

Criteria and Indicators for Sustainable Plantation Forestry in India

S. Sankar

P.C. Anil

M. Amruth



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S. Sankar, P.C. Anil and M. Amruth

In collaboration with

Ram Prasad, S. Raghavan, Abey George, S.P. Singh, Jyothi Krishnan,
D. Duggai, M. Mishra, B. Sreekumar and S.C. Prasad



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Summary

Forest plantations are an important resource of wood, fuel and a variety of other forest products in India. Development of a framework of criteria and indicators (C&I) for the sustainable management of plantations has been given high priority in the National Forest Policy, revised in 1988. Furthermore, a national initiative known as the Bhopal-India Process was undertaken recently to propose C&I for sustainable forest management in India.

In recent years CIFOR has developed a system for testing C&I for assessing the sustainability of management of natural forests at the level of a forest management unit (FMU). This system was used to develop C&I for teak and eucalypt plantations in two states in India. Development and evaluation of C&I was conducted by the Kerala Forest Research Institute (KFRI), Peechi, Kerala, in collaboration with the Indian Institute of Forest Management, Bhopal, in Madhya Pradesh. The project provided an opportunity for forestry scientists, forest managers, local communities, and NGOs in Kerala and Madhya Pradesh to participate in the testing and evaluation of C&I of sustainable management of plantations based on the Iterative Filtering and Generation Method (IFGM) developed for natural forests by CIFOR.

Field testing in Kerala was conducted in an age series of teak plantations at Nilambur and in young eucalypt plantations of the Punalur forest district. Both FMUs were managed by the Department of Forestry in Kerala. In Madhya Pradesh field testing was conducted in teak plantations of the Raipur district managed by the Madhya Pradesh Forest Development Corporation (MPFDC).

The selection of candidate sets of C&I during stage 1 of the IFGM process from the vast array of published information was found to be time consuming. To rationalise this process teams found it necessary to first group all C&I under four principles: viz. policy and planning, ecology, socio-economic and management. These were then further divided into subgroups before starting the selection process (Filter 1) for the candidate sets for field testing.

Field testing of C&I based on stage 2 of the IFGM process evolved and teams became more proficient during the two tests conducted in Kerala and the third test later on in Madhya Pradesh. The three teams defined sets of C&I, as well as verifiers for some indicators, specific to each test site. Comparison of these three sets showed that a high proportion of policy indicators proposed for teak plantations in Madhya Pradesh were unique (Table 14) due to differences in forest policies and organisations responsible for managing plantations in the two states. Likewise, a number of ecology indicators addressed specific local issues. A large number of socio-economic indicators were common for all sites reflecting similarity of social issues. Management issues were also similar, consistent with the historical development of plantation management in the two states.

Stakeholder participation during the field tests and final workshops, including local communities and NGOs played an essential role in shaping C&I related to social and economic concerns. This raised a number of important issues including:

- impact of plantation development on water supplies to villages and settlements;
- loss of biodiversity and the long-term impact on NWFP collected by local communities to supplement income;
- sharing of benefits from plantation development to improve opportunities for schooling, training and employment; and
- environmental impacts, such as soil erosion and contamination.

The site-specific C&I developed by the three teams were examined for commonalities and this formed the basis for a minimum set of C&I applicable to the three sites included in this project and considered to be more widely relevant to plantation forestry across India. This evaluation also identified a number of unique C&I addressing policy, ecological and socio-economic issues of local importance. The results from this project demonstrated the importance of testing and evaluating C&I at the FMU level to ensure that local issues pertaining to the sustainable management of forest plantations are addressed.

1. Introduction

There are over 100 countries in the world involved in developing national-level criteria and indicators for assessing trends in the state of their forests (Wijewardena *et al.* 1977). Despite similarities in the fundamental elements of C&I, experiences differ from country to country and within regions. CIFOR has led a research project on testing criteria and indicators for sustainable management of natural forests involving several governmental and non-governmental organisations (Prabhu *et al.* 1996, 1998). The present project used this experience to develop and evaluate C&I for community managed forests and tree plantations in India.

Forest plantations in India now comprise some 19 million ha and represent a significant proportion of the total plantation resource of around 70 million ha in the Asia-Oceania region. (See

FAO, *State of the World's Forests* for data on international plantation resources.) Sustainable management of plantations is important for ensuring an adequate supply of wood and other forest products for future generations. Hence this project on testing C&I for forest plantations was taken up in India. Testing was conducted in two states: Kerala, where the first teak plantation in the world was established as early as 1841; and in Madhya Pradesh, which has the largest recorded area of natural forests and plantations in the country. The lead institution was the Kerala Forest Research Institute (KFRI), Peechi, Kerala, in collaboration with the Indian Institute of Forest Management, Bhopal, in Madhya Pradesh. Testing was carried out in Kerala on teak and eucalypt plantations and in Madhya Pradesh on teak plantations only.

2. Methods

The CIFOR process for developing, testing and selecting C&I for sustainable forest management is based on an Iterative Filtering and Generation Method (IFGM) comprising three stages of evaluation or filters (Prabhu *et al.* 1999).

- The first stage (Filter No. 1) identifies an appropriate set of C&I from various sources, based mainly on professional judgement by the expert team(s).
- The second stage (Filter No. 2) evaluates the candidate set on-site based on discussions and interviews with stakeholders, field surveys and documented information. Regular team discussions are held during this stage to review and revise proposed C&I and to address overlap and discrepancies.
- The third stage (Filter No. 3) is a post-field workshop to review and revise the proposed C&I with input from the team, as well as invited participants with expertise in the various disciplines. Following this workshop a final report is prepared by the team on C&I selected for each site, including comments on the IFGM process.

The CIFOR IFGM process was adopted for the development of C&I for plantations in Kerala and Madhya Pradesh. Three interdisciplinary expert teams were constituted in Kerala (Teams 1 and 2) and Madhya Pradesh (Team 3) to select and evaluate C&I for teak and eucalypt plantations in Kerala, and for teak plantations in Madhya Pradesh. The composition of the teams is provided in Tables 1-3.

In accordance with CIFOR guidelines, the teams were familiarised with the IFGM process for testing C&I and thereafter candidate sets were selected from published C&I developed by the following organisations:

1. International Tropical Timber Organization (1992)
2. Amazon Cooperation Treaty A.C. (1995)
3. The Montreal Process (1995)
4. African Timber Organization (1998)
5. Forest Stewardship Council A.C. (1996)
6. Scientific Certification Systems (1998)
7. SmartWood Programme (1993)
8. The Soil Association Marketing Company Ltd. (1994)
9. Bhopal-India Process (1999)
10. National Forest Policy (1988)

The candidate sets for field testing were selected or new ones were created using CIFOR Filter 1 (See Annex 1, Form 1). This process of familiarisation with the IFGM conceptual framework of testing and developing C&I and the selection of candidate sets for field testing took 10 days. During the filtering process the teams referred regularly to two vital documents available for the Indian tests: The National Forest Policy of 1988 and the proposed national C&I being developed through the Bhopal-India Process (BIP 1999).

As part of the second stage of the IFGM process (see Annex 2, Filter 2), field tests were carried out in respective Forest Management Units, closely involving local staff, stakeholders and other

users. Periodic visits, questionnaire surveys, interviews, Participatory Rural Appraisal, etc. were the common methods used to collect the information needed for this stage. Each C&I was evaluated in the field by team members and their opinions and scoring were analysed to define practical sets of C&I.

The C&I sets developed for each field site were reviewed again by the teams in a final post-fieldwork workshop (Filter 3) to formulate the final C&I specific to each site.

2.1 Description of Test Sites

2.1.1 Teak plantations in Kerala

Natural forests in the state of Kerala range from temperate hill forests to dry scrub jungles and are recognised for their rich biodiversity of flora and fauna. Traditionally, production of wood has been the major objective of forest management. More recently the attention of forest management has turned to conservation, ecological balance, eco-restoration, recreation, biodiversity conservation and finally to multiple use management with people's participation.

The Kerala Forest Department is the single largest teak planter in Kerala and is responsible for the management of about 65,000 ha of teak plantations. The first recorded teak plantation in the world was established at Nilambur, Kerala, in 1841. Until the 1980s, teak was raised after clear felling natural forests. After a ban on clear felling was introduced in 1982, new plantations are established only in areas already under teak.

At Nilambur the site quality distribution is skewed towards IVth and Vth classes and plantations of age <30 years predominate. Growth is generally slow, as indicated by the average Mean Annual Increment (MAI) of 2.4 m³/ha/yr compared with an estimated potential MAI of 5.0 m³/ha/yr. Management practices such as soil erosion control, fertiliser input, soil cultivation and genetic improvement all contribute to the ecological, social and economic sustainability of teak plantations.

An age series of plantations (1-60 years) at Nilambur was selected for the field testing of C&I. The FMU (250 ha) comprised a forested catchment with varying slopes and aspects and a permanent stream.

The population at the Nilambur test site of around 700 people, including four tribal settlements, depends on plantation labour, non-wood forest products (NWFP), casual labour and cottage industries. The main opportunities for unskilled labour in plantations include fire watching, nursery management, planting, weeding, fertilising and thinning, as well as more skilled jobs such as final felling, grading, loading and transportation.

2.1.2 Eucalypt plantations in Kerala

Eucalypts were introduced in Kerala in the late 1950s for pulpwood. There are about 90,000 ha of eucalypt plantations managed by the Kerala Forest Department and Kerala Forest Development Corporation. Nearly 56% of the area is above 20 years of age. The dominant species are *Eucalyptus tereticornis* and *E. grandis*. The yield of eucalypt ranges from 7 to 10 m³/ha/yr, which is well below international yields. Correct matching of sites and species are considered to be the important criteria for increasing the productivity of this species.

The *E. tereticornis* plantations of the Punalur Forest Division, comprising an FMU of around 200 ha, were selected for the development and testing of C&I by Team 2. The test was conducted in an age series of 1 to 6 years of first and second rotation coppice regrowth and also in recently established clonal plantations (clones from Bhadrachalam Paper Boards, Andhra Pradesh, India).

The FMU is surrounded by rubber plantations and three settlements of local people, including farmers with paddy fields and unskilled labourers. There is opportunity for seasonal employment as fire watchers, nursery men and for planting and tending operations to supplement income from farming. The felling, processing and transportation of harvested materials is mostly done by contract labour imported from other locations.

2.1.3 Teak plantations in Madhya Pradesh

Madhya Pradesh accounts for about 25% of the total forest area of India. The state harbours a rich flora of some 1860 species of flowering plants. The state is also rich in wildlife including tigers, swamp deer and wild buffalo, and is the torch bearer of wildlife conservation in India with more than 15% of the country's total tiger population.

Since the 1950s approximately 1.7 million ha of natural forests have been converted to agricultural land use. Teak plantations of varying site quality comprise about 1 million ha making Madhya Pradesh one of the most important teak-growing states in India. The Madhya Pradesh Forest Development Corporation manages about 33,120 ha of teak plantations. The field testing of C&I was carried out in 1184 ha of plantations in the North Forest Division of Raipur, part of the Barnawapara project. The general topography of the region is flat to undulating with elevation ranging from 225-550 m. The project area is the catchment of the Mahanadi River. The climate is hot and humid with an annual summer-dominated rainfall of 1200 mm. The growth of

teak is generally poor with an average MAI of 2.5 m³/ha/yr and management practices are directed towards enhancement of productivity.

The FMU includes 12 settlements of mainly farming communities managing about 1400 ha of agricultural land of low productivity. Low crop production together with scarcity of water has resulted in famine and starvation during off-seasons. Villagers rely heavily on income from plantation activities such as planting, thinning, fire protection, felling and maintenance of roads for their survival. In addition, income is derived from the collection of Tendu leaves (*Diospyros malanoxylon*), an important NWFP that provides a supplementary income for many households in this region.

2.2 Composition of test teams

The expertise and professional experience of team members together with their familiarity and proficiency with C&I of sustainable forest management has been summarised for each team in Tables 1-3 below.

Table 1. Team 1 - Teak, Kerala

Sl. No.	Expertise	Years of experience	Knowledge of C&I	Country	Site/Knowledge
1.	Forester	30	Some	India	30 years in Kerala
2.	Plantation management	8	Good	India	Experience in Kerala and Pondicherry
3.	Biodiversity	5	Some	India	Expert in Kerala forest biodiversity
4.	Anthropology	5	Good	India	Experience in social anthropology of Kerala
5.	Gender specialist	10	Some	India	Problems of women in Kerala
6.	Social scientist	20	Good	India	Experience in forest-people interactions
7.	Soil, Ecology	25	Good	India	Forest soils of Kerala and productivity

Table 2. Team 2 - Eucalypt, Kerala

Sl. No.	Expertise	Years of experience	Knowledge of C&I	Country	Site/Knowledge
1.	Forester	15	Some	India	Plantation forestry in Kerala
2.	Plantation management	10	Some	India	Eucalypt specialist
3.	Gender specialist	5	Some	India	Women's issues in Kerala
4.	Botany	15	Good	India	Experience in Western Ghat Kerala
5.	Soil, Ecology	20	Good	India	Soil fertility, site management in Kerala
6.	Social science	15	Some	India	Experience in Kerala
7.	Forest economics	15	Good	India	

Table 3. Team 3 - Teak, Madhya Pradesh

Sl. No.	Expertise	Years of experience	Knowledge of C&I	Country	Site/Knowledge
1.	Forester	20	Some	India	15 years in Orissa & 2 years in Madhya Pradesh
2.	Plantation management	8	Good	India	Experience in Kerala
3.	Biodiversity	10	Some	India	Experience in Madhya Pradesh
4.	Social science	15	Some	India	Experience in Madhya Pradesh
5.	Social science	15	Some	India	Experience in Kerala
6.	Biodiversity	10	Some	India	Experience in Madhya Pradesh
7.	Soil, Ecology	20	Good	India	Experience in Kerala and Madhya Pradesh

3. Results and Discussion

3.1 Evaluation of Criteria and Indicators through Form 1

All teams were provided with the 'tool box' for testing C&I developed by Prabhu *et al.* (1998). The base set consists of C&I from the eight organisations as listed in the methods section. A summary of the candidate sets selected for field testing by each of the teams after the first evaluation (Filter 1) is provided in Table 4.

Because of their familiarity with ecology, socio-economic and management issues, the team members gave approximately equal weight to the different principles of sustainable management of plantation forests.

3.2 Field evaluation of Criteria and Indicators

The candidate sets of C&I were taken to the field and evaluated based on stage 2 of the IFGM process using Form 2. The evaluations were carried out in teak and eucalypt plantations and a

complete listing of Principles, Criteria, Indicators and some Verifiers (PCIV) selected for each site after field testing by the teams is provided in Annexes 3.1-3.3. A summary of C&I accepted by each team after field testing is shown in Table 5.

After completion of stage 2 field testing, the two teams in Kerala proposed 5 principles (two for Social issues) while the third team in Madhya Pradesh proposed only 4. Furthermore, the total C&I accepted by the teams were 18 criteria and 55 indicators by Team 1, 18 criteria and 56 indicators by Team 2, and 21 criteria and 47 indicators by Team 3. After the field evaluation there was a reduction in policy C&I tested and accepted by Teams 1 and 2, and an increase in C&I for policy, ecology and social principles accepted by Team 3 (Table 6). The changes in the number of C&I after field testing of the candidate set selected by the teams during stage 1 (Filter 1) are shown for each site in Table 6. There was an overall reduction in C&I from 228 to 215 following stage 2 field testing.

Table 4. Number of C&I selected for field testing

Teams	Policy	Ecology	Social	Management	Total
T1	24 (29%)	19 (22%)	24 (29%)	17 (20%)	84 (100%)
T2	24 (29%)	19 (22%)	24 (29%)	17 (20%)	84 (100%)
T3	9 (15%)	14 (23%)	20 (29%)	17 (28%)	60 (100%)
Total	57	52	68	51	
Ave.	19	17.3	22.7	17	

Table 5. Number of C&I accepted as final after field testing by Teams

	Team 1	Team 2	Team 3
Total C&I selected for field testing	84	84	60
C&I accepted after field testing:			
Policy	14	14	13
Ecology	18	19	15
Social	24	24	23
Management	17	17	17
Total C&I (Final)	73	74	68

Table 6. Changes in the total number of C&I between pre-field and post-field evaluation (Accepted C&I)

Teams	Policy		Ecology		Social		Management	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
T1	24	14	19	18	24	24	17	17
T2	24	14	19	19	24	24	17	17
T3	9	13	14	15	20	23	17	17

As part of the stage 2 evaluation, C&I are given a ranking for each of nine attributes considered to be important as a measure of suitability and utility of a particular indicator (see Prabhu *et al.* 1999). A scale of 1 to 5 was used to rank C&I, where 1 means unimportant/no utility and 5 means important/high utility. The ranking of C&I field tested by the teams was summarised for all sites and average scores are given for each attribute (Table 7). Maximum scores were achieved for indicators addressing Management issues as the C&I were generally considered to be easy to detect, record and interpret. High values for Social issues were achieved for ‘closely related to assess goal’ and ‘C&I are relevant’. Policy issues often received low values because of the difficulty in distinguishing between national and FMU levels and the vague nature of each indicator. The characteristics of C&I for Ecology also received low scores as team members felt that reproducible results are difficult to achieve. The evaluation against these standard attributes showed some of the strengths and weaknesses of C&I.

It also highlights the importance of accepting a degree of overlap between C&I to ensure that specific aspects of sustainability are addressed thoroughly.

3.3 Content analysis of C&I proposed by teams

One of the objectives of this project is to propose a minimum set of C&I for the assessment of sustainability of plantations across India. Accordingly, the three sets of C&I selected after field testing by the teams (as shown in Annexes 3.1–3.3) were compared on the basis of their content to obtain a core set applicable to all three sites. A comparison of the selected C&I relating to various principles is provided in Tables 8, 9, 10 and 11. Comments and background information explaining commonalities and differences between C&I for each of the sites are provided with each table.

Table 7. Average scores* for 215 Criteria and Indicators against 9 key attributes

Attribute of C&I	Policy	Ecology	Social	Management
Summary/integrative measure	3.8	3.7	3.8	4.4
Closely related to assess goal	3.4	3.6	4.0	4.0
Response range to stress	3.3	3.5	3.8	3.9
Diagnostically specific	3.2	3.5	3.8	3.9
Appealing to user	3.5	3.4	3.9	4.4
Easy to detect, record, interpret	3.8	3.4	3.8	4.5
Precisely defined	3.5	3.5	3.9	4.3
Produces replicable results	3.7	3.3	4.0	4.4
Relevant	3.7	4.0	4.6	4.4
Total	31.8	32.0	35.6	38.1
Average	3.5	3.5	4.0	4.2

* average of three teams

Table 8.1 Analysis of Commonalities
Policy - Criterion 1.1 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1		
Kerala Team 2		
Bhopal Team 3	1.1 There exists policy and legal framework for plantation land use	

Notes:

Plantation forestry in India has a long history originating in the 1840s. Through observation and experimentation, British foresters had developed silvicultural, administrative and legal frameworks for plantation forestry, establishment, management and development. These are reflected in detail in the forest working plans and crystallised in forest policies (Forest Policy of 1895). Since independence two more forest policies have been formulated (Forest Policy 1952 and 1988). Hence only one team (Team 3) insisted on retaining this criterion. Indicators are absent as these could not be well defined; possibly required for C&I at the national level and not at FMU level.

Table 8.2 Analysis of Commonalities
Policy - Criterion 1.1 (Kerala)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	1.1 There is sustained and adequate funding for the management of government-owned forest plantations	1.1.1 Institutions responsible for forest management and research are adequately funded and staffed 1.1.2 Adequacy of human and financial resources to meet legislative and administrative responsibilities in sustainable forest management 1.1.3 Investment and taxation policies and a regulatory environment which recognise the long-term nature of investments, and permit the flow of capital out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions, in order to meet long-term demands for forest products and services
Kerala Team 2	1.1 There is sustained and adequate funding for the management of government private and industry-owned forest plantations	1.1.1 Institutions responsible for forest management and research are adequately funded and staffed 1.1.2 Adequacy of human and financial resources to meet legislative and administrative responsibilities in sustainable forest management 1.1.3 Investment and taxation policies and a regulatory environment which recognise the long-term nature of investments and permit the flow of capital out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions in order to meet long-term demands for forest products and services
Bhopal Team 3		

Notes:

All forest plantations in Kerala are government owned and hence Team 1 and Team 2 insisted on including the criteria on sustained and adequate funding. The two teams experienced lack of adequate and timely funding as one of the causes of mismanagement. In Madhya Pradesh the MPFDC is a corporation with more autonomy and access to public and private financial sources, so Team 3 did not consider this criterion as important.

Table 8.3 Analysis of Commonalities
Policy - Criterion 1.2 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1		
Kerala Team 2		
Bhopal Team 3	1.2 There exists adequate and trained manpower in plantation forestry	1.2.1 Periodically of relevant training programmes 1.2.2 Content of the training programme is relevant

Notes:

In Kerala, government forest departments and the forest service wholly manage forest plantations. It is a prerequisite for all staff to be trained in traditional forestry institutions prior to or after receiving employment. The MPFDC is independently recruits staff from the open market, hence Team 3 realised the importance of forestry training to field and executive staff.

At present, plantation management is done by staff trained in regular forestry training institutions. It is necessary to reorient this training to improve performance of the service.

Table 8.4 Analysis of Commonalities
Policy - Criterion 1.3 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1		
Kerala Team 2		
Bhopal Team 3	1.3 Information for forest resource accounting, including that of plantation forests, is available on a periodic basis	1.3.1 Management plans are user-friendly

Notes:

Forest working plans or management plans at the level of the forest division are revised every 10 years. They contain an evaluation of past management and resource accounting which enables corrections and improvements to be made. The Madhya Pradesh team retained criterion 1.3 with the intention of making the teak plantation business more scientific.

Table 8.5 Analysis of Commonalities
Policy - Criterion 1.4 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1		
Kerala Team 2		
Bhopal Team 3	1.4 Monitoring and evaluation of the plantation projects and forest resource accounting are carried out periodically	

Notes:

It has been an age-old procedure in plantation forestry programmes to assess the resource base through inventories (Mean Annual Increment and Site Quality Assessment). These were conducted through working plans for each Forest Management Unit (division) every 10 years. At MPFDC this process is carried out more rigorously (once every 5 years) and the team felt that more relevant indicators and modern verifiers have to be evolved. The team felt that more time for case studies is required to undertake this mission.

Table 8.6 Analysis of Commonalities
Policy - Criterion 1.5 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1		
Kerala Team 2		
Bhopal Team 3	1.5 Reinvestment policies are conducive to sustainable plantation management	

Notes:

Proceeds of sales by public auction from plantation forestry programmes at present are credited to the State Exchequer. Departments are sometimes constrained in providing adequate funding to operations that enable sustainable plantation management. The Kerala teams took reinvestment policies as granted but the Bhopal team (because the test was conducted in the plantation of a corporation) felt the need to evolve firm reinvestment policies in this sector.

Table 8.7 Analysis of Commonalities
Policy - Criterion 1.6 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1		
Kerala Team 2		
Bhopal Team 3	1.6 Policy and legislation encourage and efficiently regulate the plantation forestry business in the private sector	1.6.1 Land conversion, type of land and change in cropping pattern are recorded 1.6.2 Production targets, markets and financial goals are stated 1.6.3 Product quality is monitored 1.6.4 There is provision for government intervention in existing rules, taxation policies and the regulatory environment

Notes:

There is an increasing interest in developing plantation forestry in the private sector to cater for the needs of wood-based industries. Certain regulations, both at national and FMU levels, for SFM are warranted.

Table 9.1 Analysis of Commonalities
Ecology - Criterion 2.1 (Kerala)/2.4 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	2.1 Impacts on biodiversity of the forest landscape are minimised	2.1.1 Endangered plant/animal species are protected
		2.1.2 Strategies ensure maintenance of viable metapopulations of indigenous biota in plantation landscapes
		2.1.3 Landscape units that are of great importance to the wildlife are conserved and access is not affected, e.g., waterholes, grasslands, bamboo breaks, etc.
Kerala Team 2	2.1 Impacts on biodiversity of the forest landscape are minimised	2.1.1 Endangered plant/animal species are protected
		2.1.2 Strategies ensure maintenance of viable metapopulations of indigenous biota in plantation landscapes
		2.1.3 Landscape units that are of great importance to the wildlife are conserved and access is not affected, e.g., waterholes, grasslands, bamboo breaks, etc.
Bhopal Team 3	2.4 Adverse impact on biodiversity of the forest landscape is minimised	2.4.1 Endangered plant/animal species are protected
		2.4.2 Strategies ensure maintenance of viable metapopulations of indigenous biota in plantation landscapes

Notes:

In Kerala and Madhya Pradesh, natural forests with diversity both in species and landscapes are converted to mono-species commercial plantations. Hence the issue of adverse impacts on biodiversity assumes importance. In Kerala forest conservation relates back to the ban on establishing new plantations after clearfelling natural forests as early as 1982. In Madhya Pradesh, in contrast, new forest plantations have been established at the cost of natural forests. Therefore, while the Kerala team stressed any impact on biodiversity through establishment of plantations, the Bhopal team referred to adverse impacts only.

Table 9.2 Analysis of Commonalities
Ecology - Criterion 2.2 (Kerala and Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	2.2 Maintenance of the health and vitality of teak plantation ecosystems	2.2.1 Protection of the plantation against fire, pests and diseases
		2.2.2 Based on the identification of key biological areas, roughly 10% of the total area under forest management (not including stream or roadside buffers) is designated as a 'conservation zone', i.e., land or forest to be conserved in its natural state without logging
		2.2.3 No chemical contamination of food chains and ecosystems
		2.2.4 Regulations for the introduction of single provenance/ clones
		2.2.5 Minimisation of impacts of monocultures through mixed cropping
Kerala Team 2	2.2 Maintenance of the health and vitality of eucalypt plantation ecosystems	2.2.1 Protection of the plantation against fire, pests and diseases.
		2.2.2 Based on the identification of key biological areas, roughly 10% of the total area under forest management (not including stream or roadside buffers) is designated as a 'conservation zone', i.e., land or forest to be conserved in its natural state without logging
		2.2.3 No chemical contamination of food chains and ecosystems
		2.2.4 Regulations for the introduction of single provenance/ clones
		2.2.5 Minimisation of impacts of monocultures through mixed cropping
Bhopal Team 3	2.2 Maintenance of the health and vitality of teak plantation ecosystems	2.2.1 Protection of the plantation against fire, pests and diseases.
		2.2.2 No chemical contamination of food chains and ecosystems
		2.2.3 Genetic diversity of teak is maintained

Notes:

In plantations in Kerala, during the colonial period, patches of natural vegetation/forests were retained to guard against pests and diseases and fire and for providing a niche for flora and fauna. At present this practice has been dispensed with. At plantation sites of MPFDC, miscellaneous species are retained around compartments at a width of 20 metres. Aerial spraying, attempted earlier to control pests, is not practised at present because of possible contamination of the food chain. There were incidences of mass mortality of young cattle and poultry in the neighbourhood of plantations sprayed annually. In the Indian context, with high man-land ratio, local people participate in fire protection activities. Eucalypt plantations in Kerala are devastated by fungal diseases. As chemical control is not feasible, due to practical problems and environmental issues, the solution is only through developing disease-resistant clones.

Table 9.3 Analysis of Commonalities
Ecology - Criterion 2.3 (Kerala and Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	2.3 Productive capacity of the land is maintained or improved	2.3.1 Measures for conserving or improving stability of ecologically fragile localities are implemented
		2.3.2 Watershed services from the land are maintained or enhanced
		2.3.3 Decline in water quality in watershed or sub-watershed
		2.3.4 Provision for protection of bodies of water
		2.3.5 Water system (regime) and quality do not decrease
		2.3.6 Soil conditions are not greatly altered, especially topsoil loss, sheet, splash and gully erosion are avoided. Norms: level of organic carbon content (change), soil respiration rate, levels of macronutrients (change), regulatory measures for the use of chemical fertilisers exist, gravel content, soil compaction, laterisation index
		2.3.7 No inadvertent ponding or water logging as a result of forest management
Kerala Team 2	2.3 Productive capacity of the land is maintained or improved	2.3.1 Measures for conserving or improving stability of ecologically fragile localities are implemented
		2.3.2 Watershed services from the land are maintained or enhanced
		2.3.3 Decline in water quality in watershed or sub-watershed
		2.3.4 Provision for protection of bodies of water
		2.3.5 Water system (regime) and quality do not decrease
		2.3.6 Soil conditions are not greatly altered, especially topsoil loss, sheet, splash and gully erosion are avoided. Norms: level of organic carbon content (change), soil respiration rate, levels of macronutrients (change), regulatory measures for the use of chemical fertilisers exist, gravel content, soil compaction, laterisation index
		2.3.7 No inadvertent ponding or water logging as a result of forest management
		2.3.8 Nutrient losses due to short rotation are replenished on a scientific basis

Table 9.3 (continued)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Bhopal Team 3	2.3 Productive capacity of the land is maintained or improved	2.3.1 Optimal stocking (as per the management plan) so as to minimise canopy opening 2.3.2 Measures for coserving or improving stability of ecologically fragile localities are implemented 2.3.3 Productive capacity of the soil is maintained or improved

Notes:

Sustainability of wood production over successive rotations has been of serious concern even during the British India period. Yield declines in second rotation plantations have been explained with reference to site quality, soil degradation, nutrient losses, etc. Therefore the three teams agreed on the need to implement mitigative measures at the FMU level in order to maintain and or improve the productive capacity of the site.

Table 9.4 Analysis of Commonalities
Ecology - Criterion 2.1 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1		
Kerala Team 2		
Bhopal Team 3	2.1 Areas under natural forests and plantations are maintained or improved	2.1.1 In a given FMU, the percentage of plantations does not exceed more than 50% of the forest land area

Notes:

In Madhya Pradesh plantation programmes are replacing natural forests at an increasing rate. Hence the indicator for preserving at least 50% of the area under natural forests in each FMU is relevant. Conservation of forests in Madhya Pradesh assumes great importance as the state controls more than 25% of the total forest area.

The bulk of the plantations (teak and eucalypt) in Kerala are of very low productivity. To increase production the only alternative is to improve the plantations already available, as there is a ban on establishing plantations by clearing natural forests.

Table 9.5 Analysis of Commonalities
Ecology - Criterion 2.5 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1		
Kerala Team 2		
Bhopal Team 3	2.5 Watershed functions of the land are maintained or enhanced	2.5.1 Water quality is maintained or enhanced

Notes:

As Madhya Pradesh is a low-rainfall area, prone to periodic droughts and forest cover is a major part of the land use, watershed services in the forests assume great importance.

Table 10.1 Analysis of Commonalities
Social - Criterion 3.1 (Kerala and Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	3.1 Local people accrue direct or indirect benefits from the plantation activities	3.1.1 Local people are given employment and promotion opportunities
		3.1.2 Local people are given training (job-oriented)
		3.1.3 Schools and educational facilities for local and other employees
		3.1.4 Local and indigenous people are given preference in competitive bidding and are encouraged to take up contract activities
		3.1.5 Supply of fuel for employees and locals under the collective management programme
		3.1.6 Water conservation/water distribution facilities equally benefit employees and local people, either at a concessional rate or free of cost
		3.1.7 Road and other communication systems are accessible to local people as well
		3.1.8 Local food security is not affected because of plantation extension
Kerala Team 2	3.1 Local people accrue direct or indirect benefits from the plantation activities	3.1.1 Local people are given employment and promotion opportunities
		3.1.2 Local people are given training (job-oriented)
		3.1.3 Schools and educational facilities for local and other employees
		3.1.4 Local and indigenous people are given preference in competitive bidding and are encouraged to take up contract activities
		3.1.5 Supply of fuel for employees and locals under the collective management programme
		3.1.6 Water conservation/water distribution facilities equally benefit employees and local people, either at a concessional rate or free of cost
		3.1.7 Road and other communication systems are accessible to local people as well
		3.1.8 Local food security is not affected because of plantation extension

Table 10.1 (continued)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Bhopal Team 3	3.1 Local people accrue benefits from the plantation activities	3.1.1 Local people get employment opportunities 3.1.2 Educational facilities, if run by the plantation management, are made available to the locals also 3.1.3 Supply of fuel for employees and locals under the collective management programme 3.1.4 Drinking water facilities equally benefit employees and local people 3.1.5 Road and other communication systems are accessible to local people as well 3.1.6 Local food security is not affected because of plantation extension

Notes:

In Kerala and Madhya Pradesh forest plantations are interspersed with human settlements. The population previously derived benefits from natural forests, which are now converted to plantations. Hence the need for ensuring more or less the same supply of benefits in the form of wages, goods and services. People settled in the fringes are the migrant group from Orissa and other parts of Madhya Pradesh, and were the labour force during the establishment of plantations by clearing natural forests. As the Forest Development Corporation is the only government agency working in the FMU it should assume responsibility for providing most of the social services, unlike in Kerala where different agencies for social advancement are active throughout.

Table 10.2 Analysis of Commonalities
Social - Criterion 3.2 (Kerala and Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	3.2 Traditional livelihood security or income-generating opportunities for tribal people are not negatively affected	3.2.1 Tribal people are adequately compensated or alternatives are provided 3.2.2 NWFP collection from the forest is not affected
Kerala Team 2	3.2 Traditional livelihood security or income-generating opportunities for tribal people are not negatively affected	3.2.1 Tribal people are adequately compensated or alternatives are provided 3.2.2 NWFP collection from the forest is not affected
Bhopal Team 3	3.2 Traditional livelihood security or income-generating opportunities for tribal people are not negatively affected	3.2.1 Forest-dependent people are adequately compensated or alternatives are provided 3.2.2 NWFP collection from the forest is not affected

Notes:

In Kerala traditional rights to forest products lie with the tribal populations, who are issued permits. In Madhya Pradesh all stakeholders are permitted to extract forest products.

Table 10.3 Analysis of Commonalities
Social - Criterion 3.3 (Kerala and Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	3.3 Labourers and employees are compensated adequately and their rights are protected	3.3.1 Periodic revision of employees' compensation occurs 3.3.2 Compliance with international or national labour rules
Kerala Team 2	3.3 Labourers and employees are compensated adequately and their rights are protected	3.3.1 Periodic revision of employees' compensation occurs 3.3.2 Compliance with international or national labour rules
Bhopal Team 3	3.3 Labourers and employees are compensated adequately and their rights are protected	3.3.1 Periodic wage revision occurs 3.3.2 National labour rules are implemented

Notes:

Trade union activities in forest labour are well organised and labour rules and regulations are implemented strictly. In Madhya Pradesh such a situation does not exist.

Table 10.4 Analysis of Commonalities
Social - Criterion 3.4 (Kerala and Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	3.4 Tenure rights of the local people are secure	3.4.1 No incidents of bullying and threats from plantation authorities
Kerala Team 2	3.4 Tenure rights of the local people are secure	3.4.1 No incidents of bullying and threats from plantation authorities
Bhopal Team 3	3.4 Tenure rights of the local people are secure	3.4.1 No incidents of bullying and threats from plantation authorities

Notes:

Tenure rights in Kerala have been provided to landholdings around plantations through revenue procedures. A section of the holdings established between 1968 and 1977 is yet to be legalised. In Madhya Pradesh the holdings are on lease that is reissued every ten years.

Table 10.5 Analysis of Commonalities
Social - Criterion 3.5 (Kerala and Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	3.5 Indirect benefits from tourism activities do not have any hidden social cost involved	3.5.1 Tourism activities associated with plantations do not affect the local resource equity, displacement or marginalisation of local or indigenous populations
		3.5.2 Plantation activities or other recreation facilities are not gender discriminatory at the local level
Kerala Team 2	3.5 Indirect benefits from tourism activities do not have any hidden social cost involved	3.5.1 Tourism activities associated with plantations do not affect the local resource equity, and do not result in displacement or marginalisation of local or indigenous populations
		3.5.2 Plantation activities or other recreation facilities are not gender discriminatory at the local level
Bhopal Team 3	3.5 Indirect benefits from tourism activities do not have any hidden social cost involved	3.5.1 Tourism activities associated with plantations do not affect the local resource equity, and do not result in displacement or marginalisation of local or indigenous populations
		3.5.2 Plantation activities or other recreation facilities are not gender discriminatory at the local level

Notes:

Tourism activities are being spread into forest areas and plantation tourism can take away certain benefits enjoyed today by the local and tribal populations for the benefit of tour operators and tourists.

Table 10.6 Analysis of Commonalities
Social - Criterion 4.1 (Kerala)/3.6 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	4.1 Plantation management involves local people in areas of common interest	4.1.1 Efficient maintenance of common wood lots
		4.1.2 Participation in fire protection
		4.1.3 Participation in watershed development programmes
Kerala Team 2	4.1 Plantation management involves local people in areas of common interest	4.1.1 Efficient maintenance of common wood lots
		4.1.2 Participation in fire protection
		4.1.3 Participation in watershed development programmes
Bhopal Team 3	3.6 Plantation management involves local people in areas of common interest	3.6.1 Efficient maintenance of common wood lots
		3.6.2 Participation in fire protection
		3.6.3 Participation in watershed development programmes
		3.6.4 Community participation in grazing control

Notes:

In Kerala, involvement of local people in maintenance of common wood lots, protection against fire and watershed development is a prerequisite to deriving goods and services from the forests. As grazing in forests is not a regular feature in Kerala as in Madhya Pradesh the indicator on grazing control refers to the latter state only.

Table 11.1 Analysis of Commonalities
Management - Criterion 5.1 (Kerala)/4.1 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	5.1 Management objectives are clearly and precisely described and documented	5.1.1 Objectives are clearly stated in terms of major functions of the plantation
Kerala Team 2	5.1 Management objectives are clearly and precisely described and documented	5.1.1 Objectives are clearly stated in terms of major functions of the plantation
Bhopal Team 3	4.1 Management objectives are clearly and precisely described and documented	4.1.1 Objectives are clearly stated in terms of major functions of the plantation

Notes:

Over the past 150 years forestry operations in India have been documented and managed through working plans and management plans.

Table 11.2 Analysis of Commonalities
Management - Criterion 5.2 (Kerala)/4.2 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	5.2 A comprehensive management plan exists, which ensures the economic and ecological sustainability of the teak plantation	5.2.1 A management plan is available
		5.2.2 Yield management plans ensure economic viability
		5.2.3 Marketing strategies avoid gluts in the market
		5.2.4 Management plans to ameliorate or counter natural catastrophes (e.g., fires) and planning responses for resource stabilisation and recovery
		5.2.5 Harvest regulation plans minimise adverse environmental impacts
Kerala Team 2	5.2 A comprehensive management plan exists, which ensures the economic and ecological sustainability of the eucalypt plantation	5.2.1 A management plan is available
		5.2.2 Yield management plans ensure economic viability
		5.2.3 Marketing strategies avoid gluts in the market
		5.2.4 Management plans to ameliorate or counter natural catastrophes (e.g., fires) and planning responses for resource stabilisation and recovery
		5.2.5 Harvest regulation plans minimise adverse environmental impacts

Table 11.2 (continued)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Bhopal Team 3	4.2 A comprehensive management plan exists, which ensures the economic and ecological sustainability of the teak plantation	4.2.1 A management plan is available 4.2.2 Yield management plans ensure economic viability 4.2.3 Marketing strategies avoid gluts in the market 4.2.4 Management plans to ameliorate or counter natural catastrophes (e.g., fires) and planning responses for resource stabilisation and recovery 4.2.5 Harvest regulation plans minimise adverse environmental impacts

Notes:

Eucalypt wood is supplied to the industry at subsidised rates, a practice which has to be dispensed with. Teak wood from plantations is sold at open auction and hence prices are determined by national demand and supply scenarios.

Table 11.3 Analysis of Commonalities
Management - Criterion 5.3 (Kerala)/4.3 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	5.3 The management plan is effectively implemented	5.3.1 Harvest efficiency and product utilisation ensure economic sustainability 5.3.2 Reduced-impact felling specified/implemented 5.3.3 Sustainable timber production (in quality and quantity) is guaranteed 5.3.4 Skidding damage to trees and soil is minimised 5.3.5 Forest management minimises impacts of logging on plantation's structure and biodiversity
Kerala Team 2	5.3 The management plan is effectively implemented	5.3.1 Harvest efficiency and product utilisation ensure economic sustainability 5.3.2 Reduced-impact felling specified/implemented 5.3.3 Sustainable timber production (in quality and quantity) is guaranteed 5.3.4 Skidding damage to trees and soil is minimised 5.3.5 Forest management minimises impacts of logging on plantation's structure and biodiversity

Table 11.3 (continued)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Bhopal Team 3	4.3 The management plan is effectively implemented	4.3.1 Harvest efficiency and product utilisation ensure economic sustainability 4.3.2 Reduced-impact felling specified/implemented 4.3.3 Sustainable timber production (in quality and quantity) is guaranteed 4.3.4 Skidding damage to trees and soil is minimised 4.3.5 Forest management minimises impacts of logging on plantation's structure and biodiversity

Notes:

Working plans and management plans are revised every ten years on the basis of evaluation of past performances and future needs.

Table 11.4 Analysis of Commonalities
Management - Criterion 5.4 (Kerala)/4.4 (Bhopal)

Team Test	Criterion (Id No./Description)	Indicators (Id No./Description)
Kerala Team 1	5.4 An efficient monitoring and control system is present to periodically revise management prescriptions based on new information	5.4.1 Documentation and records of all management activities are kept in a form that makes it possible for monitoring to occur 5.4.2 Monitoring procedures for acquiring information on plan attainment and resource conditions
Kerala Team 2	5.4 An efficient monitoring and control system is present to periodically revise management prescriptions based on new information	5.4.1 Documentation and records of all management activities are kept in a form that makes it possible for monitoring to occur 5.4.2 Monitoring procedures for acquiring information on plan attainment and resource conditions
Bhopal Team 3	4.4 An efficient monitoring and control system is present to periodically revise management prescriptions based on new information	4.4.1 Documentation and records of all management activities are kept in a form that makes it possible for monitoring to occur 4.4.2 Monitoring procedures for acquiring information on plan attainment and resource conditions

Notes:

Working plans revised every ten years also serve monitoring purposes.

3.4 Sources of the final sets of Principles, Criteria, Indicators and Verifiers proposed by the three teams

The sets of PCIV proposed by the teams to be field tested at each site are listed in Annexes 3.1 to 3.3. Included in these tables are the comments by the teams related to the original source (Reference) and the nature of any modifications to the C&I as part of the IFGM field evaluation process conducted at each site.

The sources of the PCIV for Kerala and Madhya Pradesh are summarised in Tables 12 and 13. Results demonstrate the importance of the IFGM process of field testing C&I that indicates where these may need to be modified and adapted to address those issues most relevant to plantations in Kerala and Madhya Pradesh. In Kerala the contribution from KFRI consisted of one principle, 5 criteria, 29 indicators and 44 verifiers (Table 12). In Madhya Pradesh BIP-KFRI provided one principle, 7 criteria, 15 indicators and 14 verifiers, while KFRI contributed 7 criteria, 19 indicators and 34 verifiers. The most exciting feature is the attempt to produce possible verifiers, as the Indian teams comprised a combination of experienced foresters, ecologists and social scientists. Only 38% of PCIV were drawn from other sources.

3.5 Synthesis of common Criteria and Indicators proposed by the three teams

The process of synthesising a core set of C&I was based on identification of commonalities between the site-specific sets proposed by the teams. Indicators were classified into three categories: common (selected by all teams), semi-common (selected by two teams), and unique (selected by one team only). Results of this comparison (Table 14) also include indicators that were newly formulated during the field tests.

A high proportion of policy indicators proposed by Team 3 in Madhya Pradesh were unique (Table 14) and this reflects differences in forest policies and organisations responsible for managing plantations in the two states (see Tables 8.1-8.7). Likewise, a number of ecology indicators addressed specific local issues and were therefore classed as unique (see Tables 9.1-9.5). In contrast, a large proportion of socio-economic indicators were common reflecting the similarity in social issues between the test sites (see Tables 10.1-10.6). Management issues were common at all sites, this is consistent with the historical development of plantation forestry in the two states.

Based on this comparison of site-specific C&I, a core set was formulated with C&I common for the three sites (Table 15). This set of C&I is considered to be more widely applicable to plantations across India.

Table 12. Sources of PCIV in plantations in Kerala

	Principles		Criteria		Indicators		Verifiers	
	New/ Unchanged	Refor- mulated	New/ Unchanged	Refor- mulated	New/ Unchanged	Refor- mulated	New/ Unchanged	Refor- mulated
KFRI	1	-	5	-	29	-	44	-
CIFOR	-	3	2	2	6	1	5	-
Montreal	-	-	1	1	1	-	7	-
ATO	-	1	-	1	1	-	1	1
SWP	-	-	-	1	1	3	4	1
ACT	-	-	-	-	-	-	1	-
SCS	-	-	-	-	-	1	4	1
ITTO	-	-	-	-	-	-	2	2
SA	-	-	-	-	-	5	-	2
Indonesia	-	-	-	-	-	-	1	-
Côte d'Ivoire	-	-	-	-	1	-	-	-
FSC	-	-	-	2	-	-	-	1
Total	1	4	8	7	39	10	69	8

Table 12. Sources of PCIV in plantations in Kerala

	Principles			Criteria			Indicators			Verifiers		
	N	U	R	N	U	R	N	U	R	N	U	R
KFRI	1	-	-	1	-	-	1	-	-	1	-	-
CIFOR	-	3	3	-	3	3	-	3	3	-	3	3
Montreal	-	-	-	-	-	-	-	-	-	-	-	-
ATO	-	1	1	-	1	1	-	1	1	-	1	1
SWP	-	-	-	-	-	-	-	-	-	-	-	-
ACT	-	-	-	-	-	-	-	-	-	-	-	-
SCS	-	-	-	-	-	-	-	-	-	-	-	-
ITTO	-	-	-	-	-	-	-	-	-	-	-	-
SA	-	-	-	-	-	-	-	-	-	-	-	-
Indonesia	-	-	-	-	-	-	-	-	-	-	-	-
Côte d'Ivoire	-	-	-	-	-	-	-	-	-	-	-	-
FSC	-	-	-	-	-	-	-	-	-	-	-	-
Total	1	4	4	1	4	4	1	4	4	1	4	4

N: New; U: Unchanged; R: Reformulated

Table 13. Sources of PCIV in plantations in Madhya Pradesh

	Principles		Criteria		Indicators		Verifiers	
	Unchanged	Reformulated	Unchanged	Reformulated	Unchanged	Reformulated	Unchanged	Reformulated
BIP/KFRI	-	1	-	7	1	14	1	13
KFRI	-	-	3	4	11	8	23	11
CIFOR	-	2	-	2	5	1	3	2
Montreal	-	-	1	-	-	1	4	-
ATO	-	1	-	1	-	2	-	1
SWP	-	-	-	1	-	1	3	1
ITTO	-	-	-	-	-	-	1	-
SCS	-	-	-	-	-	1	-	1
ACT	-	-	-	-	-	-	-	1
SA	-	-	-	-	-	2	-	1
Côte d'Ivoire	-	-	-	-	-	-	-	1
FSC	-	-	-	2	-	-	-	1
Total	-	4	4	17	17	30	35	33

Table 14. Level of commonality of C&I for the compiled final set

	Policy	Ecology	Social	Management
Common	-	6	17	17
Semi-common	4	5	1	-
Unique	13	7	6	-
New	-	1	1	-
Total	17	19	25	17

Table 15. Final set of criteria and indicators of sustainable management for tropical plantation forests in India

P C I	T1	T2	T3
Policy			
Planning and institutional frameworks are conducive to sustainable management of forest plantations			*
There exists policy and legal frameworks for plantation land use			*
There is sustained and adequate funding for the management of government-owned forest plantations	*	*	
Institutions responsible for forest management and research are adequately funded and staffed	*	*	
Adequacy of human and financial resources to meet legislative and administrative responsibilities in sustainable forest management	*	*	
Investment and taxation policies and a regulatory environment which recognise the long-term nature of investments and permit the flow of capital out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions in order to meet long-term demands for forest products and services	*	*	
There exists adequate and trained manpower in plantation forestry			*
Periodicity of relevant training programmes			*
Content of the training programme is relevant			*
Information for forest resource accounting, including that of plantation forests, is available on a periodic basis			*
Management plans are user-friendly			*
Monitoring and evaluation of the plantation projects and forest resource accounting are carried out periodically			*
Reinvestment policies are conducive to sustainable plantation management			*
Policy and legislation encourage and efficiently regulate the plantation forestry business in the private sector			*
Land conversion, type of land and change in cropping pattern are recorded			*
Production targets, markets and financial goals are stated			*
Product quality is monitored			*
There is provision for government intervention in existing rules, taxation policies and the regulatory environment			*

Table 15. Continued

P	C	I	T1	T2	T3
Ecology					
Ecosystem integrity of the plantation-dominated forest landscape is maintained			New		
Impacts on biodiversity of the forest landscape are minimised			*	*	
Endangered plant/animal species are protected			*	*	*
Strategies to ensure maintenance of viable metapopulations of indigenous biota in plantation landscapes			*	*	*
Landscape units that are of great importance to the wildlife are conserved and access is not affected, e.g., waterholes, grasslands, bamboo breaks, etc.			*	*	
Area under natural forests on ridges, steep slopes and swamps has to be maintained or improved			New		
Maintenance of the health and vitality of plantation ecosystems			*	*	*
Protection of the plantation against fire, pests and diseases			*	*	*
Based on the identification of key biological areas, roughly 10% of the total area under forest management (not including stream or roadside buffers) is designated as a 'conservation zone', i.e., land or forest to be conserved in its natural state without logging			*	*	
No chemical contamination of food chains and ecosystems			*	*	*
Regulations for the introduction of single provenance/clones			*	*	
Minimisation of impacts of monocultures through mixed cropping			*	*	
Genetic diversity is maintained					*
Productive capacity of the land is maintained or improved			*	*	*
Optimal stocking (as per the management plan) so as to minimise canopy opening					*
Measures for conserving or improving stability of ecologically fragile localities are implemented			*	*	*
Nutrient losses due to short rotations are replenished on a scientific basis				*	
No inadvertent ponding or water logging as a result of forest management			*	*	
Watershed functions of the land are maintained or enhanced					*
Water quality is maintained or enhanced					*

Table 15. *Continued*

P	C	I	T1	T2	T3
Social					
Socio-economic benefits are maintained or enhanced					*
Local people accrue benefits from plantation activities					*
		Local people, both men and women, get employment and promotion opportunities	*	*	*
		Local people are given training (job-oriented)	*	*	
		Educational facilities, if run by the plantation management, are made available to the locals also			*
		Supply of fuel for employees and locals under collective management programme	*	*	*
		Drinking water facilities, both quality and quantity, equally benefit employees and local people			*
		Road and other communication systems are accessible to local people as well	*	*	*
		Local food security is not affected because of plantation extension	*	*	*
		Village communities within plantations also enjoy the facilities available to revenue-receiving villages	New		
		Traditional livelihood security or income-generation opportunities of tribal people are not adversely affected	*	*	*
		Forest-dependent people are adequately compensated or alternatives are provided			*
		NWFP collection from the forest is not affected	*	*	*
		Labourers and employees are compensated adequately and their rights are protected	*	*	*
		Periodic wage revision occurs			*
		International/national labour rules are implemented	*	*	*
		Tenure rights of the local people are secure	*	*	*
		No incidents of bullying and threats from plantation authorities	*	*	*
		Indirect benefits from tourism activities do not have any hidden social cost involved	*	*	*
		Tourism activities associated with plantations do not affect the local resource equity, and do not result in displacement or marginalisation of the local or indigenous populations	*	*	*
		Plantation activities or other recreation facilities are not gender discriminatory at the local level	*	*	*

Table 15. Continued

P	C	I	T1	T2	T3
Plantation management involves local people in areas of common interest					
			*	*	*
		Efficient maintenance of common wood lots	*	*	*
		Participation in fire protection	*	*	*
		Participation in watershed development programmes	*	*	*
		Community participation in grazing control			*

Table 15. *Continued*

P	C	I	T1	T2	T3
Management					
Yield and quality of forest products and services are improved					*
Management objectives are clearly and precisely described and documented			*	*	*
Objectives are clearly stated in terms of major functions of the plantation			*	*	*
A comprehensive management plan exists, which ensures the economic and ecological sustainability of the plantation			*	*	*
A management plan is available			*	*	*
Yield management plans ensure economic viability			*	*	*
Marketing strategies avoid gluts in the market			*	*	*
Management plans to ameliorate or counter natural catastrophes (e.g., fires) and planning responses for resources stabilisation and recovery			*	*	*
Harvest regulation plans minimise adverse environmental impacts			*	*	*
The management plan is effectively implemented			*	*	*
Harvest efficiency and product utilisation ensures economic sustainability			*	*	*
Reduced-impact felling specified/implemented			*	*	*
Sustainable timber production (in quality and quantity) is guaranteed			*	*	*
Skidding damage to trees and soil is minimised			*	*	*
Forest management minimises impacts of logging on plantation's structure and biodiversity			*	*	*
An efficient monitoring and control system is present to periodically revise management prescriptions based on new information			*	*	*
Documentation and records of all management activities are kept in a form that makes it possible for monitoring to occur			*	*	*
Monitoring procedures for acquiring information on plan attainment and resource conditions			*	*	*

4. Conclusions

The project provided an opportunity for forestry scientists, forest managers, local communities and NGOs in Kerala and Madhya Pradesh to participate in the testing and evaluation of C&I of sustainable management of plantations based on the IFGM process developed by CIFOR.

The selection of candidate sets of C&I during stage 1 of the IFGM process, from the vast array of published information (in excess of 1000 C&I), was found to be time consuming and tedious by all three teams. This was due to a number of factors including:

- many published sets of C&I were developed for natural forests;
- lack of consistency in hierarchical structure between published sets of C&I; and
- C&I were broadly defined, overlapping and difficult to apply at the FMU level.

The teams found it necessary to first group all C&I under four principles: policy and planning, ecology, socio-economic and management. These C&I groups were then further divided into subgroups before starting the selection process (Filter 1) to identify the candidate sets for field testing.

Field testing of C&I based on stage 2 of the IFGM process evolved and teams became more proficient during the two tests conducted in Kerala. The third test in Madhya Pradesh was more effective because of the experience gained from the earlier tests in Kerala.

Stakeholder participation during the field tests and final workshops was invited. Local communities played an important role in shaping C&I related to social and economic issues. During the final workshops a number of issues of concern to local communities and NGOs were identified including:

- impact of plantation development on water supplies to villages and settlements;
- loss of biodiversity and the long-term impact on NWFP collected by local communities to supplement income;
- sharing of benefits from plantation development to improve opportunities for schooling, training and employment; and
- environmental impacts, such as soil erosion and contamination.

The site-specific C&I developed by the three teams were examined for commonalities and this formed the basis for a core set of C&I applicable to the three sites included in this project. This core set is considered to be more widely applicable to plantation forestry in India. However, this evaluation also identified a number of unique C&I addressing policy, ecological and social issues. This demonstrates the importance of testing and evaluating C&I at the FMU level to ensure that local issues pertaining to the sustainable management of forest plantations are addressed.

References

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- Prabhu, R., Maynard, W., Ebaá Atyi, R., Colfer, C.J. Pierce, Shepherd, G., Venkateswarlu, P. and Tiayon, F. 1998. Testing and developing criteria and indicators for sustainable forest management in Cameroon: The Kribi Test Final Report. CIFOR, Bogor, Indonesia.
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Annexes

Annex 1. Form 1

The objective of Filter 1 or response Form 1 is to provide a preliminary evaluation of all criteria and indicators to determine those most appropriate for assessing sustainability, based on professional judgement. This first examination should concentrate on eliminating only the most obviously deficient criteria and indicators. The result of this first evaluation is discussed with other team members to determine the set of C&I considered by the team to be suitable for field evaluation. See Prabhu *et al.* (1999) for a detailed discussion of the purpose and application of Filter 1 of the IFGM procedure.

The following five questions have been designed to evaluate important attributes of criteria and indicators and to enable the elimination of obviously deficient criteria and indicators. A scale of 1-5 is used to rank criteria and indicators based on the following attributes and results are tabulated in Form 1 below.

1. **Closely and unambiguously related to the assessment goal?** Directly/obviously/intuitively/logically linked to criterion or to sustainability
2. **Easy to detect, record and interpret?** Easy to get the information, straightforward?
3. **Provide a summary or integrative measure?** Summarises/integrates a lot of information, is it information efficient?
4. **Adequate response range to changes in levels of stress?** Does the indicator continue to give you useful and meaningful information over a wide range of situations?
5. **Is this item important and therefore selected as 'priority'?** Is it useful? Is it worth further investigation during the field phase?

Form 1: Evaluation of Criteria and Indicators

Please use a scale of 1=poor; 2=fair; 3=satisfactory; 4=good; 5=very good

Source	No. of C&I as printed in source document	Class (P, M, E, S, F)	Closely and unambiguously related to the assessment goal?	Easy to detect, record and interpret	Provide a summary or integrative measure?	Important and therefore selected as 'priority'? Yes=1 No=0

Annex 2. Continued

Final version of criterion/indicator, <u>state only if different from definition in Box A:</u>	F
<p>NOTES: Please record your notes on evaluating the criterion/indicator (Box A) here:</p> <p><i>Attempts were made to control fire with the participation of villagers/tribals living inside the forest. Pests were controlled earlier through aerial sprays but not attempted now. There is a green belt comprising other tree species along the border, dividing the plantations to minimise the pest attack and for easy movement.</i></p>	G
<p>Would this C&I need to be evaluated</p> <p style="text-align: right;">In the field? <input type="checkbox"/></p> <p style="text-align: right;">In the office? <input type="checkbox"/></p> <p style="text-align: right;">Both? <input checked="" type="checkbox"/></p>	H
<p>Please note below what kind of documentation would be required if the C&I were to be used in a proper field assessment of sustainable forest management</p> <p>Forest Ranger's Office should have up to date records on</p> <ul style="list-style-type: none"> • Frequency of fire in the year • Funds utilised to control fire, pest control • Management strategies adopted, its strength, weakness, etc. 	I

Annex 2. Continued

FUNCTION 1

Justify: Human input (a) (f) Human Process (a) (f) Outcome (a) (f)

K Task Leader

FUNCTION 2

Justify: Stress (a) (f) State (a) (f) Response (a) (f)

L Task Leader

LINKAGES This criterion or indicator has an information value for the following areas/criteria/indicators:

Bio-physical:

Social:

Management:

Other:

M Task Leader

WORKSHOP NOTES (For office use only)

Did the workshop accept this criterion/indicator unchanged?
Why? YES NO

Were revisions called for? State version: YES NO

State justification for revision:

OR was this criterion or indicator rejected as being unsuitable?
State reasons: YES NO

N

Annex 3.1 Criteria and indicators of sustainable management for teak plantations in Kerala selected after field testing by Team 1.

P	C	I	V	Description	Observation	Reference
POLICY						
1	Policy, planning and institutional frameworks are conducive to sustainable management of teak plantation				Reformulated	CIFOR
	1.1			There is sustained and adequate funding for the management of government-owned forest plantations	Reformulated	CIFOR
		1.1.1		Institutions responsible for forest management and research are adequately funded and staffed	New	KFRI
			1.1.1.1	<i>Policy and planning are based on recent and accurate information</i>	Unchanged	CIFOR
		1.1.2		Adequacy of human and financial resources to meet legislative and administrative responsibilities in sustainable forest management	New	KFRI
		1.1.3		Investment and taxation policies and a regulatory environment which recognise the long-term nature of investments and permit the flow of capital out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions in order to meet long term demands for forest products and services	Unchanged	Montreal

Annex 3.1 Continued

P	C	I	V	Description	Observation	Reference
ECOLOGY						
2	The main ecological functions of the plantation teaks are maintained				Reformulated	ATO
	2.1			Impacts on biodiversity of the forest landscape are minimised	Unchanged	CIFOR
		2.1.1		Endangered plant/animal species are protected	Unchanged	CIFOR
			2.1.1.1	<i>No tree of locally rare or endangered species or species included in lists of sensitive species is felled</i>	Unchanged	KFRI
			2.1.1.2	<i>Floristically and faunistically rich patches of vegetation are conserved</i>	New	KFRI
		2.1.2		Strategies to ensure maintenance of viable metapopulations of indigenous biota in plantation landscapes	New	KFRI
			2.1.2.1	<i>Indigenous and locally adapted species are permitted to regenerate in gaps</i>	New	KFRI
			2.1.2.2	<i>Corridors of unlogged forests are retained</i>	Unchanged	CIFOR
			2.1.2.3	<i>Raising plantations is not authorised if the vertical stratification of a forest strip, which forms the wildlife corridor, is disturbed</i>	New	KFRI
		2.1.3		Landscape units that are of great importance to wildlife are conserved and access is not affected, e.g., waterholes, grassland and bamboo breaks, etc.	New	KFRI
	2.2			Maintenance of health and vitality of forest ecosystems	Unchanged	Montreal
		2.2.1		Protection of the plantation against fire	Unchanged	KFRI
			2.2.1.1	<i>Fire protection and control measures</i>	New	KFRI
		2.2.2		Based on the identification of key biological areas, roughly 10% of the total area under forest management (not including stream or roadside buffers) is designated as a 'conservation zone', i.e., land or forest to be conserved in its natural state without logging	Unchanged	SWP
			2.2.2.1	<i>Area and percentage of forest land with diminished biological components indicative of changes in fundamental ecological processes (e.g., soil nutrient cycling, seed dispersion, pollination) and/or ecological continuity (monitoring of functionally important species such as fungi, arboreal epiphytes, nematodes, beetles and wasps)</i>	Unchanged	Montreal
			2.2.2.2	<i>Observed circumstances in which ecologically important areas were substantially altered through harvesting</i>	Unchanged	SCS
			2.2.2.3	<i>Conservation zone is preferably a contiguous blocks, though it may be a series of smaller blocks linked by corridors as wide as the average height of forest canopy in mature forest (over 75 years)</i>	Unchanged	SWP
			2.2.2.4	<i>Special provisions for the protection of sensitive areas, plains, stream banks, steep slopes should be defined in management plan</i>	Unchanged	ATO
		2.2.3		No chemical contamination of food chains and ecosystems	Unchanged	CIFOR

Annex 3.1 Continued

P	C	I	V	Description	Observation	Reference
			2.2.3.1	<i>Policies and procedures for proper use and disposal of hazardous materials</i>	Unchanged	SCS
			2.2.3.2	<i>Extent to which silvicultural methods minimise the need for pesticides (avoidance of clear cutting and other measures designed to limit hardwood incursion)</i>	Unchanged	SCS
			2.2.3.3	<i>Frequency of pesticide use and stated reasons for use</i>	Unchanged	SCS
			2.2.3.4	<i>Chemicals banned in Europe, America or the target country are not used</i>	Unchanged	Indonesia
			2.2.3.5	<i>Area and percentage of forest land experiencing an accumulation of persistent toxic substances</i>	Unchanged	Montreal
			2.2.3.6	<i>An integrated pest, disease and weed management plan</i>	New	KFRI
		2.2.4		Regulations for the introduction of single provenance/clones	New	KFRI
			2.2.4.1	<i>Use of only clones and provenances</i>	New	KFRI
			2.2.4.2	<i>Use of provenances well adapted to the site, having high degree of disease and drought resistance</i>	New	KFRI
		2.2.5		Minimisation of impacts of monocultures through mixed cropping	New	KFRI
	2.3			Productive capacity of the land is maintained or improved	Reformulated	Montreal
		2.3.1		Measures for conserving or improving stability of ecologically fragile localities are implemented	New	KFRI
			2.3.1.1	<i>Plantations prohibited on slopes of over 30° measured over a terrestrial distance of 100m</i>	New	KFRI
			2.3.1.2	<i>Ecologically sensitive areas, especially buffer zones along watercourses, are protected</i>	Unchanged	CIFOR
			2.3.1.3	<i>Shelter belts of natural vegetation are retained on the ridges</i>	New	KFRI
		2.3.2		Watershed services from the land are maintained or enhanced	New	KFRI
			2.3.2.1	<i>Water infiltration rate</i>	New	KFRI
		2.3.3		Decline in water quality in watershed or sub-watershed	Unchanged	Côte d'Ivoire
		2.3.4		Provision for protection of bodies of water	New	KFRI
			2.3.4.1	<i>Percentage of stream kilometres in forested catchment in which stream flow and timing has significantly deviated from the historical range of variation</i>	Unchanged	Montreal
		2.3.5		Water system (regime) and quality do not decrease	Unchanged	ATO
			2.3.5.1	<i>Percentage of water bodies in forest areas (e.g., stream kilometres, lake hectares) with significant variance of biological diversity from the historical range of variability</i>	Unchanged	Montreal
			2.3.5.2	<i>Percentage of water bodies in forest areas (e.g., stream kilometres, lake hectares) with significant variation from the historical range of variability in pH, dissolved oxygen, levels of chemicals (electrical conductivity), sedimentation or temperature change</i>	Unchanged	Montreal

Annex 3.1 Continued

P	C	I	V	Description	Observation	Reference
			2.3.5.3	<i>Run-off regime is not altered</i>	New	KFRI
		2.3.6		Soil conditions are not greatly altered, especially topsoil loss, sheet, splash and gully erosion, are avoided. Norms: level of organic carbon content (change), soil respiration rate, levels of macronutrients (change), regulatory measures for the use of chemical fertiliser exist, gravel content, soil compaction, laterisation index	New	KFRI
			2.3.6.1	<i>Area and percentage of forest land with significant soil erosion</i>	Unchanged	Montreal
			2.3.6.2	<i>Area and percentage of forest land with significantly diminished soil organic matter and/or changes in other soil chemical properties</i>	Unchanged	Montreal
			2.3.6.3	<i>Soil conservation measures</i>	Unchanged	ACT
			2.3.6.4	<i>Soil exposure</i>	New	KFRI
		2.3.7		No inadvertent ponding or water logging as a result of forest management	Unchanged	CIFOR

Annex 3.1 Continued

P	C	I	V	Description	Observation	Reference
SOCIAL						
3				Plantation establishment and management maintains or enhances intergenerational access to resources, economic benefits and infrastructural facilities for local people and other plantation labourers	Reformulated	CIFOR
	3.1			Local people accrue direct or indirect benefits from the plantation activities	New	KFRI
		3.1.1		Local people, both men and women, get employment and promotion opportunities	Reformulated	CIFOR
			3.1.1.1	<i>Proportion of local employees</i>	New	KFRI
			3.1.1.2	<i>Reservation policies for locals exist and are followed</i>	New	KFRI
			3.1.1.3	<i>Proportion of/representation of officers in management level</i>	New	KFRI
		3.1.2		Local people are given training (job-oriented)	Reformulated	SA
			3.1.2.1	<i>There is a regular locally relevant training programme or skill development for locals run by the FMU</i>	New	KFRI
			3.1.2.2	<i>The training programme is beneficial for locals</i>	New	KFRI
		3.1.3		Schools and educational facilities for local and other employees	Reformulated	SA
			3.1.3.1	<i>Nature awareness programmes</i>	New	KFRI
			3.1.3.2	<i>Student-teacher ratio</i>	New	KFRI
			3.1.3.3	<i>Scholarships</i>	New	KFRI
		3.1.4		Local and indigenous people are given preference in competitive bidding and are encouraged to take up contract activities	New	KFRI
			3.1.4.1	<i>Policy exists to give preference for locals in plantation bidding</i>	New	KFRI
			3.1.4.2	<i>Contractors are encouraged to employ locals</i>	New	KFRI
		3.1.5		Supply of fuel for employees and locals under collective management programmes	New	KFRI
			3.1.5.1	<i>Cooking fuel</i>	New	KFRI
		3.1.6		Water conservation/water distribution facilities equally benefit employees and local people, either at a concessional rate or free of cost	New	KFRI
			3.1.6.1	<i>There is a soil and water conservation programme implemented by the FMU</i>	New	KFRI
			3.1.6.2	<i>Local people are educated on cost-effective and low-cost soil and water conservation programmes</i>	New	KFRI
		3.1.7		Road and other communication systems are accessible to local people as well	New	KFRI
		3.1.8		Local food security is not affected because of plantation extension	New	KFRI

Annex 3.1 Continued

P	C	I	V	Description	Observation	Reference
			3.1.8.1	<i>Changes in cropping pattern to commercial crops following plantation activities</i>	New	KFRI
	3.2			Traditional livelihood security or income-generating opportunities for people are not negatively affected	New	KFRI
		3.2.1		Tribal people are adequately compensated or alternatives are provided	New	KFRI
			3.2.1.1	<i>Details of resettlement</i>	New	KFRI
		3.2.2		NWFP collection from the forest is not affected		
	3.3			Labourers and employees are compensated adequately and their rights are protected	Reformulated	SWP
		3.3.1		Periodic revision of employees' compensation occurs	Reformulated	SWP
			3.3.1.1	<i>Incidents of protests</i>	New	KFRI
		3.3.2		Compliance with international or national labour rules	Reformulated	SA
			3.3.2.1	<i>Welfare schemes</i>	New	KFRI
	3.4			Tenure rights of the local people are secure	Reformulated	CIFOR
		3.4.1		No incidents of bullying and threats from plantation authorities	New	KFRI
			3.4.1.1	<i>Cases, rumours, etc.</i>	New	KFRI
	3.5			Indirect benefits from tourism activities do not have any hidden social cost involved	New	KFRI
		3.5.1		Tourism activities associated with plantations do not affect the local resource equity, displacement or marginalisation of the local or indigenous populations	New	KFRI
			3.5.1.1	<i>Rise in land value</i>	New	KFRI
			3.5.1.2	<i>Change in land use to urban</i>	New	KFRI
			3.5.1.3	<i>Privatisation of common water bodies, playing grounds or pastoral lands</i>	New	KFRI
		3.5.2		Plantation activities or other recreation facilities are not gender discriminatory at the local level	New	KFRI
			3.5.2.1	<i>Number of minor cases</i>	New	KFRI
4	Stakeholders, including locals and forest actors, have a voice in plantation management				Reformulated	CIFOR
	4.1			Plantation management involves local people in areas of common interest	New	KFRI
		4.1.1		Efficient maintenance of common wood lots	Reformulated	SWP
		4.1.2		Participation in fire protection	Reformulated	SA
		4.1.3		Participation in watershed development programmes	New	KFRI

Annex 3.1 Continued

P	C	I	V	Description	Observation	Reference
MANAGEMENT						
5	Teak plantation management encourages an optimal and efficient use of products and services in order to ensure sustainable yield and quality					
	5.1			Management objectives are clearly and precisely described and documented	Reformulated	FSC
		5.1.1		Objectives are clearly stated in terms of major functions of the plantation	Reformulated	SA
	5.2			A comprehensive management plan exists, which ensures the economic and ecological sustainability of the teak plantation	New	KFRI
		5.2.1		A management plan is available	Unchanged	CIFOR
		5.2.2		Yield management plans ensure economic viability	New	KFRI
			5.2.2.1	<i>Yield regulation by area and/or volume prescribed</i>	Unchanged	CIFOR
			5.2.2.2	<i>The number of trees and/or volume of timber per hectare harvested</i>	New	KFRI
		5.2.3		Marketing strategies avoid gluts in the market	New	KFRI
			5.2.3.1	<i>Marketing strategies and the extent to which products are marketed for their highest-valued uses</i>	New	KFRI
		5.2.4		Management plans to prevent natural catastrophes (e.g., fires) and planning responses for resources stabilisation and recovery	Reformulated	ACT
		5.2.5		Harvest regulation plans minimise environmental impacts	New	KFRI
			5.2.5.1	<i>The presence of clear, official harvesting rules</i>	Unchanged	ITTO
			5.2.5.2	<i>Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact</i>	Reformulated	ACT
	5.3			The management plan is effectively implemented	Reformulated	ATO
		5.3.1		Harvest efficiency and product utilisation ensures economic sustainability	Reformulated	SCS
			5.3.1.1	<i>Production statistics of timber over time</i>	Reformulated	ITTO
			5.3.1.2	<i>The efficiency and economic viability of marketing of forest products locally, regionally and internationally</i>	New	KFRI
			5.3.1.3	<i>Review of company's annual financial statements, which provide information such as annual return on investment rates</i>	New	KFRI
			5.3.1.4	<i>Actual yield per hectare as compared to predicted yield</i>	New	KFRI
		5.3.2		Reduced-impact felling specified/implemented	Reformulated	ATO
			5.3.2.1	<i>Low-impact felling techniques are available</i>	Reformulated	ATO
			5.3.2.2	<i>Frequency of excessive felling damage to harvested trees and extent of 'skinned' residual trees or trees with tops broken during harvesting operations</i>	Reformulated	SCS
			5.3.2.3	<i>Directional felling techniques are being used (i.e., trees are felled parallel to or in the direction of skidding)</i>	Reformulated	SA

Annex 3.1 Continued

P	C	I	V	Description	Observation	Reference
		5.3.3		Sustainable timber production (in quality and quantity) is guaranteed	New	KFRI
			5.3.3.1	<i>Silvicultural prescriptions (pre, during and post-harvest) are being adhered to</i>	New	KFRI
			5.3.3.2	<i>Growth rates, stocking and regeneration are being monitored by a suitable continuous forest inventory system</i>	Reformulated	FSC
			5.3.3.3	<i>Extent to which expedient prescriptions such as diameter-limit harvesting are routinely applied</i>	New	KFRI
			5.3.3.4	<i>Harvest trees are marked prior to logging</i>	Reformulated	ITTO
			5.3.3.5	<i>A pre-logging stand inventory</i>	Unchanged	ITTO
		5.3.4		Skidding damage to trees and soil is minimised	Unchanged	CIFOR
			5.3.4.1	<i>Front end of logs is lifted off ground during mechanical skidding</i>	Unchanged	SWP
			5.3.4.2	<i>Skid trail gradients do not exceed 25 degrees</i>	Unchanged	SWP
			5.3.4.3	<i>Specifications in terms of skid trail width and location have been set and are being followed</i>	Unchanged	SWP
		5.3.5		Forest management minimises impacts of logging on plantation's structure and biodiversity	New	KFRI
			5.3.5.1	<i>Canopy opening is minimised</i>	Unchanged	CIFOR
	5.4			An efficient monitoring and control system is present to periodically revise management prescription based on new information	Reformulated	FSC
		5.4.1		Documentation and records of all management activities are kept in a form that makes it possible for monitoring to occur	Unchanged	CIFOR
		5.4.2		Monitoring procedures for acquiring information on plan attainment and resource conditions	New	KFRI
			5.4.2.1	<i>Records of annual areas cut over time</i>	Reformulated	SWP
			5.4.2.2	<i>Actual annual harvest levels as compared to planned levels</i>	New	KFRI
			5.4.2.3	<i>Provision for monitoring the residual growing stock after logging</i>	New	KFRI

Annex 3.2 Criteria and indicators of sustainable management for eucalypt plantations in Kerala selected after field testing by Team 2.

P	C	I	V	Description	Observation	Reference
POLICY						
1	Policy, planning and institutional frameworks are conducive to sustainable management of eucalypt plantations				Reformulated	CIFOR
	1.1			There is sustained and adequate funding for the management of government, private and industry-owned forest plantations	Reformulated	CIFOR/ KFRI
		1.1.1		Institutions responsible for forest management and research are adequately funded and staffed	Unchanged	KFRI
			1.1.1.1	<i>Policy and planning are based on recent and accurate information</i>	Unchanged	CIFOR
		1.1.2		Adequacy of human and financial resources to meet legislative and administrative responsibilities in sustainable forest management	Unchanged	KFRI
		1.1.3		Investment and taxation policies and a regulatory environment which recognise the long-term nature of investments, and permit the flow of capital out of the forest sector in response to market signals, non-market economic valuations and public policy decisions, in order to meet long-term demands for forest products and services	Unchanged	Montreal

Annex 3.2 Continued

P	C	I	V	Description	Observation	Reference
ECOLOGY						
2	The main ecological functions of eucalypt plantations are maintained				Reformulated	ATO
	2.1			Impacts on biodiversity of the forest landscape are minimised	Unchanged	CIFOR
		2.1.1		Endangered plant/animal species are protected	Unchanged	CIFOR
			2.1.1.1	<i>No tree of locally rare or endangered species or species included in lists of sensitive species is felled</i>	Unchanged	KFRI
			2.1.1.2	<i>Floristically and faunistically rich patches of vegetation are conserved</i>	Unchanged	KFRI
		2.1.2		Strategies to ensure maintenance of viable metapopulations of indigenous biota in plantation landscapes	Unchanged	KFRI
			2.1.2.1	<i>Indigenous and locally adapted species are permitted to regenerate in gaps</i>	Unchanged	KFRI
			2.1.2.2	<i>Corridors of unlogged forests are retained</i>	Unchanged	CIFOR
			2.1.2.3	<i>Raising plantations is not authorised if the vertical stratification of the forest strip, which forms the wildlife corridor, is disturbed</i>	Unchanged	KFRI
		2.1.3		Landscape units that are of great importance to wildlife are conserved and access is not affected, e.g., waterholes, grasslands and bamboo breaks	Unchanged	KFRI
	2.2			Maintenance of the health and vitality of forest ecosystems	Unchanged	Montreal
		2.2.1		Protection of the plantation against fire	Unchanged	KFRI
			2.2.1.1	<i>Fire protection and control measures</i>	Unchanged	KFRI
		2.2.2		Based on the identification of key biological areas, roughly 10% of the total area under forest management (not including stream or roadside buffers) is designated as a 'conservation zone', i.e., land or forest to be conserved in its natural state without logging	Unchanged	SWP
			2.2.2.1	<i>Area and percentage of forest land with diminished biological components indicative of changes in fundamental ecological processes (e.g. soil nutrient cycling, seed dispersion, pollination) and/or ecological continuity (monitoring of functionally important species such as fungi, arboreal epiphytes, nematodes, beetles and wasps)</i>	Unchanged	Montreal
			2.2.2.2	<i>Observed circumstances in which ecologically important areas were substantially altered through harvesting</i>	Unchanged	SCS
			2.2.2.3	<i>Conservation zone is preferably a contiguous block, though it may be a series of smaller blocks linked by corridors as wide as the average height of forest canopy in a mature forest (over 75 years)</i>	Unchanged	SWP
			2.2.2.4	<i>Special provisions for the protection of sensitive areas, plains, stream banks, steep slopes should be defined in the management plan</i>	Unchanged	ATO
		2.2.3		No chemical contamination of food chains and ecosystems	Unchanged	CIFOR

Annex 3.2 Continued

P	C	I	V	Description	Observation	Reference
			2.2.3.1	<i>Policies and procedures for proper use and disposal of hazardous materials</i>	Unchanged	SCS
			2.2.3.2	<i>Extent to which sivicultural methods minimise the need for pesticides (avoidance of clear cutting and other measures designed to limit hardwood incursion)</i>	Unchanged	SCS
			2.2.3.3	<i>Frequency of pesticide use and stated reasons for use</i>	Unchanged	SCS
			2.2.3.4	<i>Chemicals banned in Europe, America or the target country are not used</i>	Unchanged	Indonesia
			2.2.3.5	<i>Area and percentage of forest land experiencing an accumulation of persistent toxic substances</i>	Unchanged	Montreal
			2.2.3.6	<i>An integrated pest, disease and weed management plan</i>	Unchanged	KFRI
		2.2.4		Regulations for the introduction of single provenances/clones	Unchanged	KFRI
			2.2.4.1	<i>Use of only clones and provenances</i>	Unchanged	SWP
			2.2.4.2	<i>Use of provenances well adapted to the site, having high degree of disease, drought resistance</i>	Unchanged	KFRI
		2.2.5		Minimisation of impacts of monocultures through mixed cropping	Unchanged	KFRI
	2.3			Productive capacity of the land is maintained or improved	Reformulated	Montreal
		2.3.1		Measures for conserving or improving stability of ecologically fragile localities are implemented	Unchanged	KFRI
			2.3.1.1	<i>Plantations prohibited on slopes of over 30° measured over a terrestrial distance of 100m</i>	Unchanged	KFRI
			2.3.1.2	<i>Ecologically sensitive areas, especially buffer zones along watercourses, are protected</i>	Unchanged	CIFOR
			2.3.1.3	<i>Shelter belts of natural vegetation are retained on the ridges</i>	Unchanged	KFRI
		2.3.2		Watershed services of the land are maintained or enhanced	Unchanged	KFRI
			2.3.2.1	<i>Water infiltration rate</i>	Unchanged	KFRI
		2.3.3		Decline in water quality in watershed or sub-watershed	Unchanged	Côte d'Ivoire
		2.3.4		Provision for protection of bodies of water	Unchanged	KFRI
			2.3.4.1	<i>Percentage of stream kilometers in forested catchment in which stream flow and timing has significantly deviated from the historical range of variation</i>	Unchanged	Montreal
		2.3.5		Water system (regime) and quality do not decrease	Unchanged	ATO
			2.3.5.1	<i>Percentage of water bodies in forest areas (e.g., stream kilometres, lake hectares) with significant variance of biological diversity from the historical range of variability</i>	Unchanged	Montreal
			2.3.5.2	<i>Percentage of water bodies in forest areas (e.g., stream kilometres, lake hectares) with significant variation from the historical range of variability in pH, dissolved oxygen, levels of chemicals (electrical conductivity), sedimentation or temperature change</i>	Unchanged	Montreal
			2.3.5.3	<i>Run-off regime is not altered</i>	Unchanged	KFRI

Annex 3.2 Continued

P	C	I	V	Description	Observation	Reference
		2.3.6		Soil conditions are not greatly altered especially topsoil loss, sheet, splash and gully erosion are avoided. Norms: level of organic carbon content (change), soil respiration rate, levels of macronutrients (change), regulatory measures for the use of chemical fertilisers exist, gravel content, soil compaction, laterisation index	Unchanged	KFRI
			2.3.6.1	<i>Area and percentage of forest land with significant soil erosion</i>	Unchanged	Montreal
			2.3.6.2	<i>Area and percentage of forest land with significantly diminished soil organic matter and/or changes in other soil chemical properties</i>	Unchanged	Montreal
			2.3.6.3	<i>Soil conservation measures</i>	Unchanged	ACT
			2.3.6.4	<i>Soil exposure</i>	Unchanged	KFRI
		2.3.7		No inadvertent ponding or waterlogging as a result of forest management	Unchanged	CIFOR
		2.3.8		Nutrient losses due to short rotation nature are replenished on a scientific basis	New	KFRI

Annex 3.2 Continued

P	C	I	V	Description	Observation	Reference
SOCIAL						
3				Plantation establishment and management maintains or enhances intergenerational access to resources, economic benefits and infrastructural facilities for local people and other plantation labourers	Reformulated	CIFOR
	3.1			Local people accrue direct or indirect benefits from the plantation activities	Unchanged	KFRI
		3.1.1		Local people, both men and women, get employment and promotion opportunities	Reformulated	CIFOR
			3.1.1.1	<i>Proportion of local employees</i>	Unchanged	KFRI
			3.1.1.2	<i>Reservation policies for locals exist and are followed</i>	Unchanged	KFRI
			3.1.1.3	<i>Proportion of/representation of officers in management level</i>	Unchanged	KFRI
		3.1.2		Local people are given training (job-oriented)	Reformulated	SA
			3.1.2.1	<i>There is a regular locally relevant training programme or skill development for locals run by FMU</i>	Unchanged	KFRI
			3.1.2.2	<i>The training programme is beneficial for locals</i>	Unchanged	KFRI
		3.1.3		Schools and educational facilities for local and other employees	Reformulated	SA
			3.1.3.1	<i>Nature awareness programmes</i>	Unchanged	KFRI
			3.1.3.2	<i>Student-teacher ratio</i>	Unchanged	KFRI
			3.1.3.3	<i>Scholarships</i>	Unchanged	KFRI
		3.1.4		Local and indigenous people are given preference in competitive bidding and are encouraged to take up contract activities	Unchanged	KFRI
			3.1.4.1	<i>Policy exists to give preference for locals in plantation bidding</i>	Unchanged	KFRI
			3.1.4.2	<i>Contractors are encouraged to employ locals</i>	Unchanged	KFRI
		3.1.5		Supply of fuel for employees and locals under collective management programmes	Unchanged	KFRI
			3.1.5.1	<i>Cooking fuel</i>	Unchanged	KFRI
		3.1.6		Water conservation/water distribution facilities equally benefit employees and local people either at a concessional rate or free of cost	Unchanged	KFRI
			3.1.6.1	<i>There is a soil and water conservation programme implemented by the FMU</i>	Unchanged	KFRI
			3.1.6.2	<i>Local people are educated on cost-effective and low-cost soil and water conservation programmes</i>	Unchanged	KFRI
		3.1.7		Road and other communication systems are accessible to local people as well	Unchanged	KFRI
		3.1.8		Local food security is not affected because of plantation extension	Unchanged	KFRI

Annex 3.2 Continued

P	C	I	V	Description	Observation	Reference
			3.1.8.1	<i>Changes in cropping pattern to commercial crops following plantation activities</i>	Unchanged	KFRI
	3.2			Traditional livelihood security or income-generating opportunities for people are not negatively affected	Unchanged	KFRI
		3.2.1		Tribal people are adequately compensated or alternatives are provided	Unchanged	KFRI
			3.2.1.1	<i>Details of resettlement</i>	Unchanged	KFRI
		3.2.2		NWFP collection from the forest is not affected	Unchanged	KFRI
	3.3			Labourers and employees are compensated adequately and their rights are protected	Reformulated	SWP
		3.3.1		Periodic revision of employees' compensation occurs	Reformulated	SWP
			3.3.1.1	<i>Incidents of protests</i>	Unchanged	KFRI
		3.3.2		Compliance with international or national labour rules	Reformulated	SA
			3.3.2.1	<i>Welfare schemes</i>	Unchanged	KFRI
	3.4			Tenure rights of the local people are secure	Reformulated	CIFOR
		3.4.1		No incident of bullying and threats from plantation authorities	Unchanged	KFRI
			3.4.1.1	<i>Cases, rumours, etc.</i>	Unchanged	KFRI
	3.5			Indirect benefits from tourism activities do not have any hidden social cost involved	Unchanged	KFRI
		3.5.1		Tourism activities associated with plantations do not affect the local resource equity, and do not result in displacement or marginalisation of local or indigenous populations	Unchanged	KFRI
			3.5.1.1	<i>Rise in land value</i>	Unchanged	KFRI
			3.5.1.2	<i>Change in land use to urban</i>	Unchanged	KFRI
			3.5.1.3	<i>Privatisation of common water bodies, playing grounds or pastoral lands</i>	Unchanged	KFRI
		3.5.2		Plantation activities or other recreation facilities are not gender discriminatory at the local level	Unchanged	KFRI
			3.5.2.1	<i>Number of minor cases</i>	Unchanged	KFRI
4	Stakeholders, including locals and forest actors, have a voice in plantation management			Reformulated	CIFOR	
	4.1			Plantation management involves local people in areas of common interest	Unchanged	KFRI
		4.1.1		Efficient maintenance of common wood lots	Reformulated	SWP
		4.1.2		Participation in fire protection	Reformulated	SA
		4.1.3		Participation in watershed development programmes	Unchanged	KFRI

Annex 3.2 Continued

P	C	I	V	Description	Observation	Reference
MANAGEMENT						
5	Eucalypt plantation management encourages an optimal and efficient use of products and services in order to ensure sustainable yield and quality					
	5.1			Management objectives are clearly and precisely described and documented	Reformulated	FSC
		5.1.1		Objectives are clearly stated in terms of major functions of the plantation	Reformulated	SA
	5.2			A comprehensive management plan exists, which ensures the economic and ecological sustainability of the eucalypt plantation	Unchanged	KFRI
		5.2.1		A management plan is available	Unchanged	CIFOR
		5.2.2		Yield management plans ensure economic viability	Unchanged	KFRI
			5.2.2.1	<i>Yield regulation by area and/or volume prescribed</i>	Unchanged	CIFOR
			5.2.2.2	<i>The number of trees and/or volume of timber per hectare harvested</i>	Unchanged	KFRI
		5.2.3		Marketing strategies avoid gluts in the market	Unchanged	KFRI
			5.2.3.1	<i>Marketing strategies and the extent to which products are marketed for their highest-value uses</i>	Unchanged	KFRI
		5.2.4		Management plans to prevent natural catastrophes (e.g., fires) and planning responses for resources stabilisation and recovery	Reformulated	ACT
		5.2.5		Harvest regulation plans minimise environmental impacts	Unchanged	KFRI
			5.2.5.1	<i>The presence of clear, official harvesting rules</i>	Unchanged	ITTO
			5.2.5.2	<i>Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact</i>	Reformulated	SA
	5.3			The management plan is effectively implemented	Reformulated	ATO
		5.3.1		Harvest efficiency and product utilisation ensures economic sustainability	Reformulated	SCS
			5.3.1.1	<i>Production statistics of timber over time</i>	Reformulated	ITTO
			5.3.1.2	<i>The efficiency and economic viability of marketing of forest products locally, regionally and internationally</i>	Unchanged	KFRI
			5.3.1.3	<i>Review of company's annual financial statements, which provide information such as annual return on investment rates</i>	Unchanged	KFRI
			5.3.1.4	<i>Actual yield per hectare as compared to predicted yield</i>	Unchanged	KFRI
		5.3.2		Reduced-impact felling specified/implemented	Reformulated	ATO
			5.3.2.1	<i>Low-impact felling techniques are available</i>	Reformulated	ATO
			5.3.2.2	<i>Frequency of excessive felling damage to harvested trees and extent of 'skinned' residual trees or trees with tops broken during harvesting operations</i>	Reformulated	SCS
			5.3.2.3	<i>Directional felling techniques are being used (i.e. trees are felled parallel to or in the direction of skidding)</i>	Reformulated	SA

Annex 3.2 Continued

P	C	I	V	Description	Observation	Reference
		5.3.3		Sustainable timber production (in quality and quantity) is guaranteed	Unchanged	KFRI
			5.3.3.1	<i>Silvicultural prescriptions (pre, during, and post-harvest) are being adhered to</i>	Unchanged	KFRI
			5.3.3.2	<i>Growth rates, stocking and regeneration are being monitored by a suitable continuous forest inventory system</i>	Reformulated	FSC
			5.3.3.3	<i>Extent to which expedient prescriptions such as diameter-limit harvesting are routinely applied</i>	Unchanged	KFRI
			5.3.3.4	<i>Harvest trees are marked prior to logging</i>	Reformulated	ITTO
			5.3.3.5	<i>A pre-logging stand inventory</i>	Unchanged	ITTO
		5.3.4		Skidding damage to trees and soil is minimised	Unchanged	CIFOR
			5.3.4.1	<i>Front end of logs is lifted off ground during mechanical skidding</i>	Unchanged	SWP
			5.3.4.2	<i>Skid trail gradients do not exceed 25 degrees</i>	Unchanged	SWP
			5.3.4.3	<i>Specifications in terms of skid trail width and location have been set and are being followed</i>	Unchanged	SWP
		5.3.5		Forest management minimises impacts of logging on plantation's structure and biodiversity	Unchanged	KFRI
			5.3.5.1	<i>Canopy opening is minimised</i>	Unchanged	CIFOR
	5.4			An efficient monitoring and control system is present to periodically revise management prescriptions based on new information	Reformulated	FSC
		5.4.1		Documentation and records of all management activities are kept in a form that makes it possible for monitoring to occur	Unchanged	CIFOR
		5.4.2		Monitoring procedures for acquiring information on plan attainment and resource conditions	Unchanged	KFRI
			5.4.2.1	<i>Records of annual areas cut over time</i>	Reformulated	SWP
			5.4.2.2	<i>Actual annual harvest levels as compared to planned levels</i>	Unchanged	KFRI
			5.4.2.3	<i>Provision for monitoring the residual growing stock after logging</i>	Unchanged	KFRI

Annex 3.3 Criteria and indicators of sustainable management for teak plantations of Madhya Pradesh selected after field testing by Team 3.

P	C	I	V	Description	Observation	Reference
POLICY						
1	Planning and institutional frameworks are conducive for sustainable management of forest plantations				Reformulated	CIFOR
	1.1			There exists policy and legal frameworks for plantation land use	New	BIP/ KFRI
	1.2			There exists adequate and trained manpower in plantation forestry	New	BIP/ KFRI
		1.2.1		Periodicity of the training programmes	New	BIP/ KFRI
		1.2.2		Content of the training programme is relevant	New	BIP/ KFRI
	1.3			Information for forest resource accounting, including that of plantation forests, is available on a periodic basis	New	BIP/ KFRI
		1.3.1		Management plans are user-friendly	New	BIP/ KFRI
			1.3.1.1	<i>Management plans are also available in the local language</i>	New	BIP/ KFRI
	1.4			Monitoring and evaluation of the plantation projects and forest resource accounting are carried out periodically	New	BIP/ KFRI
	1.5			Reinvestment policies are conducive to sustainable plantation management	New	BIP/ KFRI
	1.6			Policy and legislation encourage and efficiently regulate the plantation forestry business in the private sector	Unchanged	KFRI
		1.6.1		Land conversion, type of land and change in cropping pattern are recorded	New	BIP/ KFRI
		1.6.2		Production targets, markets and financial goals are stated	New	BIP/ KFRI
		1.6.3		Product quality is monitored	New	BIP/ KFRI
		1.6.4		There is provision for government intervention in existing rules, taxation policies and the regulatory environment	New	BIP/ KFRI

Annex 3.3 Continued

P	C	I	V	Description	Observation	Reference
ECOLOGY						
2	Ecological structure, function and processes of the forests are maintained				Reformulated	ATO
	2.1			Areas under natural forests, plantations are maintained or improved	New	BIP/ KFRI
		2.1.1		In a given FMU the percentage of plantations does not exceed more than 50% of the forest land area	New	BIP/ KFRI
	2.2			Maintenance of health and vitality of teak plantation ecosystem	Unchanged	Montreal
		2.2.1		Protection of the plantation against fire, pests and diseases	New	BIP/ KFRI
			2.2.1.1	<i>Fire protection and control measures implemented on time</i>	Reformulated	KFRI
			2.2.1.2	<i>Frequency of fire</i>	New	BIP/ KFRI
			2.2.1.3	<i>Area affected</i>	New	BIP/ KFRI
		2.2.2		No chemical contamination of food chains and ecosystems	Unchanged	CIFOR
			2.2.2.1	<i>Integrated pest, disease and weed management strategies adopted</i>	Reformulated	KFRI
			2.2.2.2	<i>Chemical application should conform to existing legislation</i>	Unchanged	BIP/ KFRI
		2.2.3		Genetic diversity is maintained	Unchanged	BIP/ KFRI
			2.2.3.1	<i>Use of provenance well adapted to the site, having high degree of resistance to disease and drought</i>	Unchanged	KFRI
			2.2.3.2	<i>Use of certified and quality planting material of known origin</i>	New	BIP/ KFRI
	2.3			Productive capacity of the site is maintained or improved	New	BIP/ KFRI
		2.3.1		Optimal stocking (as per the management plan) so as to minimise canopy opening	Reformulated	CIFOR
		2.3.2		Measures for conserving or improving stability of ecologically fragile localities are implemented	Unchanged	KFRI
			2.3.2.1	<i>Ecologically sensitive areas, especially buffer zones along watercourses, are protected</i>	Unchanged	CIFOR
		2.3.3		Productive capacity of the soil is maintained or improved	Reformulated	Montreal
			2.3.3.1	<i>Area under soil compaction</i>	Unchanged	Montreal
			2.3.3.2	<i>Percentage of area under poding</i>	Unchanged	Montreal
			2.3.3.3	<i>Percentage of area under waterlogging</i>	Unchanged	Montreal
			2.3.3.4	<i>Degree of soil erosion</i>	Unchanged	Montreal
			2.3.3.5	<i>Area and percentage of forest land with significantly diminished soil organic matter in terms of depth of the humus layer</i>	New	BIP/ KFRI

Annex 3.3 Continued

P	C	I	V	Description	Observation	Reference
			2.3.3.6	<i>Soil conservation measures properly implemented</i>	Reformulated	KFRI
			2.3.3.7	<i>Soil exposure (canopy cover, stocking, fire, removal of litter)</i>	Reformulated	KFRI
	2.4			Adverse impact on biodiversity of the forest landscape is minimised	Reformulated	CIFOR
		2.4.1		Endangered plant/animal species are protected	Unchanged	CIFOR
			2.4.1.1	<i>Trees of locally rare or endangered species or socially important species are not felled</i>	Reformulated	Côte d'Ivoire
			2.4.1.2	<i>Floristically and faunistically rich patches of vegetation are conserved</i>	Unchanged	KFRI
		2.4.2		Strategies to ensure maintenance of viable wildlife (flora and fauna) populations in the plantation landscapes	Reformulated	KFRI
			2.4.2.1	<i>Corridors of unlogged forests are retained (if necessary)</i>	Reformulated	CIFOR
			2.4.2.2	<i>Raising plantations is not authorised if the vertical stratification of the forest strip, which forms the wildlife corridor, is disturbed</i>	Unchanged	KFRI
			2.4.2.3	<i>Landscape units that are of great importance to wildlife are conserved and are accessible to wildlife, e.g., waterholes, grasslands and bamboo breaks</i>	Reformulated	KFRI
	2.5			Watershed functions of the land are maintained or enhanced	Reformulated	KFRI
		2.5.1		Water quality is maintained or enhanced	Reformulated	ATO
			2.5.1.1	<i>Water quality is maintained within the range of seasonal variations</i>	New	BIP/ KFRI

Annex 3.3 Continued

P	C	I	V	Description	Observation	Reference
SOCIAL						
3	Socio-economic benefits are maintained or enhanced				New	BIP/ KFRI
	3.1			Local people accrue benefits from the plantation activities	Reformulated	KFRI
		3.1.1		Local people, both men and women, get employment and promotion opportunities	Reformulated	KFRI
			3.1.1.1	<i>Proportion of local employees</i>	Unchanged	KFRI
			3.1.1.2	<i>Equity in employment</i>	Unchanged	KFRI
		3.1.2		Educational facilities, if run by the plantation management, are made available to the locals also	Unchanged	KFRI
			3.1.2.1	<i>Local people are given vocational training</i>	Reformulated	KFRI
			3.1.2.2	<i>There is a regular locally relevant training programme or skill development for locals run by the FMU</i>	Unchanged	KFRI
			3.1.2.3	<i>The training programme is beneficial for locals</i>	Unchanged	KFRI
			3.1.2.4	<i>Nature awareness programmes</i>	Unchanged	KFRI
			3.1.2.5	<i>Student-teacher ratio</i>	Unchanged	KFRI
			3.1.2.6	<i>Scholarships</i>	Unchanged	KFRI
		3.1.3		Supply of fuel for employees and locals under collective management programmes	Unchanged	KFRI
			3.1.3.1	<i>Availability of wood fuel, fodder, thatching and construction material</i>	Unchanged	BIP/ KFRI
		3.1.4		Drinking water facilities equally benefit employees and local people	Reformulated	KFRI
			3.1.4.1	<i>Communities have access to adequate and good quality water</i>	New	BIP/ KFRI
		3.1.5		Road and other communication systems are accessible to local people as well	Unchanged	KFRI
		3.1.6		Local food security is not affected because of plantation extension	Unchanged	KFRI
			3.1.6.1	<i>Changes in cropping pattern to commercial crops following the plantation activities</i>	Unchanged	KFRI
			3.1.6.2	<i>Agricultural lands are not converted to plantation</i>	New	BIP/ KFRI
	3.2			Traditional livelihood security or income-generating opportunities for people are not adversely affected	Reformulated	ACT
		3.2.1		Forest-dependent people are adequately compensated or alternatives are provided	New	BIP/ KFRI
			3.2.1.1	<i>Direct employment in the forestry sector</i>	Reformulated	CIFOR
		3.2.2		NWFP collection from the forest is not affected	New	BIP/ KFRI
	3.3			Labourers and employees are adequately compensated and their rights are protected	Reformulated	SWP

Annex 3.3 Continued

P	C	I	V	Description	Observation	Reference
		3.3.1		Periodic wage revision occurs	New	BIP/ KFRI
			3.3.1.1	<i>Incidence of protests</i>	Unchanged	KFRI
			3.3.1.2	<i>Wage revision reports</i>	New	BIP/ KFRI
		3.3.2		National labour rules are implemented	New	BIP/ KFRI
			3.3.2.1	<i>Welfare schemes</i>	Unchanged	KFRI
	3.4			Tenure rights of the local people are secure	Reformulated	CIFOR
		3.4.1		No incidents of bullying and threats from the plantation authorities	Reformulated	KFRI
			3.4.1.1	<i>Cases, rumours, etc.</i>	Unchanged	KFRI
	3.5			Indirect benefits from tourism activities do not have any hidden social cost involved	Unchanged	KFRI
		3.5.1		Tourism activities associated with plantations do not affect the local resource equity, and do not result in displacement or marginalisation of local or indigenous populations	Reformulated	KFRI
			3.5.1.1	<i>Rise in land value</i>	Unchanged	KFRI
			3.5.1.2	<i>Change in land use from rural to urban</i>	Reformulated	KFRI
			3.5.1.3	<i>Privatisation of common water bodies, playing grounds or pastoral lands for tourism development</i>	Reformulated	KFRI
		3.5.2		Plantation activities or other recreation facilities are not gender discriminatory at the local level	Reformulated	KFRI
			3.5.2.1	<i>Number of minor cases</i>	Unchanged	KFRI
	3.6			Plantation management involves local people in areas of common interest	Unchanged	KFRI
		3.6.1		Efficient maintenance of common wood lots	Reformulated	SWP
		3.6.2		Participation in fire protection	Reformulated	SA
		3.6.3		Participation in watershed development programmes	Unchanged	KFRI
		3.6.4		Community participation in grazing control	New	BIP/ KFRI

Annex 3.3 Continued

P	C	I	V	Description	Observation	Reference
MANAGEMENT						
4	Yield and quality of forest products and resources are improved				Reformulated	CIFOR
	4.1			Management objectives are clearly and precisely described and documented	Reformulated	FSC
		4.1.1		Objectives are clearly stated in terms of major functions of the plantation	Reformulated	SA
	4.2			A comprehensive technical plan exists, which ensures the economic, social and ecological sustainability of the teak plantation	Reformulated	KFRI
		4.2.1		A management plan is available	Unchanged	CIFOR
		4.2.2		Yield management plans ensure economic viability	Unchanged	KFRI
			4.2.2.1	<i>Yield regulation by area and/or volume prescribed</i>	Unchanged	CIFOR
			4.2.2.2	<i>The number of trees and/or volume of timber per hectare harvested</i>	Unchanged	KFRI
			4.2.2.3	<i>Plantation forestry activities to be linked with industries</i>	New	BIP/ KFRI
		4.2.3		Marketing strategies avoid gluts in the market	Unchanged	KFRI
			4.2.3.1	<i>Marketing strategies to ensure maximum local-level value addition</i>	New	BIP/ KFRI
		4.2.4		Management plans to ameliorate or counter natural catastrophes (e.g., fires) and planning responses for resources stabilisation and recovery	Reformulated	KFRI
		4.2.5		Harvest regulation plans minimise adverse environmental impacts	Reformulated	KFRI
			4.2.5.1	<i>The availability of clear, official harvesting rules</i>	Reformulated	KFRI
			4.2.5.2	<i>Harvesting adheres to working plan prescriptions</i>		
	4.3			The management plan is effectively implemented	Reformulated	ATO
		4.3.1		Harvest efficiency and product utilisation ensures economic sustainability	Reformulated	SCS
			4.3.1.1	<i>Production statistics of timber over time are available</i>	Reformulated	KFRI
			4.3.1.2	<i>The efficiency and economic viability of marketing of forest products locally, regionally and internationally</i>	Unchanged	KFRI
			4.3.1.3	<i>Review of company's annual financial statements which provide information such as annual return on investment rates</i>	Unchanged	KFRI
			4.3.1.4	<i>Actual yield per hectare as compared to predicted yield</i>	Unchanged	KFRI
		4.3.2		Reduced-impact felling specified/implemented	Reformulated	ATO
			4.3.2.1	<i>Low-impact felling techniques are available</i>	Reformulated	ATO
			4.3.2.2	<i>Frequency of excessive felling damage to harvested trees and extent of 'skinned' residual trees with tops broken during harvesting operations</i>	Reformulated	SCS
			4.3.2.3	<i>Directional felling techniques are being used (i.e., trees are felled parallel to or in the direction of skidding)</i>	Reformulated	SA

Annex 3.3 Continued

P	C	I	V	Description	Observation	Reference
		4.3.3		Sustainable timber production (in quality and quantity) is guaranteed	Unchanged	KFRI
			4.3.3.1	<i>Silvicultural prescriptions (pre, during and post-harvest) are being adhered to sustain the yield over rotations</i>	Reformulated	KFRI
			4.3.3.2	<i>Growth rates, stocking and regeneration are being monitored by a suitable continuous forest inventory system</i>	Reformulated	FSC
			4.3.3.3	<i>Extent to which expedient prescriptions, such as diameter-limit harvesting are routinely applied</i>	Unchanged	KFRI
			4.3.3.4	<i>Less damage to stumps in the case of coppice systems</i>	New	BIP/ KFRI
			4.3.3.5	<i>Pre-logging stand inventory</i>	Unchanged	ITTO
		4.3.4		Skidding damage to trees and soil is minimised	Unchanged	CIFOR
			4.3.4.1	<i>Front end of logs is lifted off ground during mechanical skidding</i>	Unchanged	SWP
			4.3.4.2	<i>Skid trail gradients do not exceed 25 degrees</i>	Unchanged	SWP
			4.3.4.4	<i>Specifications in terms of skid trail width and location have been set and are being followed</i>	Unchanged	SWP
		4.3.5		Forest management minimises impacts of logging on plantation's structure and biodiversity	Unchanged	KFRI
			4.3.5.1	<i>Canopy opening is minimised</i>	Unchanged	CIFOR
	4.4			An efficient monitoring and control system is present to periodically revise management prescriptions based on new information	Reformulated	FSC
		4.4.1		Documentation and records of all management activities are kept in a form that makes it possible for monitoring to occur	Unchanged	CIFOR
		4.4.2		Monitoring procedures for acquiring information plan attainment and resource conditions	Unchanged	KFRI
			4.4.2.1	<i>Records of annual areas cut over time</i>	Reformulated	SWP
			4.4.2.2	<i>Actual annual harvest levels as compared to planned levels</i>	Unchanged	KFRI
			4.4.2.3	<i>Provision for monitoring the residual growing stock after logging</i>	Unchanged	KFRI

Annex 4 Example of a field diary, Dr Manish Misra - Bhopal Team

Dates	Activities	Remarks
12-15 April 1999	Form1 filled out at Bhopal	Candidate sets for field testing selected
20 June	Discussion with team members (KFRI-IIFM); journey to Raipur	
21 June	Arrival Raipur. Sensitisation of local staff. Halt at Rawan	
22 June	Visit to plantations. Quadrat enumeration. Interview with local staff	Verification of biodiversity C&I in relation to NTFP
23 June	Visit to irrigated plantations	C&I corrected for soil status, growth, etc.
24 June	Visit to villages for linking C&I and their relevance to ecology C&I	Remarks of S. Sankar on restricting the C&I social
25 June	Visit to villages PRA on biodiversity conservation, income generation, etc.	Active participation of team
26 June	Workshop at the guesthouses filling out Form 2	
27 June	Review of C&I. Presentation of results	
28 June	Return to Bhopal	
29 June	Review at Bhopal	