Subsequent inventory of the seedling regeneration and intermediate-size classes will indicate whether thinnings are needed to bring the forest to a selection size-class distribution and whether the regeneration is adequate or enrichment sowing or planting is needed (Tables 1,2, Annex VI). Research is planned to refine a system of regeneration and enrichment operations.

Zones II and especially III would also be underplanted with bamboo and rattan cane either for local use or for supply to industry.

Zones IV and V would be managed primarily to meet the immediate needs of populations adjacent to the forest. Presently these areas are for the most part highly degraded and they would be brought into a productive state by a combination of planting and natural regeneration, including coppice of existing badly hacked trees.

Choice of species would be made in consultation with the local people, although in some cases it may be necessary to improve highly-degraded sites by planting soil-improving nitrogen-fixing species before more demanding species can be grown. Subsequent management would be on a coppice with standards system primarily for fuel and small poles, with standards retained for fruit, fodder and medium size timber for agricultural implements. Research would be strengthened for the improvement of high-yielding planting material for fodder, fruit, and trees producing special products.

The measures for forest protection (cf. Section 3.2.1) will reduce loss from fire and restrict damage from grazing. In certain areas it would be necessary to compensate for loss of grazing by the provision of fodder raised or collected by the Forest Department.

4.8 Environmental strategies

The main environmental aims are :

Regional-	to restore the natural water balance to current legitimate water users;
National	to move towards India's 1988 National Forest Policy forest coverage target
Global	to contribute to the world's need to halt the rate of loss of tropical rain forest which is able to take in carbon dioxide,'a greenhouse' gas contributing to global warming problems.

The physical project boundary is bounded conceptually (rather than rigorously) by the 900 mm pa rainfall contour on the east, the sea on the west and the state boundaries to the north and south. The coastal plain is included as an area with scope for afforestation to take pressure off the Ghats hills close behind.

The detailed environmental goals of the project as here envisaged include

the restoration of a closed forest canopy over a significant

proportion of degraded land

reafforestation without causing significant soil erosion or using excessive fertiliser or herbicides

increased natural ground water recharge through development of forest litter and root paths on previously compacted over-grazed ground

gradual reversion to native tall dark evergreen rainforest (or its deciduous equivalents in drier areas)

fire protection to reduce regularity and severity of forest loss

safeguarding the scenic beauty of the Ghat escarpments, gorges and waterfalls for tourism and posterity

river water quality improvement

controlled logging and timber removal without new access roads

improved health and life expectancy of forest zone residents.

The strategy is to build on the proven success of the Forest Department with its reforestation techniques while augmenting its ability to accelerate planting rates, by institutional strengthening.

The first priority would be to cover degraded land with fast growing trees to meet the needs of the local people for fuel, poles, fodder, fruit and other products. This planting would continue to be done using state-of-the-art localised trenching with soil moisture conservation and flood runoff control techniques.

Land would be planted in stages with priority going to the most degraded lands. Lowest priority should be accorded to replanting land draining to water storage reservoirs. Other things being equal land should be replanted first in catchments where an extension of the flow season is required.

Hydrological monitoring would be introduced so that the Department can quantify the effects that this project is having on runoff, groundwater levels and water quality. This monitoring and its interpretation should be sub-contracted to a competent Indian organisation specialising in such work.

4.9 Social development strategies

The project can make a major contribution to the longer-term welfare of the poorer groups and communities within the Western

Ghats of Karnataka. Sensitive phasing will be needed, however, to allow the Forest Department to build an appropriate capability to manage the new planning approach and other initiatives and the local people to organise themselves to respond adequately.

4.9.1 Social differentiation

The planning approach requires particular attention to the factors which create and maintain differentiation within Western Ghats communities. Not only do the aggregate needs of local communities for forest produce vary but so too does their response to the project and its effects on particular social categories. For example, measures to control firewood extraction may benefit certain women by shortening their journeys to collect headloads of fuel and equally disadvantage other women by restricting their access to the forest to collect 'minor products'.

Other sources of variation in the project's social conditions include:

differences in the appreciation of social impacts and response within the Forest Department - particularly marked between senior management and junior field staff

variations in villagers' access to knowledge about the project

variation in the ability of social groups and categories to take advantage of potential project benefits

differences in a group's visibility to policy-makers - for example, the nutritional and income impacts on the landless of changes in land-based activity can be easily forgotten.

cultural differences in distribution, leadership, religion and preferred livelihoods.

4.9.2 Social factors in the project response

Contracts and agreements for the management of Zones IV and V are major features of the proposed strategy. Social factors will influence the likelihood of agreement and subsequent success. The relative sizes of caste groups within the village or Mandal are important. Too large a group may lead to factionalism and a failure to gain agreement.

4.9.3 Technology development and special forest products

The special products which foresters call 'minor' can be crucial sources of income and subsistence support for certain tribals and other social groups. They have special research and technology development requirements. Development of improved propagation

techniques and kissan nursery methods under realistic field conditions would be a major contribution to a social development strategy for forest dwelling peoples.

4.9.4 Multisectoral linkages

Poverty and disadvantage can often be cumulative and compounded. This is particularly the case for the tribal and scheduled caste groups. For example, tribal peoples evacuated from the forest and resettled in residential colonies on its edge tend to suffer from a combination of cultural displacement, malnutrition, ill-health, poor educational attainment and facilities, and lack of access to regular employment. To deal with these welfare and employment problems, it is important to coordinate contributions and efforts from the various forest, welfare and agricultural sub-sectors than to simply increase the overall level of welfare and training resources.

4.9.5 Institutional development

Allowance should be made in the project strategy for the evolution of local-level institutions able to respond to the project. The building of communities and development of management capacity by local groups is important in its own right and not just as a means of achieving income generation or as short term management support. If deforestation has weakened tribal and other poor rural communities then the regeneration of the forests could, as well as restoring the ecology, also rebuild community security and public care for the environment. If this reinforcing, educational process is to happen the Forest Department and local communities will both need to evolve new attitudes and patterns of interaction, with the Forest Department staff acting as facilitators and consultants to local groups rather than as external organisers according to a model previously chosen by forestry staff.

4.9.6 Forest dwellers

Existing forest dwelling communities would be allowed to remain in Zones III and IV, subject to certain conditions (cf. sn. 4.3.3).

The possible benefits of resettlement need to be set against the full economic costs as well as the social disruption. Recent estimates of the costs of resettling forest dwellers put the economic (rather than the financial) cost at a minimum of Rs 350,000 per household. Furthermore, forest dwellers are an important pool of labour and source of knowledge, without which forestry activity would be severely curtailed.

The success of this strategy depends on the ability of the project to learn more about the social and economic activities of the main forest communities and to devise programmes of extension and regulation which will permit the key communities to remain but also

Moist deciduous forest - note absence of small size classes

Overgrazed land adjoining fenced reforested land

A Tribal settler receiving a hectare of orchard land

Tribals relocated from a National Park

allow the original structure of the forests to be re-established.

The principal talukas of this zone are Mungod, Haliyal and Yellapur and the talukas of the Birigiri-Rangana Hills area.

The main forest-dwelling communities are:

Gowli buffalo herders who are Marauti speaking and depend on forest grazing and buffalo milk sales; the Gowli population is approximately 10,000.

Sidi subsistence cultivators of African descent; they number some 8,000

Sholigar tribals living within the'B.R.T Hills' wildlife sanctuary; the population is around 15,000.

4.9.7 Participation by voluntary organisations

There are many types of indigenous voluntary organisation working in the forestry sector. Some of them have focused on trees merely as a means of income generation and have been little concerned with the sociological factors which constrain project performance and the participation of poorer groups. Others are primarily concerned with community organisation and far less with sectoral priorities. Yet others have become involved in forestry and tribal development through initially health-based voluntary work. There are also non-governmental organisations of foreign origin whose objectives are mainly to support and fund indigenous initiatives.

These major differences should be acknowledged in discussions concerning the participation of non-governmental organisations. Many are dependent on the enthusiasm and imagination of one or two people. They may have difficulty in institutionalising their activity and will continue as protest organisations. Yet others have valuable research programmes and have assisted with the implementation of comparable schemes: their involvement in seminars to discuss project progress and themes would be very valuable.

4.9.8 Social audit of forestry activity

The project is an environmental and forestry project, responsive to social and economic processes and able to influence them but not in a position to control them. Many of the processes are cultural and continuing or have been evolving over many decades. The unusual interest, within and outside Karnataka, in the state's forestry and in its social consequences suggests that these relationships should be documented and evaluated both historically and in terms of current trends. A research study and audit of the relationship is recommended. Its early reports would illuminate project objectives and activities but it should also provide lessons of use for further projects in Karnataka and elsewhere in

India.

4.10 Economic Strategies

4.10.1 Investment objectives

The forests of the Western Ghats provide not just an income and livelihood for people living in or around the forest area, but are important sources of timber for the construction industry, of so-called 'minor forest products' throughout the region, and of fuelwood to rural and urban consumers in neighbouring districts. Further, revenue from the forests and taxes from the sale of forest products have been an important element of domestic resource mobilisation which has financed development throughout the State.

One of the objectives of the proposed project is to recapitalise the forest areas, which over the years have become degenerated. This is in line with present forest policy which severely restricts felling in many areas. No longer are forests seen as an immediate source of State revenue. Owing to the rapid growth in other sectors of the economy as well as slower growth in forest revenue, the contribution of forest revenue to State revenue has declined from 5.7% in 1975/6 to 2.8% in 1985/6, and is probably about 2.0% in 1988/9.

4.10.2 Zonal management strategies

Zone I is defined without reference to economic management criteria, reflecting the fact that these areas are less accessible, and by definition, have not been exploited in the past.

Zones II and III are to be managed primarily for economic purposes, subject to sound environmental principles. Procedures for the inclusion of both economic and environmental factors in all forestry management equations, and for obtaining the necessary data will need to be included in the project. Further, in Zone III, the social and economic costs of relocation of forest dwellers need to be set against any environmental benefits.

In Zones IV and V, the Forest Department's overall strategy remains the protection and maximisation of the wealth of the forest, but the specific objective is to manage the supply of forest products in order to protect Zones II and III and to supply the needs of the immediately local populations.

4.10.3 Revenue considerations

The present moratorium and restrictions on logging are unlikely to continue indefinitely. The rebuilding of the capital stock of the forest safeguards the revenue of future generations. Present policy emphasises this against the advantage of current revenue. However, there is a cost attached to a 'no logging policy', in that

revenue is foregone and where the trees are already mature, there is an additional cost attached to the delay of future growth.

Working plans and thereby logging policy need to be reviewed and based on both economic and environmental factors. The revenue potential of the forest remains a key element of the strategy, albeit adjusted for environmental impacts.

4.10.4 Pricing policy

The present pricing structure and subsidy regimes ignore environmental costs and also the effect of consumer subsidies on the rates of investment in exploitation of the forest resource.

In the words of numerous of the Forest Department annual reports, as far back as 1982/3:

> "In view of the low pricing structure for supply of raw material to the industries in the past the investment in the forests, particularly in plantations, was poor and consequently the outturn from the areas leased to them was also poor"

The exclusion of environmental factors from the present pricing structure, as well as the consumer subsidies, has resulted in lower than desirable investment in forest resources throughout the State, over-exploitation of the forest, and under-valuation of forest produce. Consumers have been the sole beneficiaries of this policy. The under-valuation of forest products affects not only the organised sector, but also the income of poorer groups in society, for example, the landless and others who collect and market 'headloads' of fuelwood.

Where subsidies are necessary for certain industries or groups of consumers, then alternative mechanisms to price subsidies could be considered in order to ensure that price signals are economically and environmentally sound.

The pricing mechanism can play an important role in both the management and appraisal of the project by ensuring that economic and environmental impacts are fully included in decision-making. It is therefore proposed that 'environmental cost' prices, or 'green' prices, are calculated, which include both full economic costs and an estimate of the environmental costs.

(a) Consumer prices and subsidies

The present pricing regime for retail sales of timber and fuelwood needs to be reviewed and compared with market prices both to ascertain the current levels of subsidy within the sector and to

identify the beneficiaries.

Seigniorage rates are presently calculated on a 'no profit/loss' basis. However, this is neither a true financial price nor an economic price since Forest Department overheads are not included.

Alternative subsidy mechanisms should be considered, with a view to gradually bringing administered retail prices, for example for grade 'C' timber, into line with market prices.

(b) Transfer prices

Much of the formal distribution of timber and fuelwood is undertaken by the forestry sector corporations, whose operations "are of the nature of entrepreneurial activity of Government" (Classification of Karnataka Government Budgets, Directorate of Economics and Statistics, GoK, May 1989)

It is therefore important that the economic price signals are not masked by distorted transfer prices between the Forest Department and the corporations.

Corporations are involved in a wide range of activity including plantation management, contract logging, tree crop cultivation as well as processing of oils and furniture manufacture. The complexity of the relationship between the corporations and the Department, the wide range of activity carried out by the corporations, some of which overlaps with the Forest Department, as well as differences in re-investment policy, makes analysis of sector policy and the net impact of subsidised prices difficult.

In particular, the environmental and economic soundness of corporation investment policy, especially if this is financed from funds generated because of differences between pre-determined transfer prices and market or 'green' prices, needs to be evaluated.

(c) Market prices for fuelwood

There is no market price for fuelwood and other forest products which are collected in Zones IV and V and distributed informally in the immediate area of collection. However, where distribution and marketing is more widespread and controlled, the option of moving towards full costing should be considered.

Limiting the threat to the forest from outside the forest area requires substitute sources of supply to be developed, and it is therefore important that the price of fuelwood is not artificially low, since this will depress forest investment in other areas of the State.

(d) Import prices

Government will also need to monitor the effect of import duties on the level of imports and the level of imports on market prices.

(e) 'Green' prices

In the same way that 'economic' prices allocate resources in terms of national welfare, and subsidies distort this allocation, the exclusion of external or environmental costs/benefits results in a distortion in the allocation of resources. It is therefore proposed that the project is planned and managed on the basis of environmental cost prices or 'green' prices to ensure that the environmental effects of the project are internalised within the project.

Many of the 'environmental' benefits and costs are external to the project, and an attempt needs to be made to estimate 'green' prices before appraisal. These estimates can be refined during the project.

'Green' prices should form the basis of decision-making for planning and management within the project, and not just at the time of project formulation and appraisal. Even where it is not possible to estimate 'green' prices, management will need to ensure that environmental factors still play a significant role in decision making.

The information needed to quantify 'environmental cost' prices needs to be generated by the project, and an economic interpretation given to the environmental information, some of which is already available, as well as to other information which will be added by the project.

The importance of managing the project on the basis of 'environmental cost' prices - or 'green' prices cannot be overemphasised, since they would provide environmental and economic dimensions to decision making. The project needs to include a mechanism in order to be able to estimate and refine these prices, and their relationship to other types of prices.

'Green' prices can also be used to estimate the levels of 'environmental' subsidy.

4.10.5 Financial aspects of shared management

The planning process envisaged for Zones IV and V will involve shared or contracted management agreements, which need to have a dynamic of their own. The development of self-regulating and self-financing schemes would provide incentives for participation, and thereby avoid the difficulties associated with subsidy orientated

In order to make these arrangements work, links between rights and responsibilities (or benefits and costs) will need to be clearly defined.

4.10.6 Sources of finance

The Forest Department receives funding from both the State and Central Governments under both the plan and non-plan allocations.(Table 4.1) The Western Ghats Integrated Development Project, within which there is an allocation to forestry, provides a precedent for funding outside the plan sector.

Table 4.1 SOURCES OF FINANCE GoK BUDGETS

Budget Category	83/4	84/5	85/6	86/7	87/8
	(Rs. million)				
Non-plan	238	318	356	393	33
Plan - State plan	19	28	32	9	5
(ODA/WB SFP)			(8)	(4)	
District sector	80	130	142	120	1
(ODA/WB SFP)			(110)	(104)	(91)
Soil conservation	-	5	6	6	80
Total	105	163	180	135	187
Total Plan + Non-plan	343	481	536	528	519
Other - FDF	39	42	43	43	43
- WGIDP	8	7	18	18	18
Total Expenditure	390	530	597	589	580

Notes: FDF = Forest Development Fund
WGIDP = Western Ghats Integrated Development Programme
ODA/W8 SFP = Social Forestry Programme assisted by ODA and the World Bank - the corresponding figures (in brackets) are included in the respective State plan and District sector figures

The Forest Development Fund (FDF) is administered by the Forest Department using funds through a Forest Development Tax (FDT) levied on sales of forest products. These funds are used to supplement finance from other sources, but are controlled by the Department. The feature of this Fund is that it is related to exploitation levels.

A trust fund or funds of a similar nature might be envisaged within the proposed project. Apart from the benefit identified earlier, of linking the fund to the level of exploitation, the fund could be attached to a particular area of forest, and earmarked for its re-investment and development. This would open up a number of possibilities:

Devolved management and planning within the Forest Department
Environmental taxes/subsidies to correct differences between market and 'green' prices, and between different areas.

Further, this sort of dedicated fund might also facilitate the formulation of the proposed agreements/contracts with village communities.

Some of the activity proposed by the project in forest areas might attract private finance if it was packaged in a suitable form. The Forest Department would keep managerial control and therefore safeguard the land and ensure environmentally sound management principles. Private finance would release public funds for investments in which the benefits and costs are not so closely linked. Possibilities for private investment could be explored further.

4.10.7 Summary of economic issues

The main thrust of the economic strategy set out here is directed at the replacement of subsidised prices with full economic and environmental prices ('Green prices') for project formulation and planning. The revenue potential of the forest is considered to be an important determinant of management policy, and subject to economic criteria. The use of 'green' prices would ensure that environmental effects were included in the economic equation.

The level of re-investment in forests versus revenue generated from the forest sector requires consideration of the activities of both the Forest Department and the associated corporations.

Options for the establishment of dedicated trust funds should be considered because of the advantages of linking costs and benefits, and the possibilities of shared management schemes with local institutions.

4.11 Research and Training

4.11.1 Research

The Forest Department has a Director of Research at Conservator level. However his staff are almost entirely involved with silvicultural work and their career development as foresters does not permit them to specialise in the inter-disciplinary areas that are required to support modern forestry management. The Department has rightly recognised the need to broaden the research thrust and has precedents for contracting out research tasks.

Research objectives can be stated as follows:

to develop forest sciences in their widest sense so that the reforestation of the Western Ghats is not hindered or rendered more costly than it need be;

to raise the Karnataka research capacity to at least the average levels of other parts of India;

to be able to quantify past and future changes due to the extension and loss of forest whether in:

- the hydrological cycle
  the biogeochemical cycle
  energy flow and transformation
- the socio-economic consequences.

Some work is going on at, or will be undertaken by, the national and regional Forest Research Institutes at Dehra Dun and in Kerala respectively. Research at Karnataka level would be co-ordinated with this work. There is urgent need for a literature review bringing together the best of existing documents and research results for use on the project; and for a concise summary of current research projects inside and outside the Forest Department.

The team considers that the innovative nature and scale of the Western Ghats Project is such that considerable emphasis should be placed on the applied research necessary to avoid setbacks (whether ecological, social or economic). The "Red Book" envisaged a range of research activities and these, together with those of the McGrew and Proctor report* and some ideas resulting from this mission, have been included in the list in Annex IX. They are listed under their lead disciplines and by phasing relative to the project. We stress 'lead disciplines' as a vital objective is to encourage more cross-specialist contact in tropical forest work.

McGrew W C and Proctor J (1988): Applied Ecological Studies in the Forests of the Western Ghats, India, in 1989-1992. Visit Report for ODA.

An indication is given by an asterisk (*) of topics where British input could be valuable. However we presume the project management team will make the final identification of where to place research contracts and generally be seeking appropriate Indian expertise backed by UK affiliates. Indications of topic priorities and research project size are also given.

The size of the research programme will be related to the scope of the project and no budget or staffing indications are included at this stage.

4.11.2 Training

The project involves:

a major increase in the current level of forestry activity in Western Ghats Circles and hence in associated staff training at all levels

retraining of staff for new objectives, values and activities

adding higher technology skills resulting from computers, software graphics and genetic engineering either through taking on new staff or in-service courses

enhancing Department strength in research management and laboratory work.

Training of senior professional staff (RFO and above) is generally at the GOI Forestry Training Institute centres at Dehra Dun, Burnihat and Coimbatore. Specific individuals may receive overseas specialist training. GOI is understood to prefer overseas courses to be focused training of the type where tutors accompany groups of course members back to India in order to apply the new skills on a predetermined project. This approach would have value in a Western Ghats context as would short study visits on topics requiring comparisons of alternative overseas technologies.

Training at this level has clearly already been successful in bringing the new values of social forestry and environmental impact considerations to the fore among Department management staff. New Training Centre courses need to be devised to bring these themes down to lower staff echelons.

It is not suggested that those destined for general forest management careers can or should be trained to become ecologists or hydrologists or sociologists. Rather training will enable foresters to appreciate what those disciplines can contribute to successful forest management.

Training within Karnataka currently centres around the Department Training Centre at Tattihalla (which the Team visited on its tour).

The Centre has made the best of an opportunity that presented itself when the Power Corporation vacated a construction camp in 1986. It combines the Social Forestry Training Centre with the Forest Guards Training School and Regional Foresters-cum-Surveyors Training School. Current plans anticipate a Rangers Training College at the same site by 1995. Its Plan Allocation for 1988/89 was 2 million rupees (£80K) within a total Extension and Training budget of 158 million rupees. The Team doubts that the Tattihalla location will succeed in retaining the best training staff and their families for sufficiently long periods. This is because of its lack of ready access to town facilities.

It is recommended that the Forest Department seeks a new additional site for an attractive long term facility. Such a facility is required for the conduct of the Project and for the continuous training which the way of working to be introduced by the Project will demand. The project should therefore make a substantial contribution to this cost, provided that the Department makes a decision to move at the outset of the Project. This may well require a Capital budget of over £1 million.

This would enable the training centre to be nearer the centre of gravity of Ghats activity and reduce costs in the long term. It would also enable the Centre to be closer to evergreen forest sites and open up the possibility of its having the added function of catchment research and plot monitoring. In effect it could provide a Ghats field research centre to complement the HQ analytical work.

Tattihalla could be retained long term for less sophisticated training. It may be needed anyway for the peak load of training during the next 5 to 10 years.

The "Red Book" estimates the requirement for training to support the level of planting activity envisaged. Our recommended project option is rather less ambitious but it may still be worth retaining the recommended basic training investment in broad terms, ie 35 new trainers (compared with 43 plus part-time staff now) for 5 years: Department budget of £200 K/year.

Short course training within Karnataka for new responsibilities is envisaged in subjects such as :

- ecological understanding (for junior staff)
- rural sociological methods for consultation
- hydrological monitoring and analysis
- management contract negotiation (section 4.4.7)
  mapping with computer graphics

Initially the project could assist with training the trainers in such topics. Financial support for the expansion might appropriately be given at a high level in year 1, gradually falling to zero by the end of the project. Some demonstration items of equipment and software should be provided within this support

package.

Professional overseas training in the ecological area of Indians in the UK has been considered previously by McGrew and Proctor. Their budget visualised training 12 staff for one year plus 24 staff on 3-month courses; this would be backed by the production of a handbook to give practical guidelines on using research findings.

Too many existing forest officers cannot be released for training at the same time as they are needed for Project operations and additional young staff need to be brought in. Training should therefore be further studied in the context of organisational planning. Provisionally a programme would consist of:

UK training on the scale noted above but covering a fuller range of disciplines
reordering courses to meet the GOI approach of training linked with subsequent project application
- spreading this programme over five years
- adding one international study tour per project discipline (of which we see a maximum of ten)
study conferences out of Karnataka, either at Kerala FRI, Coimbatore FTI or a resort conference centre

Training on this scale is a complex issue and we recommend that it be addressed as a sub-project in its own right in the appraised project document.

4.12 Conclusions regarding strategy

The Team differs little from the "Red Book" at the level of forestry and land management activities.

The environment can be protected only by rendering it unnecessary for people to damage it.

Given the debate regarding forestry, at the various levels of forestry scientists, environmentalists, pressure groups and in the public as a whole, it is necessary to draw activities into an understandable and understood strategy if the forest and the environment are to be secured for future generations.

The zoning strategies and the planning strategies advanced serve the triple purpose of:

(a) guiding specific activities;
(b) explaining them to the public and to the local level forestry and other government officers;
(c) introducing an ecological dimension alongside the production activities.

The planning process assists in setting resource allocation priorities, supports decision-taking within the technical organisations and also involves - and thereby supports - the new local government structures. It also invites the participation of other relevant groups and organisations.

The use in planning and operational management of prices which take full account of economic and environmental costs will help to bring out true values and thereby reduce the pressures on the Ghats. The aim of the strategy is to reclaim to useful forest previously degraded land at as fast a rate as can be achieved by the Department successfully, both in the short and long term, without causing social disruption.

5. PROJECT OPTIONS

5.1 The role of ODA funding

ODA contributions to an environmental project in the Western Ghats would:

enable the Forest Department to make the investments necessary to achieve the objectives set out, in the form of infrastructure development, knowledge development (research) and organisational development (training)

facilitate the organisation and delivery of technical assistance which may be necessary

an additional impulse to the will of the Forest Department and other authorities to undertake the considerable task of making the necessary revisions to forest management policies and practices.

5.2 Project design options

While precise project design would be a subsequent step, various options can be identified:

(a) The Forest Department proposal as it stands

(b) The Forest Department proposal with operational modifications

e.g.:

the inclusion of forest dwellers in place of their resettlement

the further testing of aerial seeding before deciding on its inclusion or exclusion

re-planning of activities to be done before full-scale planting takes place, implying extension of the project period to allow for more groundwork such as

- better inventory of existing forests
- experimentation with fuller consultation procedures with local authorities
- selection and training of new staff
- training seminars for senior managers and reorientation courses for existing operational staff.

(c) The Forest Department proposal made more comprehensive

In addition to the modifications of Option (b) would be included:

systematic survey of the socio-economic conditions of the forest dwelling communities
harvesting operations integrated with silviculture and overall operational planning
re-structuring of working plans according to different zones
design and reservation of the core zone
formulation of policies and procedures
organisational development, including setting up a Planning and Monitoring Unit and expanding and up-grading the State training facilities.

Annex VII Contains the corresponding Project Framework.

5.3 Funding options

ODA funding options have been considered on 3 different bases:

(a) By activity

where ODA would undertake to fund certain activities or components of the project. This can work well in projects where components boundaries can be well defined, but this is not the case in the Western Ghats.

(b) By geographical area

where ODA would undertake to fund all activities in a given geographical area, excluding others. This also can work well in certain projects where compartmentalisation into discrete geographical units can be made, but this is not the case with an environmental project, for the success of which a holistic approach is necessary.

(c) By percentage

where ODA would undertake to pay a proportion of the costs of all activities in all areas, subject, of course, to budget approval and revision procedures. This mode seems the most appropriate in the present case.

5.4 Benefits, costs and phasing

5.4.1 Project duration

The team considered the project in terms of a stage in a continuing programme of work. Many of the proposed activities are already being carried out, and although for funding purposes a 5 year

project is envisaged, it is anticipated that the project should be planned over a longer horizon.

5.4.2 Phasing

The strategy proposed by the team relies heavily on a process of planned implementation. As a result it is suggested that one Circle be introduced each year, so that the necessary management reorganisation can also be phased.

Further, priority to fuelwood and bamboo plantations on the most degraded land needs to be tempered by response to the participative planning process proposed in the strategy.

5.4.3 Benefits

The main project benefits have been grouped into three types: forestry, social and environmental.

Forestry benefits will need to be estimated on the basis of incremental yields from rehabilitated land. (The "Red Book" considers total yields.) These vary from short cycle fuelwood crops to long cycle teak plantations. The project aims to enhance the capital value of the forest area, rather than generate immediate revenue.

The bulk of the benefits identified in the "Red Book" arise from thinnings from the teak plantations. However the plantation mix which is eventually agreed should be based not just on economic factors, but also on the proposed planning process, and the use of environmental cost prices.

Socio-economic benefits are derived from the increased supply of fuelwood, bamboo and other forest products to meet the needs of local inhabitants and artisans.

Environmental benefits arise from:

- increased water percolation resulting in increased irrigation and drinking water potential
- reduced damage from droughts and floods in farming areas at the margin of the forest area
- benefits associated with the extra carbon dioxide extracted from the air.

5.4.4 Economic prices

The strategy outlined earlier proposes the calculation of 'environmental cost' prices, and first estimates of these prices will be needed at appraisal. Benefits arising from forestry

projects are often understated because external/environmental benefits are ignored.

5.4.5 Project costs

The "Red Book" sets out in detail a number of models which are used to estimate the costs of various field programmes, together with the associated costs of ancillary or overhead components.

Detailed analysis is not appropriate or possible at this stage. However for the purpose of estimating a likely project cost, the team considered 3 options:

(a) Adjustments to the "Red Book" proposal

(b) Phased introduction of project process to Circles over 4 years

(c) Phased introduction to Circles over 4 years to reach targets by year 7

Project costings, on the basis of these alternatives, and using the unit costs of the "Red Book", have been estimated. These will need to be refined at a later stage. Further, the recent increase in wage rates by 46%, will need to be added to the estimates used here, which are based on July 1988 prices.

Table 5.1 **SUMMARY PROJECT COSTS (£ ,000)**

Category	Options		
	(a)	(b)	(c)
Field - Protection	6,000	3,750	2,000
- Development	53,000	36,250	27,250
Nursery and gene pool preservation	9,000	5,750	4,000
Project Support	21,500	15,750	11,250
Project total	89,500	61,500	44,500

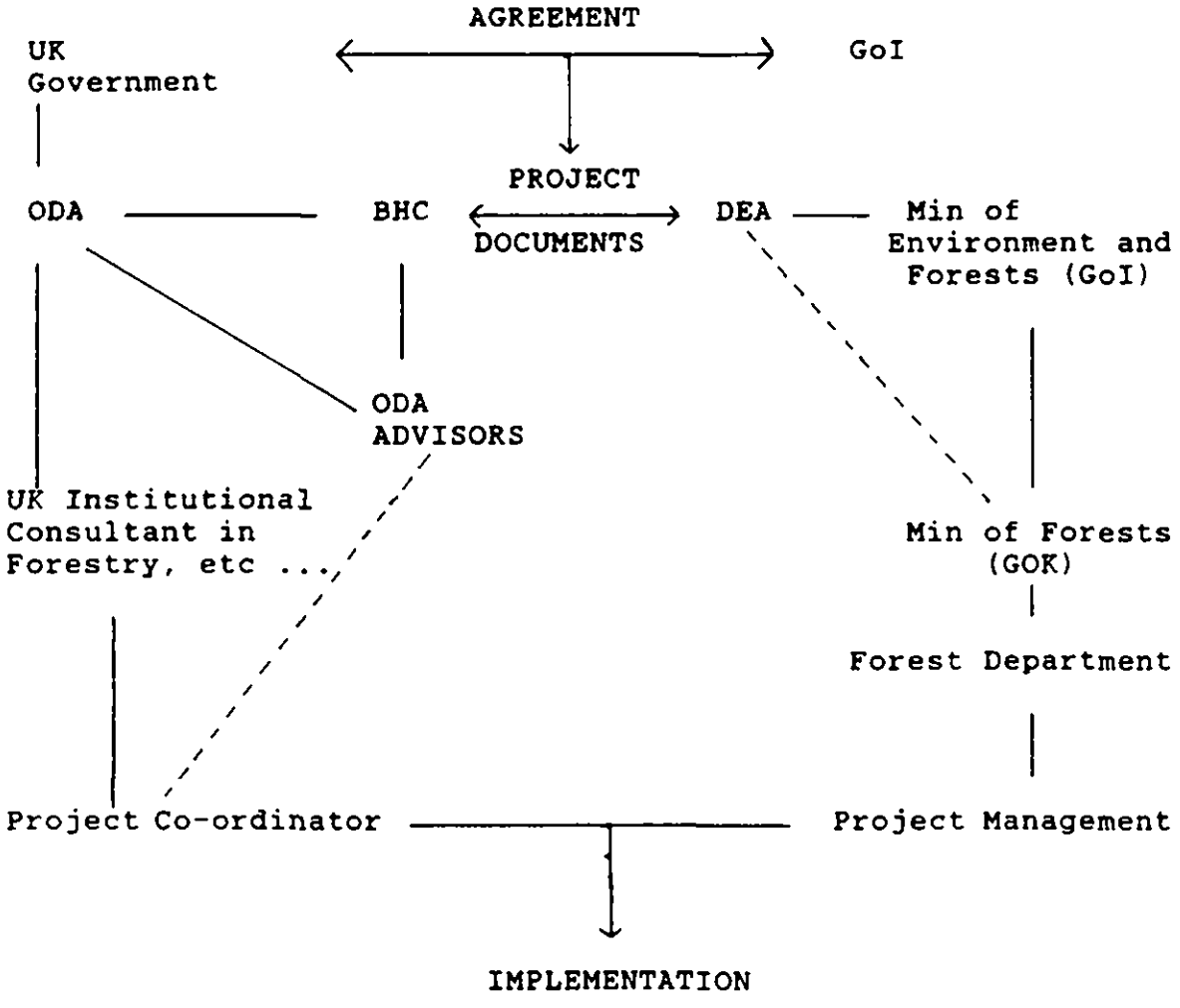
Notes: Figures are taken from the "Red Book" and scaled down where appropriate. The heading "Project Support" includes construction and buildings; equipment and vehicles; research, training and studies; tribal welfare; incremental staff (regular).

5.5 Institutional framework and project organisation

5.5.1 Institutional framework

Without going into detail at this stage, when all options are open, the institutional framework envisaged is as follows:

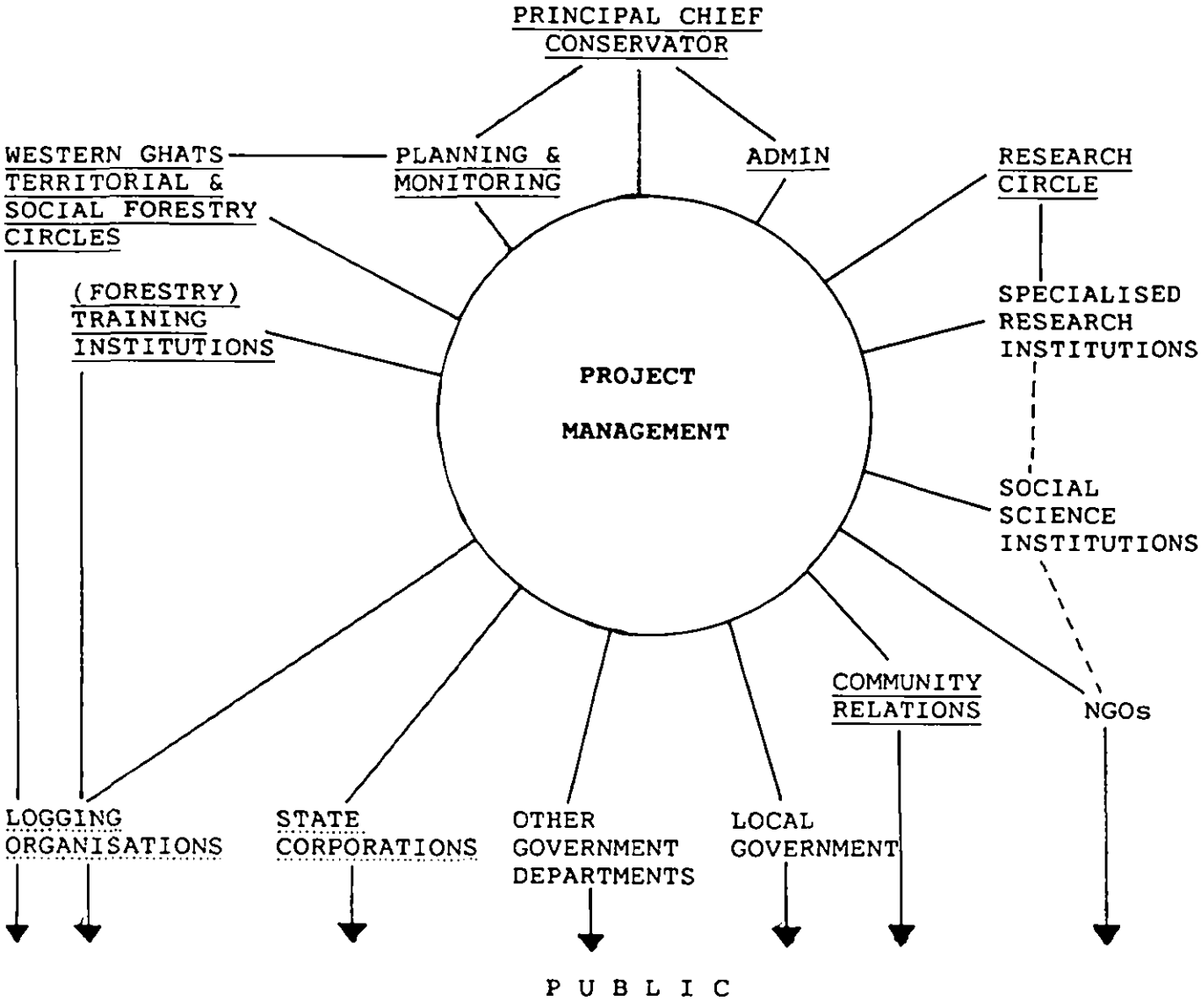
Figure 5.1 **INSTITUTIONAL FRAMEWORK**



5.5.2 Project organisation

The bodies with which the Project Management will have continuing relationships are shown in Figure 5.2. It demonstrates the complexity and variety of the management tasks. It would be premature to suggest a corresponding organisational structure for project management at this stage and only indications are given here:

Figure 5.2 PROJECT MANAGEMENT RELATIONSHIPS



Notes:

(1) Bodies underlined are part of the Forest Department organisation

(2) Bodies with dotted underlining are related to the Forest Department

(1) Project organisation should be kept small

The central organisational aim of the Project is to help the Forest Department build up its capacity to manage some new tasks and old ones in a new style. Wherever possible, therefore, existing organisational units of the Forest Department will be used. Where new units are required they could either be set up within the existing Forest Department structure or first nursed for a time in the Project organisation and then integrated into the State-wide structure.

On the other hand, the Project organisation must have sufficient conceptual and follow-up capacity to help the Forest Department adapt its thinking and style.

(2) Use of existing Forest Department units

Field operations will be carried out by the territorial Circles and Divisions. Administrative procedures will be handled by the administrative units of the Department, but owing to the size of the project some extra staff, concerned with project budget follow-up and control of funds may be required.

Legal issues will be numerous and contracting norms will have to be developed. The legal unit may therefore need strengthening.

The research component can be managed by the Research Circle, reinforced, particularly with regard to non-forestry and interdisciplinary projects.

(3) Creation of new units

Planning and Monitoring will require a new unit, best nursed into maturity within the project organisation for the first three or four years. Thereafter, it could be integrated as a full unit under the CCF's office and its procedures extended to work outside the project area.

Community Relations is similarly a newly-conceived function and a unit should be created, developed and integrated in the same way as the Planning and Monitoring Unit.

(4) Project core organisation

It is understood that a group of officers is already being formed within the Forest Department to steer the project development process. This group could be the genesis of the compact project management team, reporting to the Principal Chief Conservator of Forests.

5.6 Unresolved Issues

There can be no pretence that the strategies and actions recommended or suggested will solve all the problems and secure the Western Ghats environment for all time!

No attempt has been made to address the issues of population growth and of forest destruction for mining and particularly hydropower. These belong to political economy.

However there are also two areas which we have not addressed but which the Project should address:

The first concerns the more economical use of forest produce or substitution of it. This falls among the strategies which protect the forest and enhance its value. Work is going on regarding the economical use of fuelwood (through improved chulas). Ways of encouraging this and related work should be examined and included in the project document if appropriate. Given the size of the investments envisaged in fuelwood plantation establishment and the opportunity cost of the land so employed, the potential benefits from reduced fuelwood consumption are considerable. Studies should also be undertaken regarding the real value of green manure as compared with alternatives for use on gardens.

The second topic is that of grazing. The Team is far from convinced that the practice of stall-feeding backed up by fodder farming, will catch on - at least in a project-related time horizon. More alternatives should be considered within the Project, including innovative institutional approaches.

5.7 Next Steps

5.7.1 The present position

As the Team understands it, the Forest Department proposal has already been sent to the Centre by the Forest Department through the Government of Karnataka. Subject to modifications, it is likely to be forwarded to ODA (BHC) with a request for funding.

5.7.2 Consideration of options

The present report sets out certain strategic and project options, which would normally be discussed between ODA and the Governments of India and Karnataka with the object of setting the framework and limits for a project.

5.7.3 Drafting and appraisal of the Project document

The Forest Department would then revise their proposals, in accordance with what has been agreed. The participation of ODA consultants in that revision would help the process of final

appraisal. It would permit an in-depth discussion of issues and the way of working of the Project within the Department and in relation to outside bodies. Careful planning of project start-up activities can avoid delays and errors in implementation; such activities will need to be undertaken both in India (Karnataka and Delhi) and in Great Britain. The terms of reference for the joint Forest Department/ODA team would therefore include defining preparatory and start-up activities and the information required for them, as well as drawing up the Project Document in an appraisable form and ready for signature.

ANNEX I WESTERN GHATS ENVIRONMENT PROJECT DRAFT TERMS OF REFERENCE

In collaboration with the Karnataka State Forest Department and drawing upon (a) the Forest Department's report (July 1988) on the integrated development of the forests of the Western Ghats, (b) lessons learnt from the ODA/IDA Social Forestry Project, (c) fields visits to the forests and discussions with officials and other relevant institutions concerned, (d) other information relevant to assessing the socio-economic benefits associated with the forests and, (e) available information on other proposed actions and/or sources of support to assist the integrated development of the forests, (f) relevant experience elsewhere in India, (g) planned activities of other aid donors:

I To examine and express in both quantitative and qualitative terms the probable benefits from the integrated development of the forests taking account not only of material produce with particular attention to the needs of local communities, but also of (a) environmental benefits, both in the immediate environs of the forests and more widely, through their influence on climate and water resources and, (b) the conservation of genetic resources and biodiversity.

II To review the overall objectives and principal lines of action proposed in the Forest Department's report, in relation to the sustainable derivation and distribution of socio-economic benefits from the forests and to make suggestions for possible improvements in the overall objectives and actions proposed.

III To review the availability of the information needed to guide the integrated development of the forests for maximum sustainable socio-economic benefits and to prescribe the action required to ensure the provision of the necessary data, both now and in the future, taking account of ongoing or proposed research.

IV To review the implication for a possible project of the policy, institutional, social and legal context of forest use and management and consider ways in which integrated development of the forests and degraded areas can be ensured through local people's participation as well as the expertise and support from forest department, paying particular attention to the position of tribal forest dwellers, landless labourers and small farmers and in each of these also the role and needs of women.

To consider the institutional framework for the possible project and the preliminary recommendations.

VI. To assess and prioritise the options for a possible ODA supported project to assist the integrated development of the forests of the Western Ghats in Karnataka, taking account of (a) the relative priority and urgency of the main lines of action proposed in the Forest Department's report, as modified in the light of action taken under (I) to (IV) above (b) the appropriateness of British expertise and capabilities to assist and, (c) the expected national or other external contributions. The report should include for each option proposed inputs with rough costings and suggestions for optimal phasing of inputs to enable an early start to be made. A draft project framework should be prepared.

ANNEX II LIST OF PEOPLE MET WITH PLACES

(With apologies for omissions and mis-spellings)

Mr Phil Mason	ODA India Desk, London
Mr Ron Kemp	ODA Forestry Adviser, London
Dr Charles Clift	ODA Economics Adviser, London
Dr Rosalynd Eyben	ODA Social Development Adviser
Mr Desmond Chaffey	First Secretary (National Resources) BHC
Dr Jyotsna Paranjape	Senior Development Officer, BHC, New Delhi
Mr Jeffrey James	Counsellor, BHC, New Delhi
Mr K P Geetakhrishnan	Secretary (Enviroment and Forests), GOI, New Delhi
Prof M V Nadkarni	Ecological Economics Unit, Institute for Social and Economic Change, Banglore
Mr Syed Pasha	ISEC, Bangalore
Prof Madhav Gadgil	Centre for Ecological Sciences, Indian Institute of Science, Bangalore
Mr S Shyam Sunder	PCCF, Karnataka State Forest Department
Mr S Parameshwarappa	CCF (General)
Mr N V Ramachandra Chetty	CCF (Development)
Mr P D Gaonkhar	ACCF (SF Project)
Mr H P Krishnappa	ACCF (WP & D)
Mr R M Palanna	CF (M & E)
Mr A N Y Reddy	CF (Research)
Mr S Jogaiah	CF (Bangalore)
Mr N Sampangi	CF (Development)
Dr P J Dilip Kumar	Forest Utilisation Officer
Mr A Akbar Sha	Silviculturalist (Madikiere)
Mr R M N Sahai	DCF (SC)
Mr Nagraju	DCF (HA)
Mr S K Kamlengagourda	DCF (Bangalore Urban Development)
Mr H K Appayya	ACCF (WCP)
Mr Philip Adlard	Forester, OFI (in Bangalore)
Ms Hilary Coulby	Oxfam Area Desk Officer, Oxford
Mr Roy Trivedi	Oxfam Development Policy Unit, Oxford
Dr David Mosse	Regional Representative, Oxfam, Bangalore North Karnataka Representative, Oxfam
Mr Bhimsen Rao	Director, Rural Development and Panchayat Ra Department, Bangalore
Mr S Sethurathnan	Internal Financial Adviser, RD & PR Department
Mr S Z Pasha	Dep Secretary, Social Welfare Department
Mr D S Siddegowda	Jt Director, Social Welfare Dept (Tribal Sub-Plan)

Ms Shamithi Shankar	Under Secretary (Social Welfare Department)
Mr P Y Siddalmgappa	Research Officer, Tribal (Sub-Plan)
Dr A Kumera Swamy	Jt Director (Livestock Development)
Dr Reddy	Jt Director (Animal Health)
Dr Venkobachar	Fodder Development Officer
Mr Srinivasa Murthy	Chief Secretary, Mysore Zilla Panchayat
Mr Ranganathan	Dep Secretary, Mysore Zilla Panchayat
Dr Kodira A Kushalapa	CF (Mysore Circle)
Mr Sreenivas	DFO (Wildlife)
Mr C S Vedanth	DFO (Mysore)
Mr S K Chakrabodi	GM (Logging) KSIFC
Mr M H Swaminath	Silviculturalist (Bangalore)
Mr R K Toorvi	CF (Mercara Circle)
Mr M Basappa	DFO (Hunsar)
Mr Chikkappia	ACF (Tirimiti)
Mr K Sundarnaik	DCF (Madikiere)
Mr M B Bhemmairah	ACF (Madikiere)
Mr M N J Kumar	DCF (Mangalore)
Mr A B Appanna	ACF (Managlore)
Mr C D Dyabaiah	DCF (Kundapar)
Mr J N Raj	ACF Henguvally
Mr D P Dirakar	ACF (SF - Mangalore)
Mr I B Shrivastava	DFO (Hassam)
Mr A S Sadashivaiah	CF (Shimoga Circle)
Mr K Sugari	DFO (Chikmagular)
Mr Shivaprakesh	DPO (SF-Chikmagular)
Mr K K Purushotham	ACF (SF)
Mr A Rathnakarshetty	RFO (SF)
Mr Vishumath	ACF (Kudremukh)
Mr M G Pai	DCF (SF - Shimoga)
Mr B R Thammanapa	ACF (SF)
Mr A Madhav	ACF (Shimoga)
Mr Hiremathi	DFO (Shimoga)
Mr S M Chalwali	DFO (Badhrati)
Mr Gopal Projari	ACF (Badhrati)
Maj. Gen. B P Roy	Director (Production and Projects), Kudremuk Iron Ore Company Ltd
Mr Singanniapar	Regional Manager (Shimoga), KSIFDC
Mr K Muthappa	Manager, Shimoga Saw Mills, KSIFDC
Mr K Nanjundaswamy	Land Development Officer, CARDA, Badra Project
Mr Narayan Kari	Asst Engineer, CARDA, Badra Project
Mr V M Gungannavar	District Planning Officer, (Shimoga)

Mr Venkatha Subbiah	EE, No2 Irrigation Investigation Div (Shimoga)
Mr Shankar Murthi	AEE, Superintending Engineer (Design), North Zone (Belgaum), Department of Irrigation
Mr Nursinha	AEE, Superintending Engineer (Design), North Zone (Belgaum), Department of Irrigation
Mr Shivamurthy	PAO, Department of Agriculture, Shimoga
Mr P Subramanian	TA (1) to SE, Badra Project
Mr C S Bassippa	TA (2) to SE (World Bank Project), Badra Project
Dr S N Rai	CF (Kannara Circle)
Mr Dipak Sarmah	DCF (Sirsi)
Mr Yekantappa	DCF (Honari)
Mr Sagar	Silviculturalist (Dharwad)
Mr Narayan Swami	DCF (KCDC)
Mr Prapullachandra	Farmer, Hosalli
Mr Jayaram	DFO (Yellapkr)
Mr N D Tiwari	DFO (Harilal)
Mr Javid Hussein	ACF (Sirsi)
Mr V V Swami	ACF (Siddapur)
Mr Manjinnath Tambakad	ACF (Yellapur)
Mr Kaniappa	Village Headman, Hunusur
Mr P Sridhar	DCF and Principal, Tattihalla Training Centr
Mr N G Veerappa	CF (Belgaum Circle)
Mr N C S Murthy	DCF (Belgaum)
Dr C B Meti	Dep Director (Animal Husbandry)
Dr Raiz Ahmed Khan	Asst Director (Animal Husbandry)
Mr P A Poonacha	Jt Director of Agriculture (Dharwar)
Mr Muni Reddy	DFO (Dharwad)
Mrs Shanti Kumari	Addl Secretary, Planning Department, GOK
Mr B G Bhut	Director, Plan Finance & Resources Division
Mr M Basavangoudd	Director, District Planning Division
Dr Gladys Mitra	Director (Plan Formulation - Agriculture and Forests)
Dr Nagraj	Director, Department of Economics and Statistics
Mr Basavarajapp	Jt Director (Agriculture and Rainfall), DES
Mr V Baiasubramanian	Jt Director (Agricultursl Statistics), DES
Mr C T Muthrath	Jt Director (Development), Dept of Agriculture, Bangalore

Mr Chetty	MD, KSFIC, Bangalore
Mr Vishivanatha	MD, KRDC, Bangalore
Mr A G Oka	IGF, GOI, New Delhi
Dr George Axinn	FAO, Representative, New Delhi
Dr Jim Alexander	World Bank, Agricultural Department, New Delhi
Mr B G Channappa	Asst Director (Hydrology), Department of Mines and Geology, Banaglore
Mr M S Bhat	Geophysicist, Department of Mines and Geology
.....	Superintending Engineer (Hydrology), Water Resource Development Organisation, GOK
.....	Chief, Forest Survey of India, Bangalore
Mr I V Sharma	Executive Engineer (Investigations), Karnataka Power Corporation
Mr M S Raghavendra	Asst Executive Engineer, KPC
	Superintending Engineer Hydraulic Model Laboratory, Karnataka Engineering Reasearch Station, Mysore
Rev Fr Ambrose	Catholic Church, Yellapur
Dr J Pratash	Divisional Horticultural Officer, Sirsi
Mr Koyasur	Jammane Village, Sirsi
Mr Veerkata Swamy	DCF, Sirsi
Mr Nareudra Hedge	Sahyadri Praisara Vardhini
Mr G S Pabhin	DFO (Social Forestry)
Mr A P Fernandez	Executive Director, Myrada
Mr A K Verma	CF, (ST.SC Sub-Plans)
Dr Sundar Shau	Vivekananda Girijana Kalyana Kendra
Dr Sidaya	BAIF
Mr Deveraj	RFO, Karapur
Dr G Padmanabhan	Tribe Guild Development Council, Kaapur

Mr P B Mahishi	Administrator, CADA (Carvery Basin Projects)
Mr P Annu Reddy	DFO, Guamrajahnagar
Mr R N Vittalrao	ACF, Yellanpur
Mr Ravi Kumar	RFO, Guamrajahnagar
Mr T Dhamstrekaran	Secretary, Department of Social Welfare
Dr Jo Tharamangalam	Head, Sociology Department, Institute of Social and Economic Change, Banaglore
Dr Karanth	Sociologist, Institute of Social and Economic Change, Banaglore
Dr Jose Murickan	Director, Indian Social Institute, New Dehli
Dr Walter Fernandez	Head, Research Department, Indian Social Institute, New Delhi
Mr K M Hedge	IIS, Field Station, Bhairumbe
Mr S N Hedge	Sahyadri Parisara Vardhini, Sirsi
Mr S R Hiremath	Samaj Parivartana Samudaya, Dharwad
Mr S Girijashankar	Editor 'Janamitra', Chikmagalur
Mr Anath Hedge Ashisar	Vriksha Laksha Andolan, Sagar
Mr Ranjan Rao Yerdoos	Agha Khan Foundation, (from Geneva)
Dr Kusama	Sneha Kunja Kasarkod, Yttara Kannada
Mr S Sreekanth	DEED, Hunsur
Dr H Sudarshan	Vivekananda Girijana Kalyana Kendra, B R Hills
Dr Kabbur	Coordinator, Indian Development Service (I) Dharwad

ANNEX III DESCRIPTION OF THE WESTERN GHATS AND THE FOREST RESOURCE

Geography

The Western Ghats are the range of high hills that run about 1600 km along the West Coast of Peninsular India from the river Tapti (21°N) to the southern point of India (about 8°N). The west slope is steep whilst that to the east is more gentle. They are very variable climatically and geologically along this length. They have been described by Pascal (1982) and the following information on their structure and climate is derived from this source. Pascal separates the Ghats with three regions: north, from Surat to Gou; central, from the Gran hills to the Nilgiri mountains, and south, from the Palghat gap. The Karnataka Ghats fall in the central part. They range from 700 to 1000 m in height in the northern part of the State and then fluctuate in altitude southwards from the sudden elevation to 1343 m at Kodachadri, 645 m at Agumbe to 1892 m at Kudremukh and 1713 m at Puchpagiri. At Karwar the Ghats reach the sea and south of this there is a flat coastal zone (called South Kannada) which reaches 80 km in width. The coastal zone narrows to about 30 km in the vicinity of Coorg and is then called Malabar.

The rocks of the Karnataka Ghats are of Pre-Cambrian age. They include granites, diorites, epidiorites, and quartzites.

Climate

Like the rest of Peninsular India the climate is monsoonal: the north-east monsoon is dry whilst that from the south-west brings much rain. The rainfall (Map 3) varies along three gradients: south-north, east-west, and altitudinally. It reaches a mean of 7460 mm at Agumbe. The rain is very variable from year to year and at Agumbe since 1946 has ranged from 4012 mm to 12918 mm. In all areas there is a marked rain shadow effect of the Ghats with annual totals usually falling to below 1000 mm about 120 km from the coast. The length of the dry season varies from a mean of about 3 months (at high altitude in the south of the region) to about 8 months on the eastern side of the Ghats in the north. The wetter places of the Ghats are perhaps unique in the world in combining very high rainfall with such seasonality. Thus the mean of around 7,000 mm/year of rain at Agumbe is concentrated in 128 rain days.

There is substantial seasonality in the temperature with mean monthly maxima in the lowlands reaching about 33°C at the end of the dry season and c 29°C in the middle of the wet season. The lowlands minima vary from about 21°C in the middle of the dry season to about 25°C at the beginning of the wet season.

Most places have winds in the range of 1-19 km/hr^{-1} for most days throughout the year. Winds in the range 20-61 km/hr^{-1} occur several days in each month at certain sites but winds above 61 km/hr^{-1} were not recorded in a 10 year period for anywhere in the region.

Forests

The whole of the study area in Karnataka was probably forested before the advent of man, with the possible exception of those sites at the highest altitudes which may always have had grassland. The lowland regions and the Ghats up to about 100 km from the coast (with a rainfall of 2000 mm or more) were covered with evergreen forest. East of this the evergreen forest would have given way to forest of the dry deciduous type. The forest cover is now only about 14% of the land area of the State (Sinha 1988). The pristine evergreen forests have disappeared from South Kannada and Malabar but an important and largely continuous strip still exists on the steep western slopes of the Ghats. There are substantial patches of moist deciduous forests (possibly derived from original evergreen forests) in the strip. The dry deciduous forest areas have also largely disappeared but some important fragments remain.

20% quite earlier

The causes of the forest disappearance are entirely anthropogenic and include clearances for agriculture, submergence behind dams, burning, logging, grazing and firewood collection. The present vegetation consists largely of a patchwork of deforested land (much of which is in poor condition agriculturally) degraded forests of a range of quality, plantation forests, and the remnants of the primeval forest. The current forest types in the Karnataka Ghats, both natural and degraded, (as shown on the three maps by Pascal, 1982a, b, c), are: evergreen and semi-evergreen forest, with altitude plant communities at low (0-850m), medium (650-1,400m), and high (1,400m-1800m) elevation; moist deciduous forest, and dry deciduous forest. Forest covers is shown in Map 1, but neither the patchwork nature of the remaining forests, nor the different forest types, are illustrated. Sinha (1988) quantifies the extent of remaining forest types as follows:

- Evergreen and Semi-evergreen 20%
  Moist deciduous forest 9%
  Dry deciduous forest 12%
  and the remaining 59% is degraded.

The limited amount of undisturbed forest and their patchiness, have considerable implications for the design and location of management zones (Section 4.3). New: 50,000 scale forest type and density maps by the Forest Survey of India now exist and will greatly assist that design process.

Ecology

The natural forests of the Western Ghats are a very important resource ecologically: arguably no other rainforest area in the world should have a greater priority in conservation action. The Ghats' forests remain surprisingly little known for reasons which are not clear - perhaps because of the widespread view outside India that virtually all Indian forests are degraded irretrievably. This is clearly not the case and they are going to become much more

widely known now that an English translation of a major French ecological work is now available (Pascal 1989). The best examples of the Western Ghat forests are found in Karnataka.

The Ghats' forests are important in many ways. First they lie between the African and Indo-Malaysian rainforest blocks and along with the forests on the island of Madagascar are amongst the most isolated rainforests of the world. Perhaps only those in the islands of Hawaii occur further from a major rainforest block. Their isolation is probably the cause of their poorness in species compared with other rainforests although they are of course species-rich compared with most other types of vegetation. The lower numbers of species makes them important from the theoretical ecological viewpoint but at the some time renders them more susceptible to commercial pressures.

Their isolation means that large numbers of species of animal and plant are found only in the Western Ghats. Amongst the more notable of the animal species, the Lion-tailed Macaque is known only from a few populations in the Ghats (Ramachandran 1986). There are 5 other large mammal species endemic to the Ghats, several high altitude species with affinities to the Himalayan uplands, and numerous endemic birds. Several animal species, notable the Tiger and the Asian Elephant have important populations in the Ghats although they are not restricted to them. There are at least 130 endemic species of tree (Bor 1953) whilst Subramanian (1986) has shown that 1500 species of higher plants (including herbaceous as well as woody) species are restricted to the Ghats. Kumar (1986) has shown that eighty-four species of orchid (35% of the known orchids of Peninsular India) are endemic to the Ghats.

In no other part of the world is evergreen rainforest found under such seasonal climates (Rai and Proctor 1986a). This is critical for their susceptibility to damage; their survival during the dry season means they must have access to underground water, and interference with the system's hydrology might endanger this survival. The climatic seasonality also has important implications for their production of wood and litter (Rai and Proctor 1986b).

The interdigitation of deciduous and evergreen forest types is another fascinating feature. Tropical deciduous forests are very rare in a relatively undisturbed state anywhere in the world. Such exist in small pockets in the Ghats and should have a high priority for conservation. They may be a derived forest type but their juxtapositions with evergreen forest lends itself in a unique way to research on their origin. Sufficient patches of these natural forests remain in a pristine or restorable condition to make their conservation worthwhile, but an end to the present logging moratorium followed by unwise management might cause irretrievable damage to them.

Environmental Threats

1. Fire

Probably does not occur in natural forests to any great extent, except where they border grassland. The fires are usually confined to the undergrowth and small trees in evergreen forest, but this seems exceptional. In open degraded forests fire is probably a major factor in the lack of natural regeneration, and in the invasion of moister forest zones by dry-forest, fire-resistant species.

2. Grazing

The extent of grazing and browsing in natural forests needs investigation. It clearly forms an important part of encroachment and the spiral of forest degradation. In already degraded forest, grazing curtails the understorey vegetation and prevents natural regeneration. The Forest Department estimates that as much as 75% of the remaining forest in the State has little or no regenerating understorey (Forest Survey of India 1987). The implications are that unless this is reversed, these are dead forests once mature trees die. In young plantations grazing can be serious, particularly for bamboo and pine, but not for inedible species like eucalypts and Acacia auriculiformis.

Over-grazing can also seriously harm soil structure, as cattle trample the soil. This exacerbates the breakdown in the cycle of forest regeneration. The influence of grazing and soil compaction by wildlife, in particular the large herbivores (elephants, bison, deer), is negligible because of their low population densities.

3. Firewood collection

The damage caused is also difficult to assess without research. If confined to dead wood collections, then it entails some nutrient losses which may be sustained by the system, although it will be detrimental to many invertebrates and insectivorous and breeding birds. Since it is more likely to include living material, the nutrient loss may not be sustainable for certain species.

4. Logging

Excessive logging if followed by 1-3 above will destroy the forest. At best excessive logging (currently illegal) will result in a degraded forest that will need silvicultural treatment, possibly underplanting, to restore to a closed canopy cover. Logging may encourage villagers to encroach

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Village fuelwood distribution systems

Women's work and fuelwood supplies

(with 1-3 above) to make the land suitable for agricultural use.

5. Submergence of forest by dams

This is still occurring and a particularly unfortunate example was seen on the Sharavati River where there is a river valley of great scenic beauty with forest of much biological interest. The dam which is about to be built by KPC (funded by a World Bank loan) will seriously affect the area which has great tourist potential next to Jog Falls. NGO's query and oppose projects which destroy the environment.

6. Forest is being cleared in association with the building of a nuclear power station at Kaiga near Karwar.

Clearance for agricultural purposes is still occurring and called "Encroachment by villagers". New roads are few but do occur (eg. to provide access to the area at Kudremukh); they destroy forest and lead to the arrival of new settlers who move into the forest by the roadsides.

8. Forest is cleared to provide routes for power lines.

9. In view of the heavy seasonal rain, forest damage on sloping ground could lead to very serious erosion. At present the forest on slopes still seems reasonably intact and serious widespread erosion has not been seen.

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ANNEX IV ENVIRONMENTAL INFLUENCES OF THE WESTERN GHATS FORESTS

1 On Climate

The State has a long and substantial rainfall measuring network (WRDO 1989). Pascal's map best illustrates the past and present gauged locations while the broad pattern of rainfall intensity (illustrated in Map 3), is best shown by IBRD, 1981. The bulk of the year's rain comes with the onset of the monsoon, generally at the beginning of June, through to the end of September, (DES 1984, Deshmukh 1986). Because the Ghats provide a continuous high barrier to the moist air masses moving in from the ocean, the highest rainfalls lie along their backbone. They also create a rain shadow effect and annual rainfall totals drop rapidly with the passage eastwards.

The coastal plain is subject to high rainfall as landfall triggers rainstorm activity. However, the wettest zone is on and below the escarpment where the uplift of air as it moves east and north initiates preferential condensation of rain. From the rainguages at Kudremukh mine through Agumbe to Mastikitte it has been found that there is a 50 km long north-south mean rainfall band of 6000 mm/year or even higher. But only 90 km inland from coast mean rainfall drops to 900 mm/year (below which Pascal expects dry deciduous forest to predominate).

There are often pre-monsoon storms in mid April or May, and some inland areas benefit from October - November rains as the monsoon weather system retreats south in the annual cycle. Consequently the number of raindays per year is regionally varied and the really dry season is concentrated around January and February.

The Ghats, with a highest peak in Karnataka of 1,920m near Chikmagalur and the lowest through Siddapur pass at 600m, would be a wet zone even if denuded of trees as the forests add insignificantly to the barrier effect. However the trees do take some energy from the weather system and the extent of climate change if the forests were to disappear is as yet unknown. At the very least they ameliorate temperature ranges and raise humidity levels within the boundary layer. Even if the presence of forest does not influence total rainfall, but ensure that it is distributed over more raindays, this will assist agriculture and hydropower.

The Directorate of Economics and Statistics which is responsible for collating and analysing Karnataka rainfall data (DES 1984) has concentrated on average statistics for the period 1901-1950 using Indian Meteorological Department methods. However, no printed mean rainfall map of this excellent dataset exists and the few hand drawn ones have become dispersed such that the team could not view one. It is necessary therefore to use the detailed maps of Pascal (1984) and IBRD 1981 which summarise non-coincident historic data.

The team was told that the Bangalore rainfall record (from before 1880) shows no sign of any upward or downward trend in mean rainfall and this is confirmed by the data in the State Gazeteer. The current work to transfer computerised raindata to a microcomputer at the Bureau of Economics and Statistics will advance the essential research.

Afforestation is expected to ensure the stability of the local climate on which much of the State's economy depends. At present it has been said to the team that Belgaum rainfall 'used to be 45"/year (1000 mm/a) but is now nearer 35"/year (875 mm/a)'. This reflects the chance incidence of the last decade being a dry one. However it follows a period of substantial forest encroachment and coincides with the world's warmest decade since instrumental measurements began. It is not surprising if majority local opinion expects more forests will bring back more rain. This project will miss a major opportunity if it does not use the best hydro-meteorological research techniques to examine the climatic linkages with restoration of substantial forest acreages.

2 On Soil Resources

The Ghats are old geologically, much of the granites, quartzites, gneisses, shales and schistose greywackes being of Precambrian age. Steeply dipping strata leave dominant ridges that tend to run NNW - SSE. Important features are the variability in depth of weathering (recorded in Dept of Mines and Geology Taluk Groundwater Studies) and the extent of bedrock jointing. Red lateritic soils are dominant at the higher levels, with both aluminised and ferruginous types. There are reported to be greyer under forest and coffee/tea plantations where a humus profile has been able to develop. Towards the eastern side of the Ghats there are more fertile red loamy soils which encourage agricultural development. In the north eastern corner of the study area there are the black cotton soils that favour more intensive cultivation and are often under irrigation. (Neither those nor the coastal sandy and alluvial soils are important to this project's direct success).

Soils generally have a fair to high clay component hence the predominance of a roof tile style of housing. They are not particularly prone to erosion despite monsoon rainfall intensities. Consequently PWD road construction can employ steeply sloped cuttings and leave them unprotected without excessive slumping (although some does occur). Similarly roadside drainage does not immediately cause gullying of the native soils. Chinnamani and Sakthivadviel (1982) give a good summary of manmade landslip causes on the Tamil Nadu - Karnataka border.

Because the team was travelling in the early part of the monsoon it was possible to note the very different sediment carrying characteristics of mountain rivers. Those under forest were almost uniformly clear, occasionally with a slight grey cast from the washoff of humus and forest litter. The paddy valleys, however,

create quite strong red discolouration of streamflow, with areca garden cultivation somewhere in between. The Power Corporation, with its catchments mainly in forest areas on west flowing streams, reports no sedimentation problem. Irrigation agencies on the easterly streams monitor sediment because their reservoirs are efficient traps (KERS 1980); however the most notable difficulty to date has been restricted to the erosion of iron ore mine waste-tips eg into Bhadra Reservoir. Bed load movement is not identified as a significant problem.

During one heavy downpour we observed degraded grassland at altitude giving brown-to-red sheet runoff while adjacent recently afforested land gave a smaller clearer peak runoff. This project has the same potential to restore soil structure and limit the loss of the degraded and burnt grassland soils. Forest Department planting techniques utilise state-of-the-art soil and moisture conservation techniques and there is unlikely to be any significant soil loss at that stage especially as new access road construction is not a project feature. However it is noteworthy that the Department does not have the technical capability for routine monitoring of soil loss on its areas of planting. No examples have been seen of planted land under high water table and saturated profile conditions which might be expected to initiate soil transport. Qualitative descriptions were given to the team of high infiltration rates in the natural soils through planting pits and trenches.

3 On Groundwater Supplies

In most areas of the Ghats the Department of Mines and Geology has assessed natural recharge as between 3 and 8% of rainfall, with the higher % normally applying in the drier and generally flatter areas. Such figures for mean annual recharge (say 75 mmpa) have emerged from the taluk by taluk survey of all village wells, their ownership construction, output, equipment (including pump capacity if any and purpose). This major survey has taken almost twenty years and during that period many additional bores have been sunk following the Department's identification of extra groundwater potential. A regular water level monitoring network has been set up, pumping tests have been carried out, saturated thickness of aquifer have been assessed and groundwater quality samples have been analysed.

Typically groundwater level varies over about 5 m and just occasionally after the wet season will approach within 1 - 2 m of the surface at key locations. There are no clear reports of there being other than a single unconfined aquifer system. Storage coefficient (the proportion of drainable water volume to rock volume) is around 3%. Consequently the groundwater reservoir size is equal to perhaps 3% x 5 m = 150 mm at 200% of the mean annual recharge. This should be amply sufficient to balance out most of the variability in recharge between years, especially as springflow losses seem small.

No one bore is likely to give much above 1 litre sec but few are totally unsuccessful, provided they are kept about 200 m away from the next bore and are sufficiently deep (say 30 - 40 m). Most groundwater is fresh and well within WHO guidelines. However occasionally high total dissolved solids (TDS) are recorded and this can be taken (when away from coastal salinity) to infer poor recharge rates to that rock zone. Elsewhere high iron values may occur. Some values of high nitrate indicate proximity to domestic or farm effluent seepage, always a risk in a jointed hard rock aquifer.

The Forest Department avow that reafforestation raises the water table within two or three seasons but no quantitative proof of this has yet been attempted. The logic stems not from shielding the ground from high temperatures but from the reasonable conviction that forest litter and root pathways permit preferential recharge. If flood peaks are reduced then higher infiltration must be occurring (always assuming that there is no shallow drainage increase that completely negates this infiltration gain).

4 On Surface Water Developments

Some high rainfall high altitude forest dominated streams are perennial despite the high evaporation losses of the dry season. This is known from a State-wide network of over 100 current meter gauging stations over a range of altitudes to 1400 m, catchment sizes down to 4.5 sq km, and annual rainfalls over a tenfold range. Although stations are operated by a range of agencies, their results are all communicated to the Water Resources Development Organisation (PWD). This body has published since 1970 an Hydrological Yearbook, the latest issue being for 1986-87. (Regrettably only 60 per year are published for distribution with Government. None ever remain for sale and therefore the data have not been as widely used as they might be.) The yearbook gives daily flows for representative stations. Flood peaks are not well recorded everywhere as WRDO sites are only manually read three times a day; however Power Corporation sites do use autographic water level recorder charts. There appears not to be an authoritative water balance methodology for the Ghats, a feature first noted in IBRD 1981 Annex VI in some detail; recent examples seen by the team include:

Mean runoff = 85% mean rainfall - 12 ins/yr (Inglis formula), and
Mean runoff = 60% mean rainfall.

A local Civil Engineering Dept PhD thesis is said to be under preparation on this important topic. It seems clear that some major reservoirs have received up to 20% less inflow than expected despite a long and dense rainfall network over the Ghats. Long first filling and refilling periods are widespread and have led to supply restrictions.

For hydrodams with high percentage regulation of inflow to generate

power there is a perceptible concern at the Power Corporation that more trees will lead to less power. They quote the respected ex Chairman of the GOI Central Water Commission (Thomas 1989) who said 'while forests are required for the protection of the environment and the ecosystem, they are certainly not required for rainfall or for soil and water conservation. Grass and bush (vegetal cover) is essential on sloping lands to prevent soil erosion and this also helps in retarding the flow of rain water and thereby inducing a greater quantum of infiltration to the groundwater storage. Forest also retard the flow of rain water but the water that infiltrates into the ground is sucked back by deep roots of trees and less water goes down to the ground water storage'.

For hydropower that operates from the run-of-river flow or a minor storage then the likely ability of the forest to transfer some flood water into a longer flow recession season will be beneficial.

Similar arguments apply to irrigation works. Major dams may well be losing some inflow while minor unregulated offtakes will gain not only from prolonged low flow seasons but from sediment retention by the forests and plantations. Town water supplies to the east come from dams and can be assessed along with irrigation schemes, although recognising the former meet a steadier demand year-round. Those on the west coast are likely to be more dependent on the forest but the rapid growth of regulated flows from hydrodams secures those urban supplies anyway.

There appears to have been no attempt yet to show how the Ghats forests or their partial clearance has changed the flow-duration curve relationships. And the rate of growth of power and irrigation demand has probably masked the subtleties of any underlying small changes in the mean annual rainfall/runoff relationship of Ghats catchments under changing land use. A significant forest area growth could for some basins mean higher dam costs. However KFD are not equipped to measure this impact, to adjust their planting densities to mitigate any net loss, or to prove that better water quality below forest reduces town water treatment costs.

In making our own initial assessment we have assumed for the irrigated agriculture sector that the dominant influences of forest restoration will be above the major Command Authority canal schemes and above the 900 mm rainfall contour.

As a footnote to this section we record the marked absence of wetland swamps at any level in the Ghats thus restricting some ecosystem variants and the natural regulation of river flow.

5. On Air Quality

Our attention has not been specifically drawn to air quality problems in the Ghats. Trees are known to trap dust particles and bring them to ground by leaf fall or rain throughfall. They also produce 'occult precipitation' by acting to condense mist and

clouds into drips that may re-evaporate or coalesce to reach the ground. The latter phenomenon in Europe has been highlighted during acid rain studies. However Ghats streams and groundwaters have a pH of 6 to 7 normally; no indicators of acid rain phenomena have been seen. Although a 2 x 200 MW Mangalore thermal power station is about to be built, the bulk of the State's power is from hydro and is expected to remain so with positive air quality benefit.

The forest has the welcome advantage of acting as a sink for CO_2, the key 'greenhouse effect' gas. Thus the extension of forest areas will go towards international efforts to stabilise this trigger to climate change. However it is vital that this is not nullified by forest fire emissions and we therefore cover this latter aspect in the context of fire protection research.

The re-establishment of forest naturally has microclimate repercussions including a rise in humidity and a possible reduction of seasonal coastal sea breeze strength or inland penetration. Neither phenomenon has great economic significance although conditions round (say) a rubber factory south of Mangalore might be less pleasant.

6. On Communications

The Ghats are no longer a significant barrier in society's terms. They are crossed by railways, air routes and a network of roads, most of which are asphalted all-weather routes available to trucks as well as cars.

They are crossed by an increasing number of power transmission routes as well as telephone line rights of way. Satellite TV receiving dishes are a notable addition to many townships within the Ghats thus lessening previous distinctions between community facilities.

It is a feature of this project as proposed by the Forest Department that no new access roads would be built. This is clearly an under-estimate but it does represent a clear intention not to change significantly the nature of the forest. That they can achieve this is evidenced by the minimal amount of new access track that we saw in our tour of 1980's plantations. In effect the extent of forest encroachment to date has limited the potential for further damage. The very extensive programme of hydro-development works already planned as far ahead as 2010 by KPC will lead to considerable forest intrusion and the potential for added access eg

- on pylon and penstock routes
  at construction colonies, often not removed
- to powerhouses and dams for operation and maintenance.

These are almost entirely on the wetter westerly flowing streams where the best 'virgin' forest lies. Such works will hamper

corridor concepts for wildlife conservation and if pursued too far will reduce the State's future potential for tourism in the Ghats. Major losses to date are

- the reduced flows over the 250 m high Jog Falls
  the submergence of the beautiful lower Sharavathi valley gorge (below the Jog Falls to coast road) which will occur in the next few years.

/. On Health

It has not been possible to get through each taluk's statistics to see whether there is any correlation between health/life expectancy and the forest zone.

However the team observed that 'forced' resettlement of some southern forest dwellers into forest margin colonies had cut them off from their normal food supply; this has led to some malnutrition to the extent that eye disease is prevalent. Infant mortality reported at 150 per 1000 is also higher than is acceptable elsewhere. There have been indications too of an abnormal number of foot and leg injuries to forest tribals, sometimes leading to gangrene. This in effect is an extreme example of an occupational health hazard. Injuries from falls from trees are not usual.

Strides have been made in halting malaria in the last 20 years. As hydro dams have reintroduced malarial risks, as at Supa, Karnataka Power Corporation have taken countermeasures. Nevertheless, their own environmental impact studies (KPC 1986) make reference to Kyasanur forest disease, a tick-borne disease affecting human and non-human primates with a very patchy distribution in the Ghats,
which arrived in the 1950's. Japanese encephalitis and filaria also occur.

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ANNEX V GENERAL ANALYSIS OF THREATS TO THE FOREST

THREAT		TYPES OF FOREST AFFECTED				
Actors	Act and motive	Shola	Dry deciduous	Moist deciduous	Semi-evergreen	Moist evergreen
Incendiarists *	Fire for its own sake	X	X	X	X	
Poachers *	Fire for cooking	X	X	X	X	
Log smuggling groups *	Quality logs	X	X	X	Especially on Coorg/Kerala Border and near Mangalore	
Small traders	Small timber	X	X	X	X	
	Firewood cutting	X	X	X		
Villagers	Small timber	X	X	X	X	
	Fuelwood Cutting	X	X	X	X	
	Encroachment for agriculture		X	X	near settlements	
	Leaf collection for fuel and fodder	X	X	X		
	Pole and bamboo cutting for housing and sheds	X	X	X	mainly bamboo	
	Small timber cutting for domestic & farm requirements	X	X	X	X	
	Free grazing, browsing		X	X		
Cattle owners	Free grazing, browsing		X	X		
	Fire for fresh grass	X	X	X		
Land owners	Free for clearance for agriculture	X	X	X		
	Fire for defence against elephants		X	X		
	Encroachment for food crops	X	X	X		
	Encroachment for cash crop plantations **		X	X	X	
	Leaf collections for mulch plantations		X	X	X	
Public authorities ***	Encroachment for mining		X	X	X	X
	Encroachment for power lines		X	X	X	X
	Submersion for hydroelectric dams		X	X	X	X
	Road building		X	X	X	X

* Illegal

** eg. cardomum, rubber, coffee, areca, tapioca

*** These activities, by facilitating access to the forest, tend to encourage cutting, encroachment and fire. Although compensation payments are made for regeneration elsewhere, on a 2 trees-for-one basis, the result is the replacement of high quality, mature forest basis, the result is the replacement of high quality, mature forest by lower quality, immature plantations.

NB Damage by authorised loggers is not included here, since what is authorised is deemed (nowadays) to be silviculturally beneficial; and if the cutters cut beyond what is authorised they become 'smugglers'. However, historically this has been a major cause of forest destruction and degradation.

ANNEX VI DISCUSSION OF FOREST MANAGEMENT

Section 3.2 of the report summarises the components. This annex comments on these proposals in more detail.

1 PROTECTIVE MEASURES

1.1 Consolidation of forests — Estimated cost - Rs 250m

Large parts of the forest reserves are not clearly demarcated on the ground and it is intended that the boundaries should be surveyed and clearly demarcated with cairns and distinctive plants and, either cattle proof trenches (1,700km), or elephant proof trenches (1,800km). The programme would include preparation of maps, an essential prerequisite for efficient management. Maintenance would include regular patrol and repair of trenches and cairns to ensure that any encroachment is detected at an early stage. The proposed programme also includes the planting of feed, fodder and minor forest species over a 180m-wide belt within the demarcated boundary, together with the harvesting of dead and fallen trees.

It is considered that surveying and mapping of the forest estate is essential. Elephant-proof trenches should be sited only after careful consideration of elephant damage to farmland near to forest reserves. Many of the cattle proof trenches will co-incide with trenches scheduled for other project components and care should be taken not to budget twice for this item.

The production aspects of the component, ie. the planting of feed, fodder and minor forest product species, together with the harvesting of dead and fallen trees, also duplicates existing and proposed activities. It is suggested that these production aspects be deleted from this component. However it is agreed that agave, or alternative species not common in the local flora, eg. Duranta sp., should be planted to mark the boundary, either on the trench mound or along a cut boundary line where trenches are not scheduled. Care should be taken not to plant agave in areas of dense shade and heavy rainfall to which it is not suited.

1.2 Protection from fire — Estimated cost - Rs 60m

Parts of the forest adjacent to grassland or farmlands are particularly susceptible to fire. In the deciduous forest ground fires have led to a deficiency of regeneration and small sized growing stock which are essential to management under the prevailing modified Selection System. Fire spreading from grassy areas within the forest also kills the bark at the base of large trees and in time such trees go rotten, die and fall, gradually increasing the size of the grassy area (which is maintained as a fire climax). Newly planted trees are particularly at risk.

The programme proposes to plant live hedges on the mounds of

Typical soil and moisture conservation at planting

Typical new cattle-proof fence and trench

elephant proof trenches, fire trace to a width of 4m along the outer boundaries of forests and clean 2m wide fire lines along compartment boundaries and roads within the forest.

It is proposed to build 320 small and 32 large fire towers in sensitive areas and employ watchers equipped with radio equipment to patrol during fire hazard periods. These measures are already planned and funded from outside the project.

Full fire protection of grassland leads to a build-up of inflammable dead material so that if an accidental fire occurs after some years of fire protection the resultant fire is worse than normal. It is considered that, in addition to fire tracing, such areas should be control-burnt early in the dry season to reduce the build-up of inflammable material.

1.3 Protection of forests from grazing Estimated cost - Rs 400m

Unrestricted grazing has caused much damage to seedlings and saplings through trampling, breaking and browsing. The trampling compacts the soil surface preventing the percolation of rain water and leading to surface run-off. Under extreme conditions the ground becomes entirely bare and the increasing run-off causes sheet and gully erosion.

The programme proposed to protect 534,000 ha of forest from grazing and to encourage stall feeding with fodder collected from the forest and from fodder farms developed by the Forest Department. These fodder farms would be developed in 5 ha units at a rate of 2,000 ha per year, a total of 10,000 ha over the projected 5 year period.

The aim of the programme is in line with GOI policy but it involves an almost completely different approach to animal husbandry which may not be accepted readily by many villagers. This activity should start on a more modest scale and other activities should also be tried.

The establishment of fodder farms is a new activity for most Forest Department staff: in-service training and research trials would be required, together with advice from the Indian Fodder Research Institute.

2. DEVELOPMENTAL MEASURES

2.1 Gap planting

Estimated cost - Rs 90m

The combination of illegal felling, grazing and fire has led to degradation of large areas of forest, particularly the deciduous forest. These areas have a crown cover of between 0.2 to 0.4 and generally a basal area of less than $10m^2$/ha. The programme proposes to bring an area of 60,000 ha of such forest to a state of full stocking by planting the gaps using a mixture of species indigenous to the locality. Dead, fallen and over-mature trees would be removed prior to planting.

It is considered that, in addition, trees damaged by lopping or defective, to the extent that they will not produce one saw log of 10-12m length, should be cut and extracted also. Their retention would only occupy growing space and contribute little to the value of the crop.

2.2 Fuelwood plantations

Estimated cost - Rs1,000m

These plantations would rehabilitate degraded forest, mainly in the vicinity of villages. Some of these areas are completely denuded, others contain a scattering of lopped trees and uneven coppice of indigenous species. In most areas the soil is compacted through heavy grazing with surface erosion in places.

The programme proposes to plant 100,000 ha of such land with a mixture of 52% fuelwood, 20% fodder, 19% green manure and 9% minor forest products and fruit yielding species according to the preferred choice of the local people. Particular emphasis is placed in soil preparation, planting in soil from staggered trenches along the contour, with pit planting in between. In areas with compact surface layers and lateritic gravel the areas will be ripped to 40-50cm depth using a crawler tractor and a single ripping tine. The procedure appeared very effective in the areas visited with good water retention and initial growth of seedlings.

It is the practise not to cut any existing growth on the area. In many cases badly hacked trees are retained which would be better cut cleanly at ground level and allowed to coppice.

Given the large established root system of many of these trees, the resultant coppice would produce a good proportion of house-building poles: selected stems of preferred species could be allowed to grow on to produce small-size timber for agricultural implements.

Management would be on a coppice system with intermediate yields from thinned coppice. Procedures for harvesting of fodder and usufruct have not been defined.

2.3 Seeding: dibbling and aerial sowing

Estimated costs - Dibbling Rs 240m
Aerial seeding Rs 20m

It is envisaged that a considerable area of medium density forest (estimated 10-20m^2/ha basal area) contains an imbalance of size classes and a deficiency in younger age classes of desirable species. The programme proposes to treat 100,000 ha of such forest by dibbling seed at a density of 750 patches/ha. In addition 25,000 ha. of 'inaccessible' forest would be enriched by the aerial sowing of pre-treated seed of local pioneer species.

It is considered that, before a large investment is made on this project component, research should be carried out during the first phase of the project to monitor the success of regeneration by such sowing.

2.4 Bamboo plantation

Estimated cost - Rs 70m

The programme envisages treating 75,000 ha through the tending by natural bamboo and the enrichment of poorly stocked areas by underplanting and gap planting. The objective is to have 400 clumps/ha. Harvesting would take place on a three-year cycle, beginning at the 10th year. Dead and fallen trees would be harvested at the same time.

2.5 Sandal plantations

Estimated cost - Rs 80m

12,500 ha of forest having natural sandal, and degraded forest with potential for enrichment by planting, would be treated under this programme. Sandal seedlings, with a host tree on either side would be planted in trenches at 5m espacement.

2.6 Teak plantations

Estimated cost - Rs 400m

100,000 ha of degraded teak forest would be rehabilitated and fully stocked by underplanting or gap planting with pre-sprouted teak seedlings. Planting would be carried out in pits at 2m espacement and on average it is estimated that 1,000 plants per hectare would be introduced. All areas would be protected from fire and grazing.

It is recommended that teak planting should only be carried out on slopes of less than 50% and that large blocks of pure teak should be planted only on slopes of less than 20% because teak litter is very inflammable and accidental fires would leave the ground surface bare. Slopes steeper than 20% would be prone to erosion in the early monsoon rains.

Many existing teak in degraded areas have been badly lopped by villagers and subsequent growth is deformed and not likely to produce even one log of sawmill quality. Such trees should be cut cleanly at ground level so that coppice could produce straight-stemmed growth.

Considerable current year seedling regeneration was seen. With protection from fire and grazing this natural regeneration is likely to grow successfully.

2.7 Gene-pool preservation Estimated cost - Rs 20m

This programme component envisages the establishment of two 500 ha tree collections, or aboreta, together with 125 ha areas for germ plasm multiplication, 50 ha for seed storage, a herbarium and a laboratory. The object is to bring together rare and important species so that they can be a focus for research and study. One centre would be in the Anekand Reserve Forest in Madikeri Forest Division, the other near Jog Falls in the Sirsi Forest Division.

Such centres could serve as a focus for species and provenance trials, and tree breeding research.

Replanting degraded land, using a soil improving species, Acacia auriculiformis

Preparation for contour planting of degraded deciduous forest

3. SUPPORTING ACTIVITIES

3.1 Research, training and public relations

Estimated cost - Research Rs50m
- Education and Training Rs 5m
Publicity (included in HQ estimates).

Research would be intensified in a wide range of silvicultural and ecological activities and the research capabilities of the Forest Department would be strengthened by the appointment of additional professional and supporting staff.

Training, both overseas and in-country, would be required for specialist professional staff in a wide range of research and management activities. In-service training of technical staff would be required, particularly in such areas as:

a. techniques of liaison and planning at the village level;

b. propagation of high yielding clonal planting material;

and

c. fodder production.

Training facilities in addition to those at Tatihalla would be strengthened to cater for these varied in-service training programmes.

The Forest Department has been criticised, often unjustly, and the public are often unaware of the reasons for many of the Department's activities. Following on the success of the publicity associated with the Social Forestry Project the Department plans to develop publicity and public awareness of issues affecting development of the Western Ghats.

3.2 Seedling production Estimated cost - Rs 470m

The programme proposes to upgrade the quality of all types of planting stock including making full use of the improved seed sources and clonal material already developed by the Department. This will be done by the development of specialised units which will include 18 major nurseries, 54 permanent nurseries and 162 temporary nurseries to be located near to plantation sites throughout the project area.

4. MANAGEMENT OF HIGH FOREST NOT INCLUDED IN PROJECT COMPONENTS

4.1 Introduction

As the project is concerned with the integrated development of the Western Ghat forests it is necessary to discuss the present and future management of all the high forest, not just the individual components of the project proposal (the Red Boock). These area will continue to be managed by the Forest Department in their ongoing regular programme but it is appropriate for suggestions to be made for improvements of management in general.

4.2 The planning approach

Mapping

The Forest Department has prepared maps of the vegetative cover of the Karnataka State Forest Reserves on a scale of 1:1,000,000, showing three categories of cover: 0 - 0.2, severely degraded; 0.2 - 0.4, partially degraded; and above 0.4, moderate to complete crown cover. The Department has also collaborated with J P Pascal of the French Institute, Pondicherry, to produce detailed vegetation maps of the whole of the Western Ghats on a scale of 1:250,000.

The Western Ghats have also been covered by 1:50,000 topographical maps which show contours in sufficient detail for the preparation of slope maps. These 1:50,000 maps are used as a basis for mapping forest reserves under management plans prepared by the Department. The programme of boundary consolidation proposed under the project will provide an opportunity for revising maps where there have been boundary changes due to encroachment.

It is recommended that the 1:50,000 maps continue to be used for the management of natural forest but that for short rotation crops 1:25,000 should become the standard scale, since the afforestation areas to meet village needs will be numerous and often in small blocks. Four categories of slope should be recognised and marked on map overlays: above 100% (45^0), 50 - 100%, 20 - 50% and below 20%.

Land above 100% slope should normally be excluded from logging and given protection from fire and grazing to increase the woody vegetation. Planting should be done where the site is completely denuded, otherwise the ground should be left undisturbed. Roads should not be constructed on slopes unless properly engineered and all trenching and subsoil ripping should be along the contour.

Forest reserves should be shown on the 1:50,000 maps by the four major vegetation types: Evergreen, Semi-evergreen, Moist Deciduous and Dry Deciduous.
These should be further divided by categories of crown cover: 0 0.2 (severely degraded), 0.2 - 0.4 (degraded), and above 0.4 (moderated to well-stocked).

4.3 Management of the forest types

Severely degraded forest should be rehabilitated largely through protection, coppicing of badly hacked trees, and planting of gaps. These areas comprise Zone IV of the project (Section 4.3.4). They are mainly near villages and would grow fuel, poles, fodder and MFP crops on short rotations under a Coppice-with-Standards system. Great emphasis is placed in the project proposals on meeting the needs of the rural population who live adjacent to the forest reserves, by planting species chosen by these groups for their own use. Quantitative studies are needed on consumption levels for the proposed products. These data could be included in the computer information being assembled for each Taluka.

Most degraded forests are deficient in regeneration and also in large-sized stems. Basal area is generally below $10m_2$/ha. These areas are mainly in Zones II and III of the project (Sections 4.3.2 - 4.3.3) Felling should involve mainly over-mature and defective stems not likely to produce a sawlog of minimum length 4m. Regeneration should be augmented by planting indigenous species but teak planting should be restricted to slopes below 50%. Pure stands of teak should be planted only on slopes of less than 20% because teak litter is very inflammable and accidental fires would leave the ground surface bare. Slopes steeper than 20% would be prone to erosion in the early monsoon rains.

Moderately stocked forest should be managed for timber production under the Selection System in Zones II and III of the project (Sections 4.3.2 - 4.3.3). The least disturbed areas would be set aside as Zone I (Section 4.3.1). Data from Rai (1983), Akbar Sha (1989), and the draft Working Plan for the Madikeri Forest Division indicate that many forests have an abnormal distribution of size classes and widely varying basal areas. Some areas are deficient in large-sized trees because of past excessive logging and many are deficient in small pole sizes, possibly due to illegal removals. Basal area varies from $57m_2$/ha to $16m_2$/ha in the forests of Pattighat (Akbar Sha, 1989) and from $49m_2$/ha to $34m_2$/ha in the Wet Evergreen Forests studied by Rai (1983). If basal area exceeds $35m_2$/ha the diameter increment is likely to be negligible. Stands less than $20m_2$/ha should receive priority for enrichment planting (Table 1).

Akbar Sha, A. (1989). Basal area distribution in tropical forests of Western Ghats. Indian Forester (In press)

Rai, S N. (1983). Tropical rain (Wet Evergreen) forests of Karnataka their structure and composition. Van Vigyan, 21: 84 - 90.

4.4 Inventory and its application to management

GOI carries out inventories over Districts or groups of Districts, separating the date by vegetation types and by location. These data provide an overall picture but, as the stocking varies considerably from place to place, detailed inventories by compartments or groups of compartments are needed for the preparation of regeneration, thinning and harvesting schedules.

Data from two GOI inventories carried out in 1987, covering 6,762km_2 of forest in the Chickmalagur, Hassan and Shimoga Districts, indicate that the Deciduous Forests are only 25% stocked in some areas, and that the Teak Forests are less than half stocked. Perhaps the most alarming conclusion from these extensive inventories is that there is an absence of regeneration of valuable timber species in over 75% of the area, attributed to biotic influences: illegal cutting, and browsing and trampling by cattle. It is only in the Evergreen Forest that stocking approaches normality. For this reason great emphasis is placed in the project proposals on underplanting and gap planting in the Deciduous and Teak Forests.

Inventories of the larger size classes would be needed by Felling Series within each Working Circle in order to plan the logging sequence under selection management. Areas not to be logged until the second half of the Felling Cycle should receive a thinning if basal area is over 35m_2/ha.

In the year immediately after logging a compartment, an inventory should be carried out of stems over 10cm DBH (10 x 10m quadrats) to ascertain the size-class distribution, with a subsample (2 x 2m quadrats) of seedling and small pole-size advance growth. The size class distribution should be plotted on a graph and compared with the size-class distribution for a normal selection forest (Fig.1). If there is excess in any size-class this could be thinned to favour the more valuable stems and to bring the forest to a normal selection size-class structure. Regeneration treatment would depend on whether the small size-classes were adequately represented by valuable species, ie. contained over 200 plots (out of a potential of 2,500 stocked 2 x 2m quadrats/ha) stocked with a valuable sapling over 1m in height. A decision could then be made as to whether enrichment planting should be carried out (Table 2).

It is recommended that both regeneration studies and enrichment planting should be carried out on a pilot scale during the period of the project so that techniques most appropriate to the Western Ghat forests could be developed.

4.5 Growth studies

Limited growth data are available from Linear Tree Increment (LTI) plots dating from 1939. Although not statistically laid out, these plots are sufficiently mature to give useful estimates of tree growth rates. Data analysed by Rai (1988) indicate that, in the unmanaged forest, teak and its associates would need 177 years to reach a DBH of 60cm. Growth in plantations is probably twice as fast, and in well-managed forest somewhere in between. Until more data are available it would be prudent to assume, for the co-dominant and dominant trees of the average species, a period of 100 years is required to reach 60cm DBH in managed Evergreen and Semi-evergreen Forest, 125 years in Moist Deciduous and 150 years in Dry Deciduous Forest. This would indicate felling cycles of 20 years, 25 years and 30 years for these forest types, if the forests continue to be managed on the Selection System.

Static inventory is useful only to the logger and the short-term planner. Management planning requires information on growth rates to monitor changes between successive inventories. Information on recruitment, growth and mortality cannot be obtained from a comparison of recurrent girth-class enumerations because recurrent low-fraction samples have overlapping sampling errors which mask any differences due to time. It is to obtain information on the dynamics of forest regeneration and growth that it is recommended laying out permanent sample plots (as proposed by Dawkins (1980) for the lowland rain forest of Nigeria). The methodology described by Dawkins would be equally suited to the forests of the Western Ghats.

Approximately 50 plots of 1 ha would be needed in each of the four forest types; Evergreen, Semi-evergreen, Moist Deciduous and Dry Deciduous, distributed throughout Zones II and III of the project (Sections 4.3.2 - 4.3.3). Similar plots would be established in Zone I (Section 4.3.1), but would include more detailed studies of the total flora. The plots in Zones II and III would receive normal silvicultural management and those in Zone I,being strictly protected, would serve as controls.

Dawkins, H C. (1980). The interpretation of inventory for management purposes in Nigerian moist lowland and proposals for long-term permanent monitoring plots. Project Working Document No1 FO:NIR/77/008. FAO, Rome.

Rai, S N. (1988). Rate of diameter growth of tree species in humid tropics of Western Ghats, India. In: Proceedings of IUFRO meeting on Rate of Diameter Growth in Mixed Moist Deciduous Forests. Kuala Lumpur, June 1988.

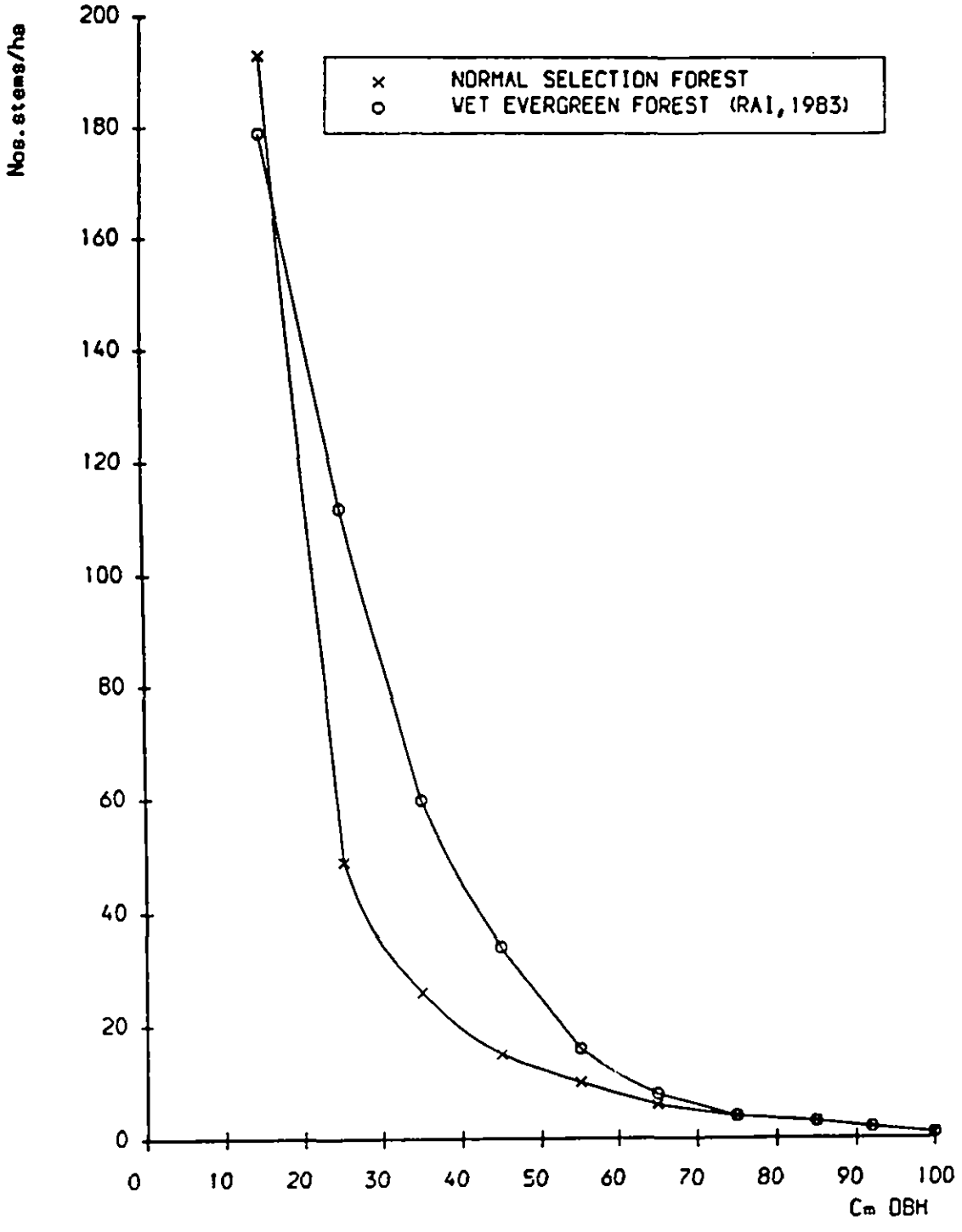
Table VI.1 Schedule of Operations for Intensive Enrichment Planing

Year and Season		Description of Operation
1 Dry Season	a)	Demarcation into grid, eg. 200m x 10m. Peg planting sites at 2.5m intervals. If advance growth of a desirable species is within 5m of a planting site, move on 5m without pegging.
	b)	Cut all climbers. Cut saplings of useless species only on planting lines.
End of Dry Season	c)	Remove all trees unlikley to produce at least one sawlog. These would mostly be understorey trees. In addition, thin trees where they interfere with a more valuable species at the same canopy level.
Beginning of rains	d)	Planting, using potted plants or strong striplings. Preferably use fast-growing, light-demanders. Dibbling-in of seed can be tried on an experimental basis.
		Weeding, removal of climbers and overhead competition (cleaning/freeing). Quick-growing weed trees which coppice vigorously may be poisoned using 2,4-D.
~		Cleaning/freeing.
4		Cleaning/freeing
11		Climber-cutting, diagnostic sampling and thinning.

Table VI.2 A Sequence of Operations for Regenerating and Increasing the Productivity of Tropical High Forest

Year	Description of Operation
At time of preparing management plan	Enumeration of merchantable size classes. Plan logging sequence.
Year 1	Cut all climbers to reduce logging damage.
Year 2	Logging. Care should be taken to minimise damage to advance growth and intermediate size classes by careful directional felling and delineation of extraction routes.
Year 4	Diagnostic sampling of advance growth and regeneration.
	Advance growth adequate (eg. 200 stocked plots with useful stems over 1m high) — Advance growth and regeneraton inadequate.
Year 5	
	Thin stems directly interfering with a tree of a higher category at the same canopy level. — Regenerate using enrichment planting, underplanting, or sowing as found appropriate.
Year 11, 21 etc.	Climber cutting
	Inventory
	Thinning

Figure VI.1 Size-class distribution in Wet Evergreen Forest of the Western Ghats compared with normal size-class distribution for a theoretical selection forest. The Wet Evergreen Forest illustrated contains an excess of stems in the size-classes 20 to 60cm DBH.



ANNEX VII WESTERN GHATS FOREST AND ENVIRONMENT PROJECT FRAMEWORK

PROJECT AIMS AND ACTIVITY	INDICATIONS AND MEANS OF VERIFICATION	ASSUMPTIONS
GOALS AND WIDER OBJECTIVES 1. Environmental protection of valuable world forest 2. Enhancing the capability of villagers and forest dwellers to manage sustainable forests and grazing land 3. Developing KSFD's capacity for environmental management		
IMMEDIATE OBJECTIVES 1. Reestablish the forest's capital stock 2. Generate revenue for future generations 3. Maintain the livelihoods of local populations in or near the forest 4. Stabilise the hydrological environment 5. Increase CO_2 absorption 6. Develop planning prices based on full environmental costing 7. Develop joint management for village forestry schemes 8. Better the wildlife environments	1. Age structure of the forest 2. Revenue - Capital value 3. Income and welfare levels 4. Measured catchment water balances 5. Net forest volume growth 6. Economic review 7. Sociological review and forest assessment 8. Ecological study	
OUTPUTS 1. Core Zone	1. Legislation or Departmental reservation.	1. No indecision about the size of zone needed re wildlife and plant conservation
	2. Fire monitoring and inventory monitoring	2. Public education will change attitudes and land rights are not in dispute
3. A socially desirable replanting programme	3. Seminars and surveys to monitor public acceptance	3. Trained staff for planning and management
4. Village plantations for fuelwood 5. Village plantations for fodder	4. No. of management contracts 5. No. of self-financing agreements	4. Local organisations willing to 5. Same as 4.
6. Protected access to special forest products for forest dwellers	6. MFP development and sales; alternative development strategies in place for forest dwellers	6. KSDF flexible about displacement from the Reserve Forest
7. Employment generated 8. Tribal social welfare improved	7. Total man-days; man-days per ha 8. Clinical health indicators	7. KSFD retain non-mechanised approach 8. Coordinated programmes based on local community organisation are effective
9. Development of a planning system	9. Sociological studies	9. Technical training does not inhibit facilitation skills
10. Development of a monitoring system 11. Joint KSDF and community determination of new schemes 12. Clarification of rights, privileges and responsibilities 13. Long-term commercial forestry secured	10. Sociological studies 11. Management reports and sociological studies 12. Same as 11. 13. Circle and Department measurement records	
INPUTS 1. Staff salaries and allowances 2. Reorientation programme 3. Nurseries and planting materials 4. Civil works 5. Vehicles 6. Equipment 7. Casual labour	NATURE, QUANTITY, QUALITY, TIMING, COST to be specified at the preparation stage	1. Staff are available 2. Attitude change is possible 3 & 6. The phasing does not overextend KSFD's capacity to manage the project 7. Labour supply is sufficient 9. Selection and administrative screening procedures permit planning and Research scheduling 10. Specialised, quality consultancy is available
9. Long-term and overseas training 10. Consultancy inputs		

Note: KSDF = Karnataka State Forest Department

ANNEX VIII LIST OF DOCUMENTS HELD BY THE TEAM

A. GOVERNMENT OF INDIA PUBLICATIONS

	Where held
National Forest Policy 1988	OFI
Report on Inventory of Forests of Survey of Chickmagalur and Hassan Districts Forest Survey of India, Southern Zone, Bangalore, 1987	
Report on Inventory of Forests of Shimoga District, Forest Survey of India, Southern Zone, Banaglore, 1987	
Western Ghats Region: Karnataka Sub-regional Plan, Town and Country Planning Organisation, Ministry of Works and Housing, 1983, (seen but no spare copy obtained)	FML
Census of India, 1981. Series-9, Karnataka. Director of Census Operations, Karnataka.	DS

B. GOVERNMENT OF KARNATAKA PUBLICATIONS

Project Report on Integrated Development of Forests in Western Ghats
Karnataka Forest Department, 1989 ("Red Book") OFI

The Karnataka Forest Act, 1963
OFI
The Karnataka Forest Rules, 1969)

The Karnataka Preservation of Trees Act, 1976
OFI
The Karnataka Preservation of Trees Rules, 1977)

The Karnataka Forest Manual, 1976 OFI

Karnataka Forest Statistics, 1984 OFI

Karnataka Forest Department, Annual Research Report, 1987-88 OFI

District Governments and Decentralised Planning, 1988 OFI

The Karnataka Scheduled Costs and Scheduled Tribes Development Corporation Limited - Annual Action Plan, 1988-9 OFI

Directorate of Social Welfare - A Brief Note on Tribal Sub-Plan, 1988-9 OFI

Irrigation Department - Maps of Malaprabha & Ghataprobha Projects (Belgium) FML

Directorate of Economics & Statistics - Intensity of Droughts in Last Four Years, '82 - '85 in the Taluks of Karnataka, 1986 FML

- Rainfall Probability Estimates as an Aid in Dryland Farming.
(Balasubramanian, V. 1984) FML

Department of Mines and Geology : Groundwater Studies FML

65 Groundwater Resources of Tarikere Taluk, Chickmagalur District (1972)

- 79 : Groundwater Development in Mundgod Taluk, North Kanara District (1973)

- 101: Groundwater Development in Haliyal Taluk, North Kanara District (1972)

121: Groundwater Resources of Koppa Taluk, Chickmagalur District (1974)

- 209: Groundwater Resources in Honnavur Taluk, North Kanara District (1980)

- 210: Groundwater Availability in Virajpet Taluk, Coorg District (1980)

- 219: Groundwater Resources of Hanagal Taluk, Dharwar District (1982)

Karnataka Shows the Way .... District Governments and Decentralised Planning. 1988 DS

Demand and Supply of Fuelwood in Karnataka, Indian Institute of Management, Bangalore DS

Report on Crop Estimation Surveys in Karnataka 1978-87 DS
Directorate of Economics and Statistics, Bangalore

Monthly Economics Bulletin, April 1989. Directorate DS
of Economics and Statistics, Bangalore

Quarterly Bulletin of Economics and Statistics, DS
Directorate of Economics and Statistics, Bangalore

Economic Survey 1988-89. Directorate of Economics DS
and Statistics, Bangalore

Development of Agriculture in Karnataka, Karnataka DS
State Department of Agriculture, Bangalore

Report on Regionwise Cost of Cultivation for the year DS
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ANNEX IX PROPOSED RESEARCH PROJECTS

In the following schedules

* indicates major potential for UK input

(H) indicates high priority project

S indicates smallscale topic

T indicates typical topic

M indicates major topic (by cost)

SP indicates special topic (high capital cost)

Immediate Research and Baseline Surveys

To be completed by, say 1991.

a)	Inter-disciplinary	Fire Damage Statistical Review and Mapping		S
		Ecosystem Inventory to locate Core Zone I	*	(H) T
		Regeneration Processess and in Native and Plantation Forests (Phases 1)	*	(H) T
b)	Environment	Rainfall Duration and Seasonal Trends (with automatic rainfall mapping)	*	S
		Perennial Riverflow Survey and Recession Analysis	*	(H) S
c)	Ecology	Ecological Requirements of wide-ranging large mammals	*	T
		Wildlife Ecology on the Grassland/Forest Interface	*	(H) T
d)	Forestry	Prioritised inventory of stock in Evergreen Forest		(H) M
(See Annex VIII)		Prioritised inventory of stock in Moist Deciduous Forest		(H) T
		Prioritised inventory of stock in Dry Deciduous Forest		S
e)	Social Development	Baseline Survey of Non-Tribal Forest Dwelling communities	*	(H) T
		Patterns of Tribal Employment and Social Development (Mysore phase)	*	(H) S
		Local Institutions and their Forest Management Potentials		S
f)	Economics	Distribution and Marketing Systems for Forests Products		S

Targetted Research: To take between 2 and 4 years

a)	Inter-disciplinary	Species association studies	*	T
		Effective Fire Mitigation in Ghats Plantations	*	(H) T
		Ecology and Management of Cane (Calomus spp.)		(H) S
		- Ecology and Management of bamboo		*(H)T
		- Tree ring analysis of long living species	*	S
		Survey of indigenous forest knowledge	*	(H) T
b)	Environment	Water Quality and Sediment Intensity Changes with Afforestation and slope	*	(H)
		Quantifying moisture conservation techniques for new plantings		S
		Western Ghats Role within UKMO Global Circulation Modal	*	S
		Rainfall Intensity to Initiate Ghats Aquifer Recharge	*	S
c)	Ecology	Food Value of Upland Grassland to livestock (compared with fodder crop alternative)	*	T
		Ecological Effects of Plantations on surrounding Forests Farmland	*	S
		Plant/Animal Ecological Inter-actions within Key Indicator Species		*(H)
d)	Forestry	Logging Impact and Control Plots (from KFD records, fieldwork and development)	*	S
		Parameters controlling Germination and Regeneration and Tree Growth (phase 2)	*	(H)
		Thinning trials and productivity		T
e)	Social development	Patterns of Tribal Employment and Social Development (Follow up phase)		S (H)
f)	Economics	Rural Energy Sources, Costs and Prices		T
		Self-financing Self-regulatory command forest management	*	S

Long Term Research and Monitoring

Assumed to continue indefinitely while there remain unresolved issues in Western Ghats land use. UK input may end after Project Phase 1 leaving costs thereafter to be borne by Karnataka State Forest Department.

a)	Inter-disciplinary	Degradation rates related to grazing beyond carring capacity		T
		Tree improvement studies on imported species in village forestry		M
b)	Environmental	Water Balance and Flood Response of catchments of different forest types, staffed by Forest Hydrology unit	*	(H) SP
		- Fertiliser trials		
		- Aquifer Recharge under different forest types	*	(H) M
		Nutrient Balances of main forest types	*	M
c)	Ecology	Permanent plots monitoring forest ecology dynamics	*	M
d)	Forestry	Permanent measurement plots and study of Forest Growth Dynamics		(H)T
		Regeneration studies (including seeding and enrichment planting) in the Evergreen Forest (phase 3)		(H)T
e)	Social development	Social audit of forestry activity in the Western Ghats	*	(H) T
f)	Economics	Western Ghats and Employment Time-sliced surveys and Interpretation		
g)	Microbiology	Pest and Disease Control Studies (with appropriate staffing link to Kerala FRI)	*	(H) M

MAP 1

VEGETATION STATUS OF WESTERN GHATS, KARNATAKA

Scale 1 1000 000

0 20 40 60 80 100 kilometres

- Mainly closed forest canopy
- Mainly open or degraded forest
- Mainly coffee estates
- No forest cover
- State boundary
- Trunk roads

Mapping based on 1948-85 Landsat Imagery interpreted by Karnataka Forest Department
For details of secondary variations reference should be made to 50,000 scale maps held by Forest Survey of India, Bangalore

BELGAUM
DHARWAR
KARWAR
Hire Basangar
SHIMOGA
CHITRADURGA
Bhadra
CHIKMAGALUR
TUMKUR
HASSAN
BANGALORE
MANGALORE
Krishna Raja sagar
MANDYA
MERCARA
MYSORE
Cauvery

ARABIAN SEA

MAP 2

NATIONAL PARKS AND WILDLIFE SANCTUARIES

Scale 1 1000 000

0 20 40 60 80 100 kilometres

National Parks

Wildlife Sanctuaries

BELGAUM

DHARWAR

Dandeli
Wildlife Sanctuary

Anshi
National Park

KARWAR

Sharavathi Valley
Wildlife Sanctuary

Hire Basangar

Mookambika
Wildlife Sanctuary

Shettyhalli
Wildlife Sanctuary

SHIMOGA

Someshwara
Wildlife Sanctuary

Bhadra
Wildlife Sanctuary

Bhadra

CHIKMAGALUR

CHITRADURGA

TUMKUR

Kudremukh
National Park

HASSAN

BANGALORE

MANGALORE

Pushpagiri
Wildlife
Sanctuary

Krishna Raja sagar

MANDYA

MERCARA

Talakaveri
Wildlife
Sanctuary

Brahmagiri
Wildlife
Sanctuary

Arabithittu
Wildlife Sanctuary

MYSORE

Cauvery

Nagarahole
National Park

Nugu Wildlife Sanctuary

Bandipur
National Park

ARABIAN

SEA

MAP 3

AGROCLIMATIC ZONES

Scale 1 1000 000

0 20 40 60 80 100 kilometres

Zone edge

—600— Mean annual rainfall (mm)

Acknowledgement is made to IBRD document 3239-IN (1981) as data source

BELGAUM
DHARWAR
KARWAR
CHITRADURGA
SHIMOGA
CHIKMAGALUR
TUMKUR
HASSAN
BANGALORE
MANGALORE
MERCARA
MYSORE
MANDYA

NORTHERN TRANSITIONAL ZONE
NORTHERN DRY ZONE
HILLY ZONE
COASTAL ZONE
SOUTHERN TRANSITIONAL ZONE
CENTRAL DRY ZONE
EASTERN DRY ZONE
SOUTHERN DRY ZONE

Hire Basangar
Bhadra
Krishna Raja sagar
Cauvery

ARABIAN SEA

MAP 4

WESTERN GHATS FOREST DIVISIONS, KARNATAKA

Scale 1 1000 000

0 20 40 60 80 100 kilometres

KOPPA Division name and boundary

BELGAUM
BELGAUM
DHARWAR
HALIYAL
DHARWAR
KARWAR
YELLAPUR
KARWAR
SIRSI
HONNAVAR
SAGAR
Hire Basangar
SHIMOGA
BHADRAVATI
SHIMOGA
COONDAPUR
KOPPA
Bhadra
CHIKMAGALUR
CHIKMAGALUR
CHITRADURGA
TUMKUR
BANGALORE
HASSAN
HASSAN
MANGALORE
MANGALORE
MADIKERE
MERCARA
Krishna Raja sagar
MANDYA
Cauvery
MYSORE
HUNSUR
MYSORE
CHAMARAJANAGAR
KOLLEGAL
ARABIAN
SEA

MAP 5

WESTERN GHATS ADMINISTRATIVE DIVISIONS, KARNATAKA

Scale 1 1000 000

0 20 40 60 80 100 kilometres

SIRA Division name and boundary

BELGAUM
BAILHONGAL
KHANAPUR
DHARWAR
HUBLI
SUPA
HALIYAL
KUNDGOL
KALGHATGI
SHIGGAON
SAVANUR
YELLAPUR
MUNDGOD
KARWAR
HANGAL
HAVERI
ANKOLA
BYADGI
RANIBENNUR
SIRSI
HIREKERUR
HARIHAR
DAVANGERE
KUMTA
SIDDAPUR
SORAB
HONNAVAR
SHIKARIPUR
CHITRADURGA
HONNALI
SAGAR
CHANNAGIRI
HOLALKERE
Hire Basangar
BHATKAL
HOSANAGAR
SHIMOGA
HIRIYUR
BHADRAVATI
HOSADURGA
SIRA
THIRTHAHAHALLI
TARIKERE
COONDAPUR
N R PURA
KOPPA
KADUR
Bhadra
CHIKNAIKANAHALLI
SRINGERI
UDIPI
CHIKMAGALUR
ARSIKERE
TIPTUR
GUBBI
TUMKUR
KARKAL
MUDIGERE
BELUR
TURUVEKERE
NELAMANGALA
N
BELTHANGADI
HASSAN
KUNIGAL
MAGADI
BANGALORE
S
MANGALORE
BANTWAL
SAKALESHPUR
ALUR
CHANNARAYAPATNA
NAGAMANGALA
PUTTUR
ARKALGUD
H N PUR
ANEKAL
RAMANAGARAM
K R PET
CHANNAPATNA
SULLIA
SOMWARPET
Krishna Raja sagar
PANDAVAPURA
MADDUR
MANDYA
KANAKAPURA
K R NAGAR
S R PATNA
MALAVALLI
MERCARA
PERIYAPATNA
Cauvery
MADIKERE
HUNSUR
MYSORE
VIRAJAPET
KOLLEGAL
NANJANAGUD
HEGGADADEVANKOTE
YELANDUR
CHAMARA JANAGAR
GUNDLUPET

ARABIAN SEA