Guidelines for Developing, Testing and Selecting Criteria and Indicators for Sustainable Forest Management

1 The Criteria & Indicators Toolbox Series

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Tel: +62-251-622 622 Fax: +62-251-622 100
E-mail: cifor@cgiar.org
WWW: http://www.cgiar.org/cifor

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C&I Toolbox Series

C&I Tool No. 1

Guidelines for Developing, Testing and Selecting Criteria and Indicators for Sustainable Forest Management

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C&I Tool No. 2

The CIFOR Criteria and Indicators Generic Template

CIFOR C&I Team

C&I Tool No. 3

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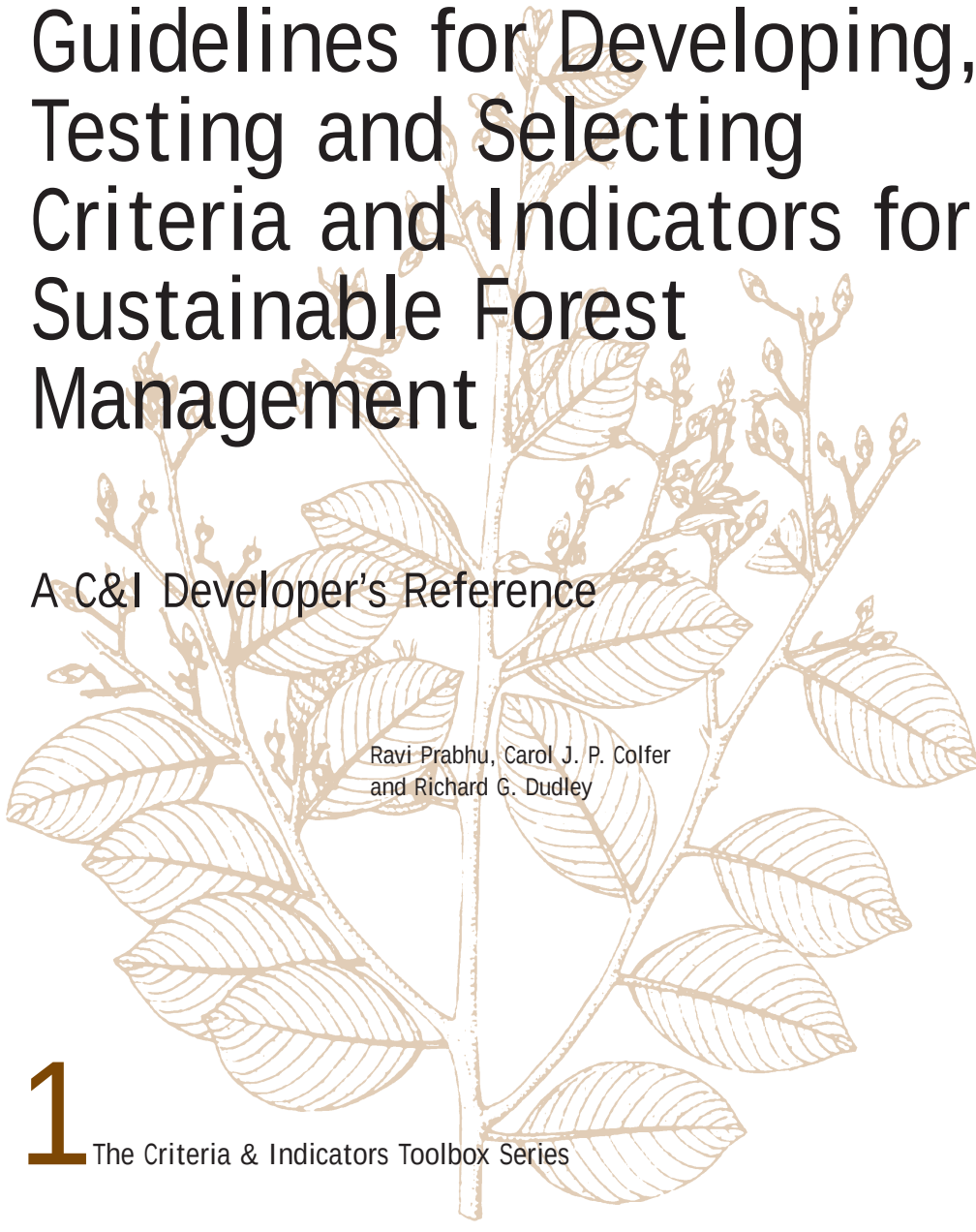
Methodologies for Assessing Ecological Indicators for Sustainable Forest Management (Draft under development)

Guidelines for Developing, Testing and Selecting Criteria and Indicators for Sustainable Forest Management

A C&I Developer's Reference

Ravi Prabhu, Carol J. P. Colfer
and Richard G. Dudley



1 The Criteria & Indicators Toolbox Series

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1 Introduction

1.1 – THE PURPOSE OF THIS MANUAL

This manual provides methods to assist the development and evaluation of criteria and indicators (C&I) which can then be used to assess the sustainability of forest management. The methods presented are aimed at the development of sets of C&I for natural forests at the forest management unit (FMU)[1] level, especially in the tropics. This manual is aimed especially at researchers and developers of C&I for assessing the sustainability of natural forest management in the tropics.

C&I are tools which can be used to conceptualise, evaluate and implement sustainable forest management. C&I can be identified at various levels: global, regional (ecoregional), national and subnational, or, as in this case, at the FMU level. National-level C&I have been developed essentially as reporting and monitoring instruments, not as standards with which to assess sustainability. On the other hand, development of C&I at the FMU level has been largely for the purpose of assessing sustainability and, to a lesser degree, as tools to facilitate the implementation of better management practices. It is unlikely that a single set of C&I will apply uniformly across the globe. Similarly, it is equally unlikely that a set of C&I developed at the national level will be meaningful at the forest level. Therefore, these guidelines are provided to assist in the creation of sets of locally appropriate C&I. Such C&I can then be used to evaluate the FMUs in question.

The methods presented in this manual were developed during the CIFOR project on *Testing Criteria and Indicators for Sustainable Forest Management*. The sites for this research were FMUs which focused on the production of timber. In subsequent versions of this manual, we will

1 An FMU is defined as a clearly demarcated area of land covered predominantly by forests, managed to a set of explicit objectives and according to a long-term management plan. See discussion of FMU under *Section 5: The Conceptual Basis of C&I Development*.

incorporate our experiences of testing C&I in forests managed for other objectives as well.

We hope this manual will be used by those interested in developing tools for on-site assessment of the quality and performance of forest management systems. Users might include:

- *certification bodies* assessing timber management for certification purposes;
- *government officials* designing more sustainable policies pertaining to forestry and other related sectors;
- *funding agencies* evaluating the sustainability of the activities undertaken by various natural resource management projects;
- *forest managers* improving the sustainability of their management at the forest management unit level;
- *project managers* planning, implementing and evaluating conservation and development projects; and
- *scientists* researching the causal links among ecological, forestry and human factors of sustainability.

1.2 – THE OBJECTIVES OF C&I TESTING

The principal aim of C&I field testing is to identify C&I that are objective, cost-effective and relevant to the sustainable management of forests. The focus of the testing procedure should be to identify the smallest number of C&I needed to reliably assess forest management in a cost-effective manner.

The process of identifying appropriate C&I is based on the evaluation of existing sets of C&I. If gaps exist, or if existing C&I are not suitable, new or substitute C&I can be developed. This iterative process involves multiple stakeholders in the region or countries concerned. The methods described in this manual were designed to be both flexible and rigorous. They are achieved by using interdisciplinary teams of experts acting within the framework of a well-defined iterative process.

1.3 – SUMMARY OF THE C&I DEVELOPMENT PROCESS

The focus of the exercise should be solely on development of C&I for a particular FMU. One should not attempt to produce a definitive set of C&I for a region during a test at a single FMU. C&I for a region (i.e., several similar FMUs) should develop out of the comparison of two or more FMU tests. Such comparisons will permit a separation of purely site-specific C&I from more generic C&I.

If additional objectives, other than those defined above, are identified for the testing process, then the suitability of methods outlined in this manual should be reviewed with reference to the conceptual framework presented in Section 5.

Figure 1 illustrates the entire CIFOR process for development of C&I for sustainable forest management at the FMU level. It also shows where the information relevant to each stage in the process can be found in this manual.

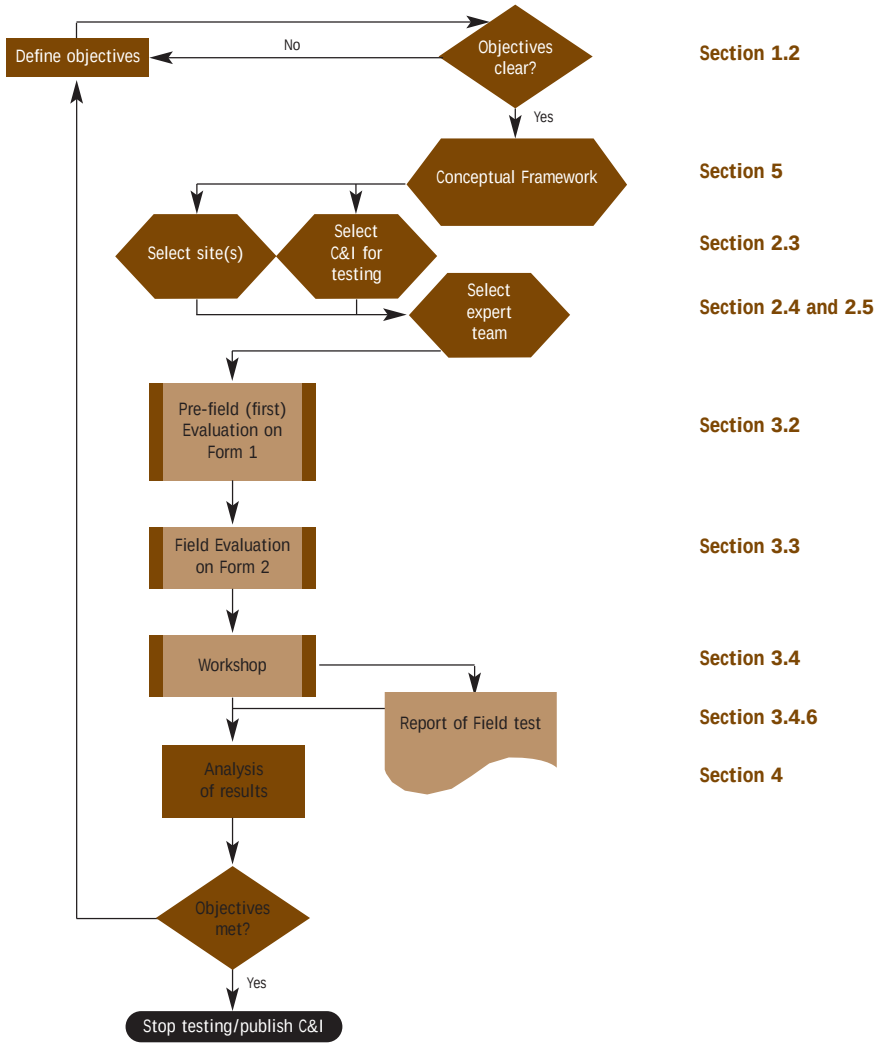
A summary of the process is as follows:

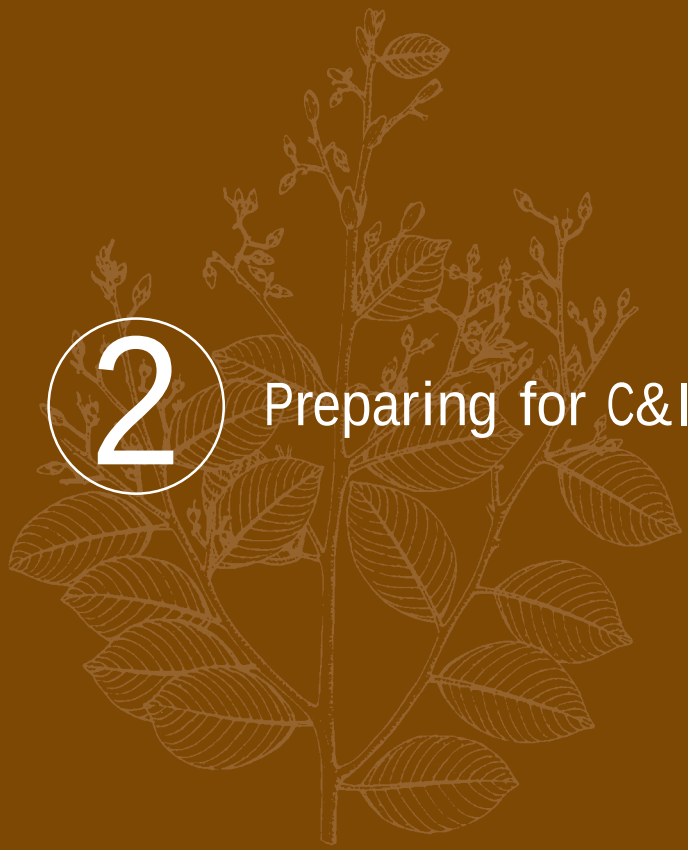
- clarify and review the overall goals of sustainable forest management as well as objectives of the procedures presented in this manual;
- create and/or obtain candidate sets of C&I prior to actual field testing;
- select sites where the testing of the C&I will be carried out;
- select a group of experts to carry out the test;
- allow the experts to review and comment on candidate C&I;

- compile results of expert comments;
- convene a workshop of experts to discuss and refine the candidate C&I;
- field test candidate C&I by experts;
- convene a workshop of experts to finalise C&I; and
- document test results and the C&I selected.

Figure 1. **Flowchart of the C&I evaluation and development process.**

Figure 2 on the page 29 provides a more detailed view of the same processes





2 Preparing for C&I Testing

2.1 – REVIEW OF THE CONCEPTUAL FRAMEWORK FOR C&I

A review and discussion of a conceptual framework for C&I provides the context within which the development of realistic C&I can take place. This conceptual framework:

- defines the main terms, such as principles, criteria and indicators;
- places them in the context of sustainable forest management;
- defines the constraints under which assessment[2] of sustainability takes place;
- facilitates the use of the C&I system by clarifying the hierarchical links and relationships among the different elements;
- provides a strategy for developing an operational and cost-effective assessment system; and
- permits the identification of a minimum number of reliable C&I for each test site.

The conceptual framework provides the teams of experts with a common frame of reference for their work. Without such a frame of reference, interdisciplinary teamwork will be very difficult and cross-site comparisons risky.

The conceptual framework developed by CIFOR is presented in Section 5. It was developed iteratively, responding to interactions during the field tests and the international debate on sustainability. It will change because sustainability, being an essentially human-centred concept, will evolve in response to society's demands. Thus, the proposals in Section 5 are not an end product, but rather an iteration of an ongoing process. We suggest the first step in the development of

2 See definition of 'assessment' on page 95.

a C&I set is a thorough review of the conceptual framework including information presented in Section 5. Such a review should consider the objectives selected as well as recent developments in the debate on sustainability and modify the conceptual framework and methods if necessary.

2.2 – A COMMON STARTING POINT FOR THE ORGANISATION OF C&I

Based on experience gained during field testing of C&I during the CIFOR project, we suggest that an appropriate set of C&I address issues within the following four categories:

- matters largely outside the influence of the FMU: policy, planning and legal frameworks;
- ecological impacts of the management of forests;[3]
- impacts on the social environment, including economic impacts; and
- C&I related to the production of goods and services; C&I related to financial performance may be included here, if desired.

The CIFOR tests revealed that several C&I were common to all the sites in which testing took place. They are listed in Section 8. These can be used as a starting point for the testing process and provide a guideline for organising the final results.

3 This statement implicitly ignores the effects of external factors (e.g., damaging air pollution, or plans for future industrial or agricultural developments). These external factors cannot be ignored in the overall consideration of sustainable forest management. Nevertheless, in the focus on developing C&I at the FMU level these factors are clearly secondary. In some circumstances, such external factors may play an overriding role and, in those cases, may have to be considered during C&I development.

2.3 – SELECTION OF INITIAL SETS OF C&I

Locally appropriate C&I can be based on existing one or more initial sets of C&I. Initial sets of C&I are available from a number of sources and provide a platform for the development of the final locality/site-specific set of C&I. These should be selected carefully as they have an important influence on the likelihood of successfully developing a viable local set of C&I.

The three main conditions required in selection of the initial sets of C&I for the project are:

- selected sets should represent the global 'state of the art' C&I for the assessment of sustainable forest management at the forest management unit level;
- wherever possible, the most advanced national or regional set of C&I should be included to provide local relevance; and
- selected sets should cover ecological, economic and social aspects of sustainability.

Sources for such C&I include:

- reports of the CIFOR test series;
- certification bodies such as Smart Wood, Woodmark, SGS-Forestry/Qualifor and SCS Inc.;
- other initiatives such as ITW, CSA, Greenpeace, LEI, DDB;
- international organisations and NGOs such as FSC, ITTO, ATO, TCA, WWF, FAO, UNEP; and
- national or ecoregional initiatives (e.g., Helsinki and Montreal Processes).

Some candidate initial sets of C&I are provided in Section 8.

All C&I to date have been designed to test whether management is in accordance with current perceptions of 'best management practices' or 'good forest stewardship'. This is not the same as assessing sustainability, as good forest stewardship is simply a statement of the 'state of the art' *means* with which to reach the goal of sustainable forest management. In some cases (such as FSC and ITTO), the C&I have been developed more as platforms for further development, rather than as field assessment tools. In other cases (such as TCA), not all C&I have been developed for the FMU level. These factors should be taken into consideration when selecting initial C&I sets.

Another important consideration is the total number of C&I in the base sets. While it is desirable to ensure that the base sets cover as many of the possible assessment issues in as many different ways as possible, there are usually very real constraints on resources for the C&I evaluation and development exercises. We suggest that, as a rule of thumb, the base sets should not contain a total of more than 250–300 C&I at the start of testing.

2.4 – SELECTION OF SITES

The sites selected for testing C&I should, as far as possible, typify regional conditions and the management systems in the selected zones. They should represent examples of 'above average' forest management.[4] An important condition for the selection of sites is the willingness of the forest managers at national and local levels to participate and collaborate with the project team. This will also facilitate the identification of generic and site-specific C&I through comparisons of results among different sites. During the first iteration of development of C&I, we suggest that, as far as possible, sites are located in areas designated by national authorities as belonging to *permanent forest estate*. At least for the first iteration, sites with long management histories and good documentation of the forests, their management and the people who are dependent upon the forest should be given preference. Other important considerations are access to the site and mobility, accommodation and work facilities within the site.

Note

The evaluation of C&I should not be confused with an evaluation of the management of the forest units at the selected test sites, as the latter is a completely separate exercise based partly on the results of the former.

Selection of test sites should be based on consultations with the relevant government departments and NGO groups.

4 In theory, an ideal test site should include forest in poor, good and excellent condition so that the proposed C&I could be tested under a wide range of field conditions. In reality, most forest management agencies or businesses will wish to present their best efforts to a group of potentially critical outsiders. This is not as big a problem as it may seem because assessing the sustainability of an apparently well-managed forest is perhaps more difficult than determining that management is poor. Thus, working on a 'good' forest will force the team to look for sensitive indicators.

2.5 – THE EXPERT TEAM AND THE TESTS COORDINATOR

2.5.1 THE TEAM

Selection

Each team should include *at least* one forester, one ecologist and one social scientist. The size of the team may vary between three and six members according to resources available. Our experience indicates that, although three-member teams can carry out effective C&I evaluations, a larger number is more likely to result in a better selection of appropriate C&I. This is true because:

- if one member of a three-person team is not able to contribute for any reason, the team is no longer able to function;
- a five or six-member team has a much better 'critical mass' for discussions; and
- larger teams improve the chances that important disciplinary, institutional or personal outlooks are included.

During the CIFOR series of tests teams typically included three internationally recruited members and two host country nationals. Although the inclusion of international members is not necessary, we suggest that at least one international expert of repute and appropriate expertise be included on the team to provide an external perspective. Sometimes, for example, an outsider will have the freedom to question problems with policies or programmes that local consultants may be reluctant to bring up.

Effort should be made to recruit the best expertise available, both with respect to the discipline and site concerned. As far as possible, gender diversity should be

ensured. It is also important to include differing perspectives on the teams (e.g., academics, consultants, NGOs, government officials). The team should not represent an 'insider' group, overly familiar with each other and holding very similar views. Such a situation detracts from the range of views and the quality of discussions during evaluation of C&I. As a result, opportunities for introducing new and potentially important C&I may be lost.

Team members should:

- be well informed on all developments pertaining to sustainable forest management in their fields, as they will act as the resource person for the team on their subject(s) of specialisation;
- have a good understanding of current debates on evaluation of sustainability and certification;
- be experienced with, and ready to work with, a multidisciplinary team under the coordination of the team leader and the coordinator;
- comply with the procedures set out for the test;
- have a good working knowledge of the local languages; and
- be knowledgeable about forestry conditions in the region in which the FMU is situated.

We suggest that it is important to use different teams at different sites, especially if identification of generic as well as site-specific C&I is an objective.

The Team Leader

The primary tasks of the team leader are to facilitate interdisciplinary teamwork and to compile the final report at the conclusion of the test. We recommend a collegial approach to teamwork, with the team leader primarily making certain that the input of all disciplines and all team members is given equal weight in deliberations and final conclusions. The team leader may also help the coordinator in organisational or administrative matters, to keep things running smoothly.

The team leader is to be selected from the expert team.

The Team Concept[5]

The team must act as a cohesive multidisciplinary unit to evaluate the selected criteria and indicators. To achieve this, team members must:

- maximise exchange of information which will take place both on an informal basis and more formally during designated daily 'debriefing' periods, team discussions and workshops;
- carry out operations both within and outside their areas of specialisation; and
- take an active and creative role in all discussions and workshops.

Results from CIFOR tests suggest that:

- the composition of the teams in terms of experience and expertise is important;
- team leaders should not be overly dominant, but should work to encourage participation and cooperation of all team members;

5 For ideas to improve teamwork, see Section 3.3.5.

- an egalitarian sharing of responsibilities and the willingness to discuss and reach consensus without being overly confrontational are very important;
- a clear understanding of concepts is important;
- a total of at least 20 days, including desk and fieldwork, seems necessary;
- joint review of all the C&I, two to three times during the course of the test, has been shown to be valuable in keeping team members interacting and also sharing their growing understanding of local conditions;
- a clear understanding of the strategy to be used in evaluating C&I greatly increases team effectiveness and must be based on a consensus among team members — one danger is getting caught up in precise definition of terms when what is needed is a broad general consensus at the outset; and
- the most successful teams have adopted a systems analysis approach from the start, recognising that the local FMU and its immediate surroundings form an integrated system, with each component/discipline interrelating with the others.

In addition to the expert teams and project coordinator, other experts may be necessary from time to time. These experts will not evaluate C&I themselves, but will assist expert team members in understanding issues or providing reliable interpretation of situations and trends. They will usually participate in the test workshop as well. Additional support staff to safeguard the logistics of the testing activity may be necessary. We provide an example of the total staff needs which were required for the full-fledged CIFOR testing activities (Table 1).

Table 1. **Examples of staffing needs for a CIFOR C&I test.**

	Indonesia	Côte d'Ivoire	Brazil
Duration of Test (field phase)	34 days	34 days	34 days
Expert Team	5 members: 3 foresters, 1 ecologist, 1 anthropologist	5 members: 2 foresters, 1 ecologist, 2 sociologists	5 members: 3 foresters, 1 ecologist, 1 sociologist
Coordinator	yes	yes	yes
Other Experts	4 1 forester, 1 ecologist, 1 anthropologist, 1 natural resource 1 manager	3 2 foresters, 1 anthropologist	2 1 forester, 1 anthropologist
Other Support Staff	4 1 project assistant, 3 research assistants	3 1 project assistant, 2 research assistants	2 1 project assistant, 1 research assistant
Short-term Staff	Secretaries, field crews, etc.	Secretaries, field crews, etc.	Secretaries, field crews, etc.

2.5.2 THE C&I TESTS COORDINATOR

The coordinator has a key role to play in the testing of C&I. This person could be a specially appointed member of the expert team, but will usually be a staff member of the agency engaged in determining the new set of C&I. In general, the tests coordinator provides the team with background information, ensures that the test process runs smoothly, and receives the final report from the team for further analysis and subsequent action. More specifically, the responsibilities of the coordinator are as follows:

- *Development of planning and methods:* further development/adaptation of this manual for the selected objectives.[6] He/she will plan and be responsible for the execution of the tests but, to avoid bias, will usually not be a member of the test teams.
- *Site selection:* selection of sites in consultation with relevant advisory groups and partner organisations.
- *Selection of team members:* selection of the expert teams in consultation with advisory groups and other relevant persons and institutions.
- *Coordination and facilitation of testing:* coordination of all activities related to the testing of criteria and indicators. He or she will be expected to accompany test teams in the field to ensure correct interpretation of objectives and methods and to facilitate the work of team members. It is important that the coordinator understands the dual role of 'guide' and 'service provider'.
- *Communication, analysis and report writing:* communication of the status and results of the C&I development activities to team members, workshop participants, the agency desiring the C&I development, and subsequently to other interested parties.

6 Objectives may change, for example, if the purpose of the tests is modified to create C&I sets for forests managed for NTFPs, community-managed forests, or for C&I at national or regional levels. Such changes in objectives might require changes in the methods used.

- *Collaboration with partner organisations:* conduct testing in a collaborative manner with all relevant partner organisations. This will require considerable interpersonal skills.

2.5.3 BRIEFING THE TEAM

Developing a Briefing Document

In order not to overburden the expert teams with unnecessary information, a concise 'briefing document' should be developed to guide them through the evaluation process. This briefing document is normally prepared by the C&I tests coordinator in cooperation with the agency desiring the new C&I.

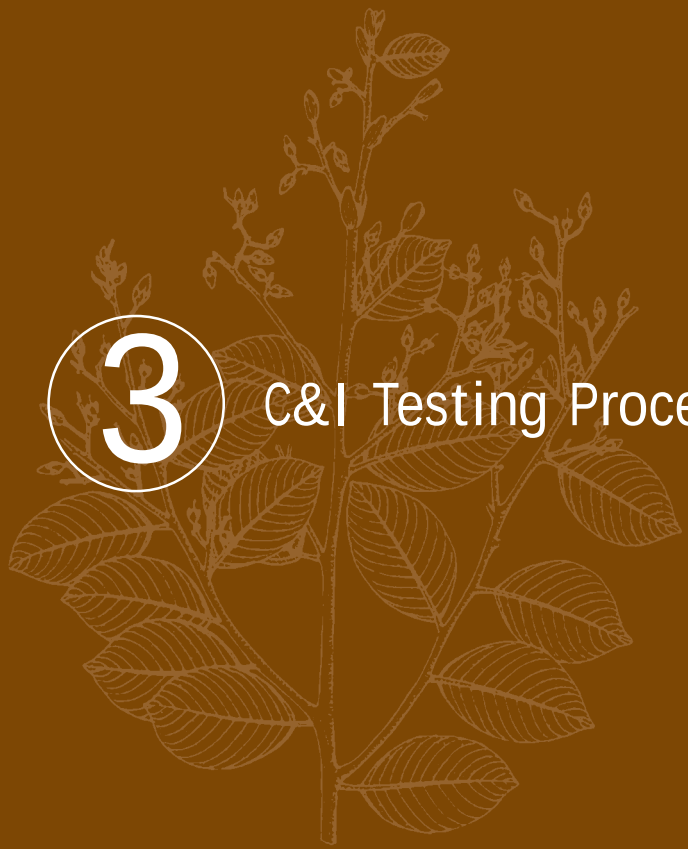
This document should:

- present a clear description of the objectives, methods and process of testing C&I at a field site;
- contain all the C&I in the initial sets for evaluation;
- provide information on the site itself;
- contain the most relevant excerpts of the management plan, production, income and input statistics, pertinent vegetation and ecological information, demographic information on the people living in or around the FMU and maps of the area (in Annexes); and
- be sent to the expert teams at least three weeks before a test, so that they are familiar with the test site.

A Briefing Workshop

If possible, a short preliminary workshop should be held to introduce the team members to each other and to the C&I testing and development process. This workshop should be held prior to having the team completing

Form 1 (see next section). If this is not possible, then the tests coordinator should ensure that the team members are sufficiently familiar with the overall process and that this process is reviewed at the start of the field testing phase.



3 C&I Testing Procedures

3.1 – OVERVIEW OF METHODS

Field testing of C&I involves three phases, conceived as three separate filters (Figure 2). It is important to note that this is not simply a mechanical sifting process. It explicitly allows creative inputs and modifications to criteria and indicators, provided these are also subjected to the evaluation process.

- *Filter No. 1: Pre-fieldwork phase based on use of 'Form 1'*: During this first filter, experts will separately evaluate criteria and indicators, using 'Form 1' as their principal tool (see Section 3.2 for a description of Form 1 and its use). This is essentially a desk exercise to carry out a preliminary evaluation of all C&I in the initial sets selected. Towards the end of this phase, expert team members will meet for the first time to organise and classify the results of their C&I evaluations from Form 1.

- *Filter No. 2: Fieldwork phase based on use of 'Form 2'*: After completion of the first filtering of candidate C&I (Filter 1), activities turn to a phase of interdisciplinary teamwork at and near the FMU. Intellectually, this phase represents a cyclic repetition of inductive and deductive approaches, as team members apply their existing knowledge to the C&I, then test their conclusions against field realities and their colleagues' views, returning to re-evaluate the C&I with their now-improved knowledge, in an iterative process.

  Team members fill out assessment forms regarding each selected C&I (Form 2) and exchange information and views with representatives of other disciplines. A description of Form 2 with examples of how it is used is provided in Section 3.3 (see Annex 8.2). One of the main tools for evaluation is the set of nine attributes (Section 5.3.1) with which C&I are to be

assessed. As Figure 2 suggests the entire evaluation process is complex with team members calling on 'static resources' (such as 'site data' or 'expert knowledge' in Figure 2) to support a dynamic process to examine, test and revise potential C&I. The entire process is iterative, with the principal constraint being time. A final check of the conclusions of team members takes place at the closing workshop.

- *Filter No. 3: Post-fieldwork phase — workshop:* Following the field testing and modification of candidate C&I (Filter No. 2) the process turns to a discussion/modification phase (Filter No. 3) where team members discuss proposed C&I with other participants (see Section 3.4) The new participants at this closing workshop are drawn from different institutional and disciplinary backgrounds, but are all characterised by their knowledge and interest in sustainable forest management. These workshops should last about three days.

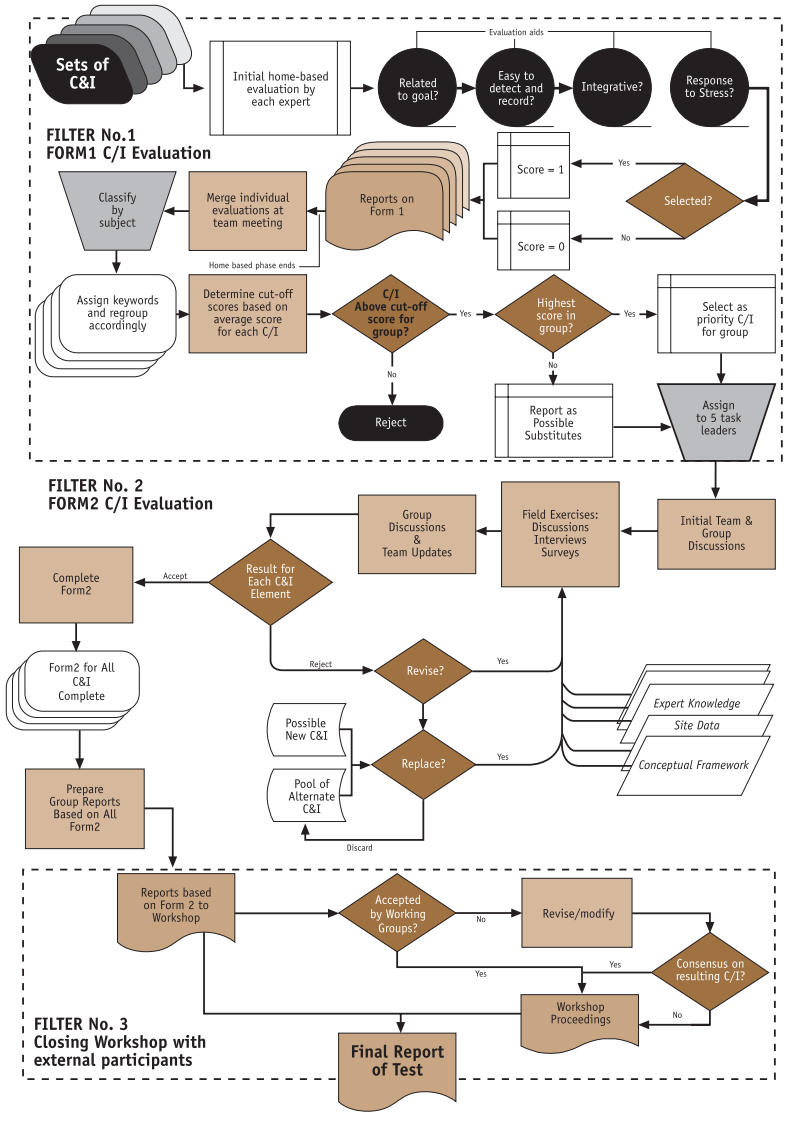
  During the workshop, discussions take place in working groups which have the mandate to review the proposals made by the team concerned. This serves two purposes. It provides peer review to the team members' work and also, because the frame-of-reference of workshop participants is usually broader in scope than the selected FMU, the workshop provides a first view of the wider applicability of the C&I proposed by the teams.

  Finally, team members will summarise their experiences and conclusions in reports, taking into account the recommendations of the workshops. These results are then passed on to the coordinator, to be examined and evaluated, both qualitatively and quantitatively.

  Follow-up activities after the workshop will depend on the needs of the initiating organisation. Presumably most organi-

Figure 2. **Flowchart of methods used to evaluate C&I during each test.**

Explanation of the processes are explained in the text.



sations will wish to put the new set of C&I into a form that is useable by assessors for the identified forests. Other follow-up actions might be to provide the C&I to interested donors, national governments or special projects.

In Table 2 (Section 3.2), we present a typical timeline for the activities related to field testing of C&I at any one site of the CIFOR test series.

3.2 – PRE-FIELD EVALUATION OF C&I: FILTER NO. 1

3.2.1 PURPOSE OF FILTER NO. 1

Filter No. 1 provides a *preliminary* evaluation of all C&I to determine those most appropriate for assessing forest sustainability, based on best professional judgement. This first examination of candidate C&I should concentrate on eliminating only the obviously deficient C&I. The results of this evaluation will subsequently be discussed with other team members when the team meets for the first time (see Table 2). During this first meeting, the team will determine the C&I subset to be considered 'priority', meriting further and more detailed evaluation.

Filter No. 1 uses Form 1 to evaluate all C&I. Completion of Form 1 takes place during the preparation period at each expert's home base. All Form 1 results are reviewed and compared at the start of field testing of the C&I at the FMU under consideration. There the expert team, working together, will use the individual evaluations on Form 1 to develop a subset of C&I (see Figure 2 and Table 2). This subset will represent the experts' joint view of the most important C&I for assessing sustainable forest management at the site under consideration. Data from Form 1 are the basis of the starting set of C&I for the site *prior to* any actual field testing.

3.2.2 INTRODUCTION TO FORM 1

Form 1 uses the following five questions to focus on important attributes of criteria and indicators and to enable the elimination of those obviously deficient (see Section 5.3.1 for a more complete discussion of the first four attributes.)

1. *Closely and unambiguously related to the assessment goal?* Directly/obviously/intuitively/logically linked to criterion or to sustainability.

Table 2. **Schedule of activities during a field test.**

Note that times are presented in terms of the final day 'F' which is day 65 of the test. We recommend about 65 days. However, it is possible, but not advisable, to carry out the tests within a 20-day period under ideal conditions.

Phase	Activity	Timeline	Remarks
Filter No. 1	Briefing book to team members	Commencement date: Final date ('F') - 65 days	Briefing book contains methods TOR and forms.
	First briefing of team members by project staff	Approx. F - 50 days	
	Home-based evaluation of C&I in base sets	Approx. F - 35 days	Objective: mark C&I for selection or rejection.
	Arrival of team members at assembly point	F - 30 days	
	Comparison and collation of results from Form 1	F - 29 to F -28	
	Assignment of C&I to each task leader	F - 27	
	Grouping of C&I according to keywords, identification of overlaps, determination of cut-off scores and selection of 'priority' C&I	F - 27 to F - 26	By this stage, about 25% of the original 1100 C&I had been rejected, about 10% selected as 'priority' and the rest retained as 'substitutes' (see Fig. 2).
Filter No. 2	1. Entry of C&I on Form 2. 2. Meeting with policy makers, regulatory institutions and policy "influencers'	F - 25 to F - 22	These discussions usually take place in the national and relevant state, province or district capitals. This is extremely important in order to clarify the frame-of-reference for management and establish interdisciplinary cooperation.
	Field evaluations at the FMU	F - 21 to F - 7	It is during this phase of the testing that the C&I undergo the most qualitative changes, although their number may not change very much
	Formal team discussions of C/I	Every third to fourth day during F - 21 to F - 7	Participation is not restricted only to expert and project team members. Forest managers and other stakeholders are invited to participate in small numbers.
	Compilation of results based on Form 2 evaluations	F - 6 to F - 4	Preparation for Closing Workshop. Only team and project members.
Filter No. 3	Closing workshop	F - 3 to F - 1	This is the final phase of each test and the single most important review to which the C&I are subjected. Modifications and rejections are permitted.
	Review of test, completion of reports	F (Final day)	Only team and project members.
	Departure of team	F + 1	
	Preparation of final report	F + 15 to 30	By team leader only.

2. *Easy to detect, record and interpret?* Easy to get the information, straightforward?

3. *Provides 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?

These, plus other considerations given below, lead to the fifth question:

5. *Is this item important and therefore selected as 'priority'?* Is it useful? Is it worth further investigation during the field phase?

It is important to note that a criterion or indicator does not have to have high scores on questions 1–4 to be selected as a 'priority' C&I (Question 5). For example, principles and criteria will often have relatively low scores on Question 2, compared to indicators and verifiers. Therefore, the final selection cannot simply be based on the average of Questions 1–4. There is always an additional element of expert judgement necessary.

The following points will be useful in guiding the final decision for Question 5:

- Are the criteria and indicators are to be evaluated in the context of conditions in the FMU or country in question?
- Is this criterion/indicator important for the assessment of sustainability?
- What is the moving spirit behind the criterion or indicator? Is this being respected during the evaluation?
- Is there a better way of expressing the criterion or indicator?

- Be prepared to formulate new criteria and indicators where deficits have been recognised.
- Is it possible to suggest upper or lower limits for the criterion or indicator concerned?
- Give preference to simply measured, easily understood criteria and indicators.
- Keep in mind the need to identify a minimum set of criteria and indicators.
- Seek a small number of integrative rather than many detailed, dissective criteria and indicators.

3.2.3 USING FORM 1

In order to facilitate analysis and save time, we suggest that data for Form 1 (Table 3) be recorded directly into a computer retrievable format. During the CIFOR tests, we found a Microsoft Excel spreadsheet to be perfectly suitable.

Form 1 instructions:

Column 1 — Source: Enter the source of the C&I (e.g., Smart Wood, CIFOR Côte d'Ivoire Test, FSC) It is useful to define simple codes for each of the base sets selected.

Column 2 — No. of C/I as printed in source document: Usually all C&I in the base sets will be coded or numbered. This number should be entered to enable re-identification at a later time. It is strongly suggested that the tests coordinator develop a numbering system for those initial sets of C&I that do not already have one.

Column 3 — Class: When evaluating the C&I, the expert should classify (reclassify) C&I in the source document according to the following five categories and using the appropriate class codes shown here:

P: Policy, planning and legal frameworks

S: Social impacts

M: Forestry practices, production of goods and services

E: Ecological impacts

F: Financial and economic aspects

The purpose of this coded classification is to facilitate sorting the C&I into these classes during the process of selecting 'priority' C&I.

Columns 4–7: Please use a scale of 1–5 in responding to these columns where:

1 = poor 2 = fair 3 = satisfactory

4 = good 5 = very good

Column 8 — Important and, therefore, selected as 'priority': When responding in this column experts should evaluate the responses made in the previous four columns, consider the guidelines given above and the purpose of Filter No. 1. Answers in column 8 should be either:

0 = not accepted for further evaluation

1 = accepted for further evaluation

Table 3. **Form 1**

Form 1: Evaluation of all criteria and indicators							
Source	No. of C/I as printed in source document	Class	Closely and unambiguously related to the assessment goal?	Easy to detect, record and interpret?	Provides a summary or integrative measure?	Adequate response range to changes in levels of stress?	Important and therefore selected as 'priority'? Yes = 1 No = 0
1	2	3	4	5	6	7	8

3.2.4 TABULATION AND ANALYSIS OF RESULTS

Once all C&I in all the selected base sets have been evaluated by all experts, a first meeting of the team will take place under the guidance of the coordinator. During this 1–2 day meeting, Form 1 results will be tabulated and analysed. The steps in this process are listed below.

- Responses of all experts concerned are tabulated on one Excel spread sheet.
- The first two columns in Form 1 will be used to match responses of the expert.
- The averages of Column 8 ('Selected') will be calculated for all rows in the new comprehensive table. This column may be called 'Avg. Selection'.
- At this point the table should be subjected to a sort command using the following sort keys: (1) Column 3, (2) Column 1, (3) Column 2.

- Inconsistencies in the classification of the C&I into the five categories for Column 3 should be resolved at this point.
- A second sort is carried out using the following keys: (1) Column 3, (2) 'Avg. Selection' (descending order), (3) Column 1, (4) Column 2.
- As a result of step 6, the table should now be divided into five sections based on the class (P, M, E, S and F), with the results in 'Avg. Selection' in descending order.
- The five sections are to be divided among the experts appropriate to their disciplinary backgrounds.
- The experts will analyse these sections to determine a cut-off point, below which the C&I will not be accepted for further evaluation.
- Experts now assign keywords to describe the content of each C&I in the section allocated to them.
- The keywords are used to create groups (and subgroups) of similar C&I within each class.
- Using the scores in the column 'Avg. Selection', the experts select the best representatives in each group/subgroup as a 'priority' C&I for further field testing. The remaining C&I in that group/subgroup are also retained as 'substitute' C&I, provided they are above the cut-off point determined previously.
- The experts present their selections to the rest of the team and the coordinator for discussion.
- Following this discussion final lists of C&I for field testing are drawn up and organised along the lines suggested in Section 2.2.

- The C&I in these lists are allocated to the expert team members according to discipline and workload. Experience shows that an expert can handle a maximum of about 50 C&I during the field phase.
- Experts enter the C&I allocated to them on Form 2 (see Section 3.3.4).

3.2.5 PREPARATION FOR FIELD TESTING

The field phase of a C&I testing exercise requires advance planning of logistics, meetings and flow of information. Accommodation and transport must be arranged in advance. All appropriate parties must also receive advance information about the purpose of the expert team's visit, their information and material needs and a schedule of activities involving third parties. It is also useful to provide advance notice to organisers if translators and other local support staff are needed. If the FMU is in a remote location, there will be need to ensure that adequate writing materials and appropriate work space and facilities are available.

3.3 – FIELD TESTING OF C&I: FILTER NO. 2

3.3.1 PURPOSE OF FILTER NO. 2

Filter No. 2 is the key evaluation exercise which leads to a minimum set of C&I. The experts filter out all redundant C&I, modify existing ones where necessary to make them more relevant or applicable, and propose new C&I to fill gaps identified during fieldwork.

3.3.2 FILTER NO. 2 PROCESS

At the end of Filter No. 1, the team will have divided responsibilities according to areas of specialisation and experience of team members, leaving each with a subset of criteria and indicators for which he/she will lead a detailed evaluation.

Expert team members will be expected to carry out most of their activities in (rotating) pairs so that cross-disciplinary interactions can be maximised. Except for internal group discussions and exceptional cases, the panel should *not* carry out its Filter No. 2 activities as a single group.

The Filter No. 2 process consists of the following steps:

Initial Team Discussion. The aim of this is to make the methodology of the test clear to all team members. A schedule of operations for the field phase is also decided, after the key locations for C&I evaluation have been identified. Scheduling will be carried out in such a way as to ensure that team members will work together in changing interdisciplinary pairs.

Field exercises. The subsequent investigations will be carried out in a flexible and innovative manner, which will include, for example, the use of small interdisciplinary task-oriented

teams. The purpose of the field exercise is *to test the viability of the selected criteria and indicators*. Form 2 will be used as a basis for this evaluation, however, the consultants are encouraged to develop additional evaluation methods and materials as needed.

In order to be able to test a criterion or indicator and report the results on Form 2, expert panel members will have:

- carried out group discussions with key stakeholders/ forest actors;
- individual interviews with key persons (e.g., with loggers or farmers);
- conducted field surveys (e.g., of logging sites, road conditions, boundaries, regeneration); and
- carried out bibliographic research wherever possible.

For the purpose of these investigations, experts should be encouraged to bring with them reference literature important to their areas of specialisation.

Team discussions. Interspersed with the field exercises are regular team discussions during which team members are expected to: report their progress in evaluating C&I and discuss and defend changes or additions they have suggested. These discussions will provide a basis for the reports to be presented by each expert at the closing workshop.

3.3.3 INTRODUCTION TO FORM 2

Form 2 has been designed to record field assessments of C&I selected for more intensive evaluation after Filter No. 1. It has also been designed to provide guid-

ance on how to carry out this evaluation. An example of Form 2 is provided in Annex 8.2. Please consult it when reading the following steps.

- Once a list of 'priority' criteria and indicators has been agreed upon (based on an analysis of Form 1), each of these criteria and indicators will be entered on its own separate Form 2 (in Box A).
- Each Form 2 will be allocated to one panel member in accordance with the member's areas of expertise.
- Panel members will, from this point on, be responsible for the evaluation of the set of criteria and indicators assigned to them. They will use Form 2 to record their observations and evaluations (pages 1–3).
- Page 4 of the Form 2 has been reserved mainly for evaluation by the other team members (Boxes J–O) and the Workshop (Box P).

By using Form 2, the entire test is broken down into a series of 'tasks' for the expert team and the support group.

In addition to the assessment of C&I based on his/her disciplinary background and experience, each expert will evaluate all 'priority' C&I on those points that cut across disciplinary boundaries. The purpose of this is to maximise interaction between team members and to enhance opportunities for additional points of view to be incorporated into the assessment process.

3.3.4 USING FORM 2

These notes provide information needed to fill in Form 2:

The first six unnumbered boxes on Form 2 (Annex 8.2)identify:

- which panel member is primarily responsible for the evaluation of the criterion or indicator ('Expert's Initials');
- the C&I set from which it originated ('Source');
- the C&I number or reference as recorded in the *source* document (Identification No. in source);
- the subject matter ('Class'): P, S, M, E or F;
- whether, after completion of the field phase, it was recommended or not ('Recommendation'); and
- the final identification number as listed in the workshop document ('Final Identification No.').

Part A	Enter the original text of the 'priority' criterion or indicator. Please refer to relevant forms of all team members, before effecting this selection.
Part B	Justify selection of the priority criterion or indicator concerned, giving the main arguments.
Part C	**Attributes** The expert's view regarding the following attributes provides a key input for determining the utility of a particular C&I. Each of these attributes will be ranked on a scale of 1 to 5 where 1 means no, bad or unimportant; and 5 means yes, good or important. Note that two entry boxes have been provided for each attribute in this part of the form (and for questions in subsequent parts). The first box (d) refers to the original criterion or indicator as listed in Part A, which is the initial selection. If the initial C&I selection is later mod- …

... ified, this will be recorded in Part F. This final version must then be subjected to a renewed evaluation recorded in box (o). By comparing evaluations (d) and (o) the reader can assess differences between the initial and revised version.

The attributes to be scored in **Part C** are:

- **Does it provide a summary or integrative measure?** Does it summarise or integrate a lot of useful information? Is it information efficient?
- **Is it closely and unambiguously related to the assessment goal?**
- **Does it adequately respond to a range of stresses?** Is it sensitive to changes in the environment or the system? Does it provide meaningful information about these changes?
- **Is it diagnostically specific?** Does the indicator (or criterion) tell us something about the criterion it relates to? Or is it more general, relating perhaps to more than one criterion or area? A high score here indicates that the item is diagnostically specific.
- **Is it appealing to users?** Would a potential user feel predisposed to use it? Is it cost-effective?
- **Is it easy to detect, measure, record and interpret?** How feasible is the criterion/indicator?
- **Can it be precisely defined?** Is the meaning clear? Would two different people understand it the same way? (Test this on your fellow panel members.)
- **Will it produce replicable results?** Is it reliable and repeatable? How robust are predictions based on this indicator or criterion?
- **How relevant is this criterion or indicator?** Your opinion on the relevance of this criterion or indicator to sustainability.
- **Other attributes**: For example, is an absolute or a relative measure better?

Part D	Give bibliographic references to provide additional weight to the justification, if possible.
Part E	Give the references, wherever possible, of similar criteria and indicators from the other sets of C&I.
Part F	If the criterion or indicator selected in Part A has undergone changes in its definition, the final version should be recorded here. It is assumed that justification for these changes has been recorded on pages 2 and 3 of Form 2.
Part G	Record additional notes in this space. If a criterion or indicator is rejected, please provide the reasons here.
Part H	If this C&I were to be later used in an actual assessment of forest management, would the assessment need to made in the field, or could it be made in the office, or would both be necessary?
Part I	What kind of documents (or means of verification, e.g., field inspection) would an assessor need in order to evaluate forest management using this C&I?
Part J	A diary of the principal actions carried out to evaluate the criterion or indicator should be maintained and recorded here. This will help justify reasons for selection, modification or rejection at the workshop and during the following analysis phase. Additional pages may be added, if desired.

Part K

In this part, the responsible task leader will determine whether the criterion or indicator belongs to the category of 'human inputs' (e.g., capital, labour) or 'human processes' (as opposed to natural processes) such as the various planning processes or whether it is an 'outcome' of either of the first two categories in the biophysical or social systems.

The difference between a human input and a human process is often a very fine one. An indicator such as 'Annual, five-year and twenty-year management plans exist' would be an input resulting from the process 'Management is based on appropriate planning horizons...'. Inputs are generally easier to record, predict and interpret. Processes, on the other hand, are often more revealing of the commitment of management to achieving its goals.

Part L

This part provides a classification of criteria and indicators according to whether they refer to a 'stress' on the system (biophysical, social or management), describe its 'state' or describe how the system 'responds' to stress. This classification provides an effective way of looking at causes and effects. Determining if a criteria or indicator adequately captures information about major sources of stress, and a system's responses to these, is an important factor in objectively judging the overall effectiveness and reliability of that criterion or indicator.

Part M

This part records possible linkages to other areas, such as between ecological and social C&I. Criteria and indicators constitute a network or web to capture information. Parts A through L have attempted to examine whether the right strands have been woven into this web, and whether the mesh is the right size to capture the information we need. In part M, we are looking for linkages between criteria and indicators, to ensure that the same or similar information is not collected twice and to ascertain whether the necessary feedback loops exist between criteria and indicators. Examples of important feedback loops in forestry are between regeneration and growth on the one hand and silvicultural prescriptions and cutting cycles on the other. An effective system of criteria and indicators needs to reflect such information loops.

Part N The workshop notes section will be used by each team member to record the most important conclusions of the workshop on the criterion or indicator.

3.3.5 SOME HELPFUL FIELD METHODS

Structuring Team Interactions

Interdisciplinary cooperation does not 'just happen'. During the CIFOR C&I test series, the following four techniques were used to encourage effective cooperation among team members.

- *Explicit training*. Such training can include presentations which focus on the importance of interdisciplinary cooperation, the different strengths offered by different disciplines, and practical dos and don'ts for team members to keep in mind (see below under 'Improving Interdisciplinary Communication').
- *Pairing of different disciplines*. Although success in this endeavour will vary from time to time and from team to team, a concerted effort must be made to persuade team members to rotate their partners for each day's work among the various disciplines. This allows team members to have sufficient exposure to the potentially useful ideas and perceptions of others.
- *Leadership Example*. The coordinator and support team must establish excellent interdisciplinary cooperation and communication amongst themselves. Team members exposed to this regularly are likely to follow by example. This involves supporting each other, with appropriate recognition of the differing strengths represented in the respective disciplines.

- *Togetherness*. The teams should be kept together every day. In all CIFOR tests, they lived in the same lodging, ate the same food and looked at the same forest management unit, over the one-month period. This kind of continual exposure, in a context encouraging interdisciplinary communication, also functioned to encourage cooperation and sharing of perspectives.

It is important that the team should meet often as a group to discuss progress on evaluating C&I. During the CIFOR tests, these meetings took place every 3–4 days. Usually such meetings take half a day as the topics for discussion were very wide ranging. Meetings held early in the testing process are frequently taken up with discussion of the concepts of principles, criteria, indicators and verifiers rather than with evaluation of C&I which dominate discussion of meetings later in the process. Most team meetings reveal conflicting conceptual approaches to evaluating C&I, especially between social and biophysical scientists. It is important that the chairperson guides these meetings so that frustrations may be vented, but do not derail the process. During the CIFOR tests, such team meetings were often instrumental in bringing about significant improvements in C&I. Therefore, these meetings are potentially a very useful tool, but must be used with proper caution. Otherwise, interpersonal conflict can lead to unnecessary stress.

Improving Interdisciplinary Communication

Effective interdisciplinary communication is absolutely essential for the C&I test method to work. We have found four attitudes important in improving communication:

- a willingness to make reasonable compromises to accommodate the needs of other team members;
- a sincere interest in learning about other fields;

- genuine respect for your team members and acknowledgement of the relevance of their expertise; and
- significant agreement among team members about goals.

In addition to these, we developed a short list of dos and don'ts that we have found helpful.

DO:

- Identify your co-workers' *strengths*. Concentrate on what people *can* do, not what they *can't* do.
- If you don't understand something, assume your own *ignorance*, rather than the *stupidity* of your colleague. (For example, different disciplines might use the same word differently, or have different ways of thinking about problems.)
- Make criticisms in a gentle, polite and *constructive* way, so that team members will feel comfortable exposing their own ignorance and being corrected.
- Share findings and approach freely and be generous giving credit to your co-workers for their contributions.
- Be *patient* and, if necessary, *forgiving*, particularly in field situations, where people may be under unusual stress.

DON'T:

- Make snide remarks about other *paradigms* for doing research. A variety of concepts is needed in this context.
- Don't compete with other team members. It's almost always counterproductive and wastes valuable time.

Data Collection and Evaluation of C&I

Field evaluation of C&I does not necessarily entail collection of any primary data. However, during the CIFOR C&I test series most experts collected some primary or secondary data in order to clarify their thinking on particular C&I. Because the disciplines involved were very different, the types of data collected were also very different. Thus, it is difficult to provide any hard and fast rules on what data to collect.

Apart from interviews, questionnaires and discussions, tools that were used by experts during the CIFOR test series to provide additional means of evaluating C&I included:

- physical surveys of damage caused by harvesting (e.g., erosion, skidding roads, gap sizes, stream crossings, ponding);
- secondary data collection at base camp manager's office, local government offices, local hospitals, etc.;
- regeneration surveys in large gaps, log landings, felling gaps, primary forest, secondary forest etc.;
- survey of road networks, coupe boundaries, silvicultural rehabilitation areas, plantations etc.;
- spot checks of compliance with management plan, management guidelines etc.; and
- survey of ecological transects or gradients, sampling at permanent sample plots, etc.

In principle, any survey methods that help the expert concerned come closer to reaching a conclusion on the quality and utility of a particular C&I are permissible. An adequate explanation of the methods used to deter-

mine the value of a particular C&I should be documented on Form 2 for future reference.

Identifying Stakeholders and Forest Actors

Stakeholders can be defined as anyone having an interest in the forest.[7] Clearly, expecting a logging enterprise to address all the concerns of all these people (from locals to international consumers) is not realistic. Nor is there much clarification within the existing sets of C&I on this issue.

We, therefore, developed the following simple method for separating the most important 'forest actors' from the broader category of 'stakeholders' or individuals with an interest in the forest.[8] CIFOR teams identified the stakeholders qualitatively and found this process fairly straightforward. A typical list of stakeholders includes national citizens, consumers, forest officials, small-scale entrepreneurs and forest workers. In each of our test sites, we have also identified groups specific to that location. For instance, in the Kiani Lestari timber concession in East Kalimantan, we identified Dayaks, Kutai (two indigenous groups) and transmigrants (in-migrants from other islands) as additional stakeholders. In Côte d'Ivoire, we identified the Agni (*Autochtones*, or the indigenous ethnic group), the *Allochtones* (Ivoireans from other areas in Côte d'Ivoire) and the *Allogens* (typically refugees from other countries). For further information on these methods, please refer to C&I Toolbox Series Nos. 5–8.

After identifying the stakeholders, team members assess each stakeholder group with a simple 1 (high) to 3 (low) score, on the following six dimensions.

7 The material presented here is provided in Colfer (1995) in an expanded form.

8 For the purposes described in this document, we define 'forest actors' as that subset of 'stakeholders' who are most important to forest management

- *Proximity to the forest*. People living in or near the forest have a greater opportunity to affect the forest and be affected by it. The exact meaning of proximity will, of course, vary with location, depending on the quality of transportation and infrastructure.

- *Pre-existing rights*. In many commercial forest areas, there may be conflicting paradigms of what land ownership and use should mean. Sometimes, communities that have occupied a given area for a long time have had their traditional rights usurped or severely compromised in recent times. Both justice and pragmatism suggest that these claims need to be respected.

- *Dependency*. Some stakeholders depend on the forest for their very livelihoods. They may hunt, fish, gather foods, medicines, fibres, timber and/or practise agroforestry. The resource base for people's microeconomic system has important implications for human well-being and, in turn, for the forests.

- *Local knowledge*. Those who have lived in forested areas often have unique and useful knowledge, based on long-term, local experience, that can be used to improve forest management and grant people a voice in their future.

- *Forest/culture integration*. Cultures, or ways of life, tend to be intimately linked to their environments; forest communities are no exception. There may be sacred sites within the forest, symbolic systems that give meaning to life and are intimately tied to people's sense of self, security functions of forest plants during times of scarcity and myriad other connections.

- *Power deficits*. People who live in and around the forest often have comparatively little power *vis-à-vis* other stakeholders. Where such a power deficit does exist, it may adversely affect

both the people and the forest, since the people will not have the means to protect their resources.

Once each stakeholder has been assessed on each dimension, the scores can be averaged, giving a single score for each stakeholder. We have concluded that those stakeholders receiving a score of 2 or less seem to be those deserving particular attention in commercial forest management. Those stakeholders were identified as 'forest actors'.

Basic Interviewing Guidelines

Interviews form the basis for much of the data collected by the teams assessing C&I. Given this, the social scientist on the team has a special responsibility to help the other team members with interviewing skills. Since the team is operating as a unit, there is the potential for the unskilled interviewing behaviour of one team member to adversely affect the work of others.

Following are some guidelines, which should be supplemented by the team social scientist.

- *Establish rapport* with the respondent by explaining why you are there and what you want from him/her.
- Be sensitive to the *conditions of the interview*. Different information will arise depending on such factors as time of day and location, and whether the interviews are individual or group, single or mixed sex/ethnic group/age, etc.
- Try to get a broad *spectrum of respondents* (high and low status and wealth, various ethnic groups, ages, occupations, genders).
- Make your *respect* for them and their opinions obvious (this might entail sitting on the floor, eating their food, following

their lead from time to time). People are much more forthcoming if they feel your respect and appreciation.

- Ask *open-ended questions* in a manner that does not reveal your own views. Avoid 'leading questions' (that is, questions in which the preferred response or opinion of the interviewer is obvious). Avoid questions with 'yes-no' answers. Instead, ask people to recount how something happened, or to *tell* about something.
- Interviews typically require respondents to *recall events and perceptions*. Use events like droughts, elections, children's birthdays, etc. to stimulate memories and assign dates. If you need historical information, it is usually easier to begin with the present and go backwards. You can triangulate to check perceptions.
- Protect the *confidentiality* of what they tell you (by disguising sensitive material, using pseudonyms, altering irrelevant details to protect individuals or communities, as needed).
- Offer to *answer their questions* to you. Make your dependence on their input obvious and thank them for their valuable help.

3.3.6 THE NEED TO COMBINE TOP-DOWN AND BOTTOM-UP APPROACHES

During the field exercise, it is essential to emphasise the need for *both* top-down and bottom-up sources of information. The purpose of the conceptual framework (see Section 5) is to facilitate development of a system to assess sustainable forest management. One important question is where to begin this development: at the top or at the bottom? The answer is both.

The CIFOR project has taken the view that a sustainability assessment system must be *conceptualised* from the top-down, i.e., it is important first to define the principles before moving on to the level of criteria and indicators. The principles are defined on the basis of wisdom and knowledge. This ensures that there is a proper focus to the assessment system. In the related field of ecological risk assessment, Gentile and Slimak (1992) also suggest that the approach should be top-down. The first step, according to them, is to define the highest ecologically valued target and then move downwards to identify a suitable suite of ecological endpoints and indicators. The advantage of proceeding in this fashion is that it ensures, conceptually and scientifically, that environmental values are integrated with the selection of ecological endpoints and indicators.

CIFOR teams involved in the several test series followed this same process. The CIFOR approach uses the knowledge, experience and judgement of experts, together with the conceptual framework outlined in Section 5, to work out the broad intellectual outline of the critical issues for the subject area concerned. An important aid to the top-down process was the use of existing frameworks for sustainable forest management (e.g., principles and guidelines of the FSC, ITTO criteria and indicators) as a development platform.

However, after arriving at the basic principles and criteria in this fashion, it is necessary to reverse the process and to approach the same question from the *bottom-up*.

In principle, the CIFOR experts first began thinking about the bottom up application of C&I

The objective of the bottom-up process is to ensure that information, especially from the field, is not lost; the objective of the top-down process is to ensure that the right conceptual information is retained.

when they considered the 1100 criteria and indicators in the five initial C&I sets provided. Although the first phase of the process (Filter No. 1) does not involve actual fieldwork, the experts drew on their previous field experience in the current or similar areas to start the bottom-up process.

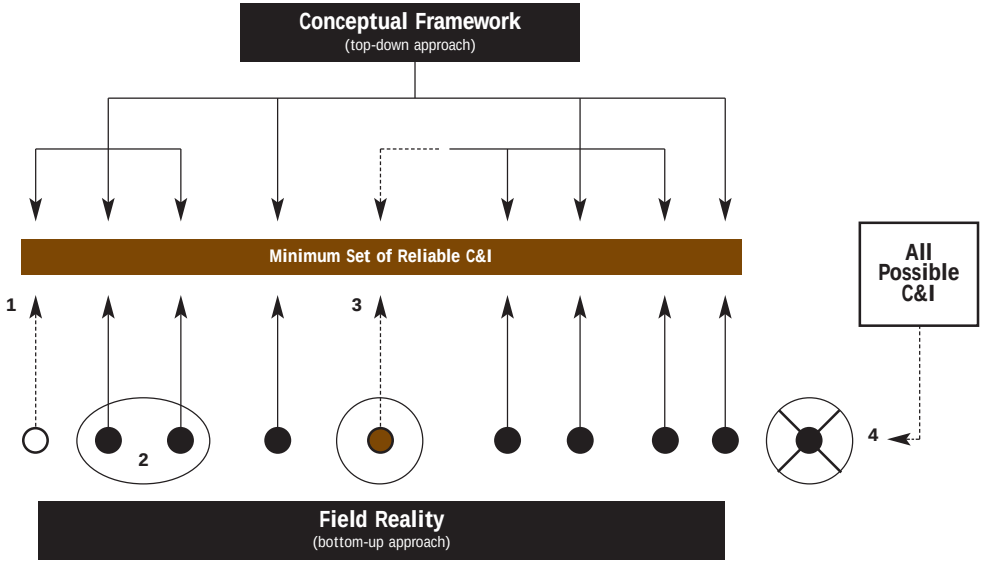
At this point the 1100 C&I could be considered simply as possible elements in a sustainability assessment tool-box. These elements were pre-filtered based on the experts' prior experience and those expected to be most useful were fitted into the logical framework of principles, criteria and indicators.

During the next step, data and information from the field sites were added. This was then the basis from which a bottom-up analysis towards the levels of criteria and principles was undertaken. The minimum set of reliable C&I was then identified through a comparison of the top-down and the bottom-up processes in the minds of the expert teams. Mengin-Lecreulx *et al*. (1995) have depicted this process as similar to that shown in Figure 3. This process was used not only by the field teams, but also in our articulation of the conceptual framework for social sustainability (Colfer *et al*. 1995).

It is important to understand that the top-down and bottom-up approaches have to be integrated into an oscillating process that ensures iterative improvement of the criteria, indicators and verifiers. This is essentially because our current understanding of the underlying processes that drive the interactions between human beings and ecosystems is incomplete. As this understanding improves, so will management standards and practices. This new information must find its way into the process of defining sustainability assessment tools. It is important to recognise that this 'new' information is not just the result of recent efforts; often it is the inclusion of informa-

Figure 3. **Schematic depiction of the 'top-down' and 'bottom-up' processes for evaluating C&I.**

Dendrite represents an outline of the critical issues manifested as principles and criteria. Black dots represent C&I in base sets. Number 1 represents a gap in base sets (a new C/I to be proposed); number 2 represents a match between C&I in the base set and the conceptual framework — C/I selected; number 3 represents a gap in the expert's conceptual framework; and 4 represents C&I outside the limits of the conceptual framework — C/I rejected.



tion that has previously been ignored or undervalued, such as traditional knowledge of local communities. Therefore, in addition to iterations in time, there is a need to iterate these processes spatially as well, in order to sample the wide variation of forest ecosystems, human societies and their demands on the forests.

The process outlined above is central to the evaluation, development and generation of criteria and indicators by expert team members.

3.3.7 PREPARING FOR THE WORKSHOP

Tabulation and Analysis of Results

At the end of the field phase, it will be necessary to tabulate the results in a form that can be readily understood by participants at the following workshop. The most important information contained in these tables are the C&I of the 'minimum, reliable set'. It is important to organise them in such a way that the assessment goal is always very clear. They should be grouped in descending order from principles through to verifiers. In Annex 8.4, we provide examples of how the C&I were presented to workshops during the CIFOR test series.

Short Reports by Each Expert

In preparing for the closing workshop, expert team members should prepare short reports on how they evaluated the criteria and indicators. As mentioned above, there will be differences in approach among the experts due to disciplinary backgrounds, experience and personal preferences. It is, however, very important that the workshop clearly understands the evaluation process that was used in each case. Input

for these reports can, for the most part, be based on notes maintained on Form 2.

The following headings are suggested for this report:

- base sets of C&I: evaluation of their contribution to results;
- methods used to evaluate C&I, including data-collection techniques; and
- proposals for the final set of C&I, including C&I organisation, as well as ranking and ranking methods if possible.

3.4 – WORKSHOP: FILTER NO. 3

3.4.1 PURPOSE OF THE WORKSHOP

With the exception of follow-up analysis and report writing, the final workshop is the last step in the C&I testing procedure. The primary output of the workshop is a clearly defined set of criteria and indicators. The workshop format provides peer review of the team members' work. Because the frame of reference of workshop participants is usually broader than the selected FMU, the workshop also provides a first view of the wider applicability of the C&I proposed by the teams. As part of the workshop, team members summarise their experiences and conclusions in reports, taking into account recommendations of the workshop. These results are then passed on to the tests coordinator, to be examined and evaluated, both qualitatively and quantitatively. The C&I developed are intended to be used by assessors (e.g., national governments, donors, certifiers).

It is extremely important that the workshop concentrate on the discussion of criteria and indicators. Caution should be exercised to avoid having the workshop become a vague discussion of sustainability, certification or similar issues. The output of the workshop has to be a clearly defined set of criteria and indicators. Toward this end, the workshop should focus on:

- field methods used to test the C&I;
- usefulness of the recommended criteria and indicators as evaluation tools;
- cost-effectiveness of the recommended criteria and indicators;

- justification for the selection of the recommended set of criteria and indicators (note that each team member will be expected to provide justification for the criteria and indicators selected by her or him); and
- relative importance (weighting factor) of the selected criteria and indicators.

3.4.2 WORKSHOP, AGENDA, STRUCTURE AND ORGANISATION

Participants at the closing workshops include a number of additional people who should be drawn from a variety of institutional and disciplinary backgrounds. All should be characterised by their knowledge and interest in sustainable forest management. The workshop should last three to five days.

If at all possible, it is desirable to include local people as participants in the workshop. However, in some cases, a significant amount of effort may be required to provide them with the appropriate background to permit their full participation. Nevertheless, it is important that local participants make a true contribution to the workshop and are not just token representatives.

In general, the workshop is organised into discussions by working groups which are given the mandate to review the proposals made by the team concerned. Most of the discussions will take place within these small working groups on the specific subjects assigned. Each working group will be led by a chairperson and will have a rapporteur to record the most important findings. The starting point for the discussions within each group will usually be the results from Filter No. 2 and the processes used in identifying C&I for the subject area concerned. Form 2, will be the primary reference document for these discussions.

Each working group will prepare reports to present in the plenary sessions. A typical workshop agenda and schedule is presented in Table 4.

3.4.3 PLENARY SESSIONS

Plenary sessions of the workshop provide a forum for discussions related to generic issues facing all working groups and provide an introduction to the whole C&I process for non-team members. The purpose of plenary sessions is to:

- introduce and explain the objectives of C&I testing for non-team members;
- provide a frame-of-reference for the testing (i.e., the FMU level with a particular site as focus);
- introduce the site(s) where testing took place;
- introduce the methods used for non-team members;
- clarify important issues (including those raised by participants) before the working group sessions begin.

3.4.4 WORKING GROUP SESSIONS

Working group sessions are more technically oriented than are plenary sessions. A working group should have no more than 15 members. It is important that working group members are given the freedom to query/criticise any C&I proposed by the expert team which is relevant to the mandate of the working group.

The relevant expert team member should be a member of the appropriate working group and wherever necessary provide explanations/clarifications on the C&I concerned and should explain the process by which decisions were reached. However, this should not be viewed as a 'last-ditch' defence, but rather as a validation process.

Table 4. **A suggested agenda for the final workshop**

Day 1	
08:00–08:30	Registration of participants
08:30–09:30	Opening speeches, Introduction
09:30–10:00	Break
10:00–11:00	Review of previous C&I tests
11:00–12:00	Presentation on the use of criteria and indicators, especially respect to certification, followed by discussion
12:00–13:30	Lunch
13:30–15:30	Team Report Methods and process followed to test criteria & indicators Testing management for timber production Testing ecological criteria & indicators Testing criteria related to sustainable production of non-timber goods & services The conceptual framework of the evaluation system
15:30–16:00	Break
16:00–17:30	Discussion of Team Report
17:30	Close
Day 2	
08:30–09:00	Presentation on a topic of general interest
09:00–10:00	Introduction to Working Groups & Methods (plenary)
10:00–10:30	Break
10:30–13:00	First Meeting of Working Groups I. Working Group on Management Criteria & Indicators II. Working Group on Ecological (bio-physical) Criteria & Indicators III. Working Group on Social Criteria & Indicators IV. Working Group on Policy & Planning Criteria & Indicators
13:00–14:00	Lunch
14:00–15:30	First working group session continued
15:30–16:00	Break
16:00–17:30	Reports of Working Groups (plenary)
17:30	Close
Day 3	
08:30–09:00	Presentation on a topic of general interest
09:00–10:00	Plenary to review progress
10:00–10:30	Break
10:30–12:30	Second Meetings of Working Groups I. Working Group continued II. Working Group continued III. Working Group continued IV. Working Group continued
12:30–13:30	Lunch
13:30–15:00	Reports of second working group session (plenary)
15:00–15:30	Break
15:30–17:00	Wrap-up session (plenary)

It is important that the expert introduces himself/herself at the beginning of the working group.

Each working group will have a chairperson and a rapporteur. The chairperson will run the group meeting. The rapporteur will be expected to record working group findings and present these to the plenary sessions of the workshop. It may be necessary, if several languages are used, that notes be taken by several participants.

Normally, an expert team member should not chair working group meetings because they will need to address the technical issues of the sessions. However, it may be useful for the appropriate expert team member to be the rapporteur. The expert team member is usually required to assist in preparing the report of the working group. Both the team members and chairperson will be expected to facilitate dialogue between participants as far as possible.

3.4.5 CONFLICT MANAGEMENT

With a subject like sustainable forest management, conflicts within working groups are to be expected. Experience of the CIFOR tests shows that these conflicts often revolve around contentious issues in the domains of social and ecological C&I. All of them were resolved by interventions of the chairperson. We, therefore, do not believe it would be necessary to hire the services of a professional facilitator. If problems do arise, the chairperson might try to:

- prevent a few individuals from dominating the discussion by specifically asking quiet people for their point of view;
- isolate particularly contentious issues, by saying 'we agree to disagree';

- have an informal timetable for dealing with all the C&I and use that as an excuse to move on, if things get bogged down — differences can be documented in the report; or
- remind the participants of the need to conclude and to prepare a report.

3.4.6 PREPARING THE FINAL REPORT

Based on the results of all three filters, the expert team leader is expected to prepare a final report. The main aim of the final report is to present the C&I proposed by the expert team and explain how these were developed. This report should be prepared within one month following completion of the workshop. The readers of this report will vary depending on who requested the test and why. Typically, the report will be prepared for: forest managers, certifying bodies, projects, governments, donors or academics.

At a minimum the report should consist of:

- an introduction to goals of the test;
- a description of location and important characteristics (human, ecological, forest management);
- a description of method followed;
- the results of the test including the set of proposed C&I; and
- discussion.

4 Follow-up Analysis

4.1 – BEYOND THE WORKSHOP

Following the production of the workshop reports, the expert team leader will prepare the final report which will contain a compilation of the workshop reports and other information arising during the whole test process. After this is submitted, C&I test coordinator will most likely edit that report to produce a final version. At this point, the selected C&I should be available to be used in assessment of the forest site in question.

Although the report represents the end of the C&I field testing process, it is likely that those responsible for organising the test will wish to carry out some follow-up analysis and, in fact, the team leader and coordinator will do some analysis during their report preparation. Basic analysis of C&I, within the context of the CIFOR project, consisted mainly of describing the content of the C&I, reviewing their practical applicability and examining the context in which they were developed.

This kind of analysis can be subjective and requires that the analyst understand the process by which C&I were evaluated. Testing of C&I is a conceptual, stepwise, learning process. Experts, selected for their expertise and personal experience in the region, attempt to apply a selection of C&I in the field. During that exercise they accept, alter or reject the C&I following the collection of qualitative and quantitative information in the field. This is a fairly complex process, and follow-up analysis requires a very detailed understanding.

We feel confident, for example, that bias in our CIFOR group's content analysis of the C&I proposed by various teams testing C&I has been minimised by the fact that our group was represented by one or, usually, two peo-

ple at all tests. We have, thus, been in a position to understand the context in which the C&I were developed and the issues they aim to address. We recommend that any follow-up analysis of C&I testing be carried out by those people with first-hand experience at the field tests.

During the CIFOR team's comparison of results from several C&I field tests, interest centred on the process by which the field team members arrived at their conclusions. We remain uncertain whether differences among individuals' preferred decision-making process represent differences of approach/ method, subject matter, or methods associated with their respective fields. Indeed, all three may be relevant factors in the development of simple, straightforward, cost-effective indicators. Because this issue provides a convenient arena for clarifying some of the differences encountered among the approaches used by team members (within both CIFOR and the field teams), further discussion is warranted.

Just as we have a hierarchy composed of principles, criteria, indicators and sometimes verifiers, so we have a hierarchy of important questions for these categories in evaluating their utility. At the levels of principles and criteria, the most significant issue in their selection must be the strength of their relevance to sustainability (which includes, according to our definition, human well-being). We must ask ourselves a number of questions about any given principle or criterion. For example:[9]

- Is this a principle or criterion associated with processes which are likely to lead to sustainability?
- Does it represent contributory evidence that a sustainable system already exists?

9 See a more detailed discussion of these questions in Section 5.3.1.

- Can a causal relationship be demonstrated between the criterion and sustainability (including plausible logical, empirical or chronological evidence of the relationship)?
- Is this condition necessary for sustainability to occur?
- Is this principle or criterion unique and/or sufficiently important vis-à-vis other principles and criteria being considered?

As we move down the hierarchy to indicators and verifiers the type of questions we ask will change. One important question now centres on their relevance for determining the condition specified in the hierarchical level immediately above. Is the indicator, for instance, linked in a causal or associative manner with the criterion whose fulfilment it is designed to ascertain? Again, is there plausible logical, empirical or chronological evidence for a relationship? Is the indicator necessary or sufficient to inform the criteria?

Another issue in selecting C&I is an evaluation of confidence that the indicators, verifiers and their measurement (or determination) in the field will accurately reflect the condition of the C&I. Some variables that can affect measurement results have been identified (e.g., ease and cost effectiveness of data collection, need for experience and judgement). The varied needs of people who will carry out evaluation in the future will also affect the selection of appropriate C&I, because individual evaluators will have different resources, expectations, needs and perceptions. Who will be carrying out these evaluations, and will their interpretation of the C&I differ from those who developed them? Are the C&I specific enough to surmount this difficulty? Is it a difficulty?

There is no way to completely avoid context-specific decision making. Although there is a core of generic C&I which can be helpful for any evaluation of forest

sustainability, there are also site-specific indicators that may be closer to the 'ideal type' for a specific location. In Brazil, for instance, it was possible to substitute one site-specific indicator (which referred to a comprehensive, local worker safety code) for a long series of more generic indicators pertaining to worker safety. Similarly a series of generic forest management C&I used on other sites could be subsumed under one, with Indonesia's TPTI system. For this reason, it is almost certain that every person evaluating principles, criteria and indicators will need to adjust a generic set of C&I for his or her own use.

A useful reference during such an analysis is the Tropenbos hierarchy framework paper (Lammerts van Bueren and Blom 1997).

4.2 – ADDITIONAL POINTS FOR CONSIDERATION

The following subject areas may be considered for further analysis of C&I test results and the sets of C&I that resulted from them.

Identify possible areas of overlap and redundancy

In identifying overlap and redundancy among the C&I, data recorded in the linkages box of Form 2 could be used as a starting point. This data could be represented graphically. See Lammerts van Bueren and Blom (1997) for examples of 'correct' and 'incorrect' hierarchies and comments about similar issues. Is overlap avoidable within the C&I selected? If so why did the C&I test process not removed the overlap?

Examine the need for consistency versus flexibility in using the hierarchy of principles, criteria, indicators and verifiers

During the CIFOR test series we found that although all team members were able to put the C&I into a hierarchical framework, the category assigned to any individual concept within the hierarchy could vary from criterion to indicator to verifier, depending on the site and the expert.

In order to improve consistency in the use of principles, criteria, indicators and verifiers we suggest that a basic entity model of information and information processing described by Liang (1994) could be a potentially useful aid.[10] He identifies four basic entities in ascending order of hierarchy: data, information, knowledge and wisdom. In the strict sense of his model, Liang maintains that 'Information conveys a 'single message' compared to a data element, which conveys a 'single value'. Knowledge, on the other hand, is a large-scale selective combination of related pieces of information, e.g., the science of physics. Finally, wisdom is perceived as a small increment in knowledge created by a person's intellectual deductive ability after attaining a sufficient level of understanding of a knowledge area. If we attempt to fit the elements of the conceptual framework into the categories of this basic entity model, we will find that principles and criteria reflect wisdom and knowledge, whereas indicators and particularly verifiers can be classified as information or data following Liang's hierarchy.

There will remain a tendency for hierarchies to be adapted to specific locations. What was a criterion may become a verifier, and vice versa, depending on the perceived critical points in the field setting. Although in some sense, the C&I sets remain 'of one cloth' they get moulded by the experts to the topography of the real world.

10 See also discussion in Section 5.2.

Identify gaps in the C&I

Another useful exercise would be to use the FSC and ITTO guidelines to determine what gaps, if any, were left in the C&I selected by the expert team. Why did the gaps remain? How could the testing process be improved to avoid such gaps?

Developing and optimising the principles, criteria, indicators and verifiers resulting from the field tests

Using the above discussion points, an overall goal might be to further develop and optimise the C&I set resulting from the field test. This might be particularly important in cases where, for some reason, the field test proved to be faulty. For example, it may have resulted in many gaps in the link between the C&I and sustainable forest management. However, caution should be used in modifying the C&I set resulting from the field tests. Field tests, if carried out carefully, should produce a good set of C&I.

Examine the case for generic and site-specific C&I

Another useful exercise is to examine the C&I set for generic and site-specific elements. Several base sets of C&I were used as starting points. Were these useful? What type of elements required the most adjustments to local conditions? Would the final set be applicable to a larger region? Within what boundaries? Does a universal set of C&I exist?

Linking FMU-level and national-level C&I

In some cases (e.g., working 'down' from the FSC, Montreal or Helsinki sets) it is also worthwhile to examine the link between FMU and national C&I sets. Are national sets realistic? Useful? Under what circumstances? At what hierarchical level might national or FMU sets be most appropriate?

5 The Conceptual Basis of C&I Development

5.1 – INTERPRETING SUSTAINABLE FOREST MANAGEMENT

As Wiersum (1995) notes: 'Notwithstanding 200 years of efforts to operationalise the concept of sustainability, its exact application in forestry remains troublesome'. Several recent[11] definitions of sustainable forest management have been proposed (e.g., ITTO 1991). Most have their roots in the concept of sustainable development as stated in the Brundtland Commission Report (World Commission on Environment and Development 1988).[12]

For the purpose of developing an assessment system, we define sustainable forest management as: a set of objectives, activities and outcomes consistent with maintaining or improving the forest's ecological integrity and contributing to people's well-being both now and in the future.

This definition represents the common denominator in the other definitions of sustainable forest management that we have examined. The task of a system to evaluate the sustainability of forest management will therefore be to assess the following two conditions, that:

- ecosystem integrity is maintained or enhanced; and
- well-being of people is maintained or enhanced.

These conditions represent the biophysical, social and temporal elements of sustainability and are discussed in greater detail below. From a pragmatic and operational point of view, fulfilment of the above two conditions is expected to take place continuously over long, but not indefinite, periods of time (perhaps tens to hundreds of years). We also

11 The principle of sustainability has a long history of evolution in Germany and France from the 17th century. The earliest 'modern' definition dates back to Hartig (1804) in Germany: '…utilise them *[the forests]* to the greatest possible extent, but still in a way that future generations will have at least as much benefit as the living generation' (quoted in Schmutzenhofer 1992).

12 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development 1988: 43).

recognise that there may be short-term and site-specific conflicts between these two goals, and that the determination of the appropriate balance is likely to be problematic for assessors.

Since this project has focused on the forest management unit, it is important to provide a definition of that entity. This definition will have important consequences for the assessment of sustainable forest management.

An FMU is defined as: a clearly demarcated area of land covered predominantly by forests, managed to a set of explicit objectives and according to a long-term management plan.

An FMU can *usually* be expected to cover a few hundred hectares[13] to several hundred thousand hectares. The entire area of the FMU has to be clearly demarcated on the ground and usually also on a map. Under the broad objectives to which the entire management unit is subjected, sub-units may be managed under different and separate management regimes. The management plan will *usually* be written and may sometimes be published. However, neither are necessary conditions.

Management of the FMU can have implications for people dependent on forest resources and vice versa. These people may or may not reside within the physical boundaries of the FMU, but the impacts of management activities may spill across the formal FMU boundaries. In fact, these impacts may be social, as well as physical or ecological, and may affect material, cultural and social values. The team has sought to determine these impacts based on a gradient of importance, using a method under development by Colfer (1995).

13 Although an FMU could be as small as a few hundred hectares, it is assumed that in most cases it is part of, or is within, a larger forested area. That is, we don't mean this size to imply that a few hundred hectare plot could be managed sustainably on its own, but rather that the management unit could be this small.

5.1.1 ECOSYSTEM INTEGRITY

Schneider (1992) defined ecosystem integrity as:

> the ability to support and maintain a balanced, integrated, adaptive biological community having a species composition, diversity and functional organisation comparable to that of natural habitat in the region.

An alternative term is *ecosystem health*, which is defined as: a comprehensive, multiscale, hierarchical measure of system stability, organisation and vigour (Constanza 1992).

These two definitions imply that ecosystem *structure*, *function* and *resilience* should be dimensions of concern for ecosystem management. The project's work has been based on the following definitions:

Ecosystem

The biotic and abiotic components of an environment that interact to produce a flow of energy and cycling of nutrients. Ecosystems are extremely difficult to define practically because of high variation, temporal changes and lack of discreteness. The project has taken the physical boundaries of the FMU as the external limits of the forest ecosystem for which C&I are tested and developed. As is the case for social spillover impacts, this has not meant ignoring landscape-level interactions. Nonetheless, the major focus, for practical reasons, has been on interactions within the physical confines of a forest management unit.

Structure

The species composition, dispersion pattern and organisation of plant and animal species into higher ordered levels, such as trophic levels, food webs or guilds. The change of structural parameters through time is important for the long-term view of ecosystems (Landres 1992).

Function

The set of processes that results from interactions among biotic and abiotic components of the ecosystem. Four classes of processes are important:

- processes that affect the rate and total quantity of energy flow;
- processes that affect the rate and total quantity of nutrient cycling;
- processes that influence ecosystem services important to human beings (Landres 1992); and
- processes that affect the life and diversity of living organisms over both short and long time periods.

Resilience

A measure of the ability of the system to absorb changes of state variables and parameters, and persist or rebound within a given amount of time. It is also defined as the persistence of relationships within a system or the rate of recovery of the ecosystem. Related terms are stability, elasticity and restoration time. Resistance, on the other hand, relates to the extent to which an ecosystem is displaced under stress (Attiwill 1994).

5.1.2 WELL-BEING OF PEOPLE[14]

The concept of 'well-being' encompasses the economic, social and cultural aspects of people's lives, as influenced by forest management. Forest management by its nature is intended to provide benefits to people although, as Colfer (1995) has pointed out, who benefits and by how much is an ongoing debate, especially on lands classified as public forest.

14 Based on Wollenberg and Colfer (1996).

It is unrealistic to expect forest managers to solve all society's woes but, on occasion, team members, workshop participants and others have indicated such an expectation.

What People?

Careful analysis is needed to determine which social groups require the attention of forest managers. One critical element is that of proximity. People living in close proximity to the forest have the greatest potential to affect the forest directly.[15] However, other important features have emerged in the course of our research. These include: pre-existing rights, forest dependence, indigenous knowledge, forest-culture integration and power deficits. We suspect that 'a concern for sustainability' and 'poverty' may be necessary additions to this list (see CIFOR C&I Toolbox Series No. 8 for additional info).

Following these observations, we have begun developing a simple method with which to identify the group of people affected by the management of a particular forest, partially to reduce unfair expectations directed at forest managers, and partially to ensure adequate attention to the relevant populations. A clearer definition of the forest management unit in question, from a social point of view, can be obtained by applying this method which is outlined in the section 'Identifying Stakeholders and Forest Actors' on page 50 (based on Colfer *et al*. 1996).

Human Dimensions and Sustainable Forest Management

When we first began to investigate the human dimensions of sustainable forest management, we found two distinct aspects of the concept of sustainability to be important. From a social perspective sustainability can be said to include:

15 The meaning here is direct *local* effect. It is certainly possible that policy makers, for example, could have a greater overall impact.

- the maintenance of people's well-being — often with a focus on forest dwellers; and
- the actions of people that affect the sustainability of the forest.

What Affects People's Well-Being?

A review of existing principles of sustainable forest management and general literature on forest peoples, provides five essential areas of concern for people's well-being. These could be thought of as a sort of 'Bill of Inalienable Sustainability Rights'.

- *Security and sufficiency of access to resources*. Access should be assessed both now and in the future, including the intergenerational distribution of benefits, i.e., the Brundtland Commission (World Commission on Environment and Development 1988) definition of meeting the demands of the present without compromising the needs of the future.
- *Economic opportunity*. Forest activities should maintain or enhance people's livelihood opportunities.
- *Heritage and identity*. People's rights to their cultural values, behaviour, land use and material goods should be respected, both for the present and as a necessary context for the enculturation of the young.
- *Justice*. There should be fair resolution of conflict and distribution of benefits, rights, responsibilities and incentives.
- *Safety and health*. Employment, residence in or use of a forest should not endanger people's safety and health (either physical and mental).

In other words, if these five general conditions are satisfied, then the sustainability of the associated forests, from a social perspective, should be secure.

Intergenerational distribution of benefits is a particularly important component of people's well-being because this focuses on the persistence or improvement of social equity over time. Indicators for assessing intergenerational benefits include the stability of people's well-being, the maintenance of 'social capital',[16] equitable inheritance systems, tenurial security and values of, and opportunities available to, the younger generation.

How People Affect Forests

People can affect the sustainability of forests both through active participation in management (or mismanagement) and through aspects of their normal life such as building houses, finding firewood or other forest use. In further developing our approach to human well-being and peoples' effects on forests, we found the work of Ostrom (1994) to be relevant to understanding how local people's actions can positively affect management of forests (or other resources) under their collective control. She outlined eight 'design principles' which, if satisfied, would lead to effective local management of common pool resources. By building on her ideas and those of others on common property resource management, we identified at least nine social conditions as necessary for effective resource management by a group.

- *Boundaries* are clearly defined and agreed upon. Rights of use and the distribution of benefits clearly defined and agreed upon.
- *Capacity to protect the resource*. The users of the forest have the means to exclude outsiders.

16 Ostrom (1994: 20), drawing from Coleman (1988) and Putnam (1993), says 'Social capital is the shared knowledge, understanding, and patterns of interaction that a group of individuals brings to any productive activity… [it] is created when individuals learn to trust one another so that they are able to make credible commitments and rely on generalised forms of reciprocity rather than on narrow sequences of specific quid pro quo relationships.'

- *Decision-making mechanisms*. People affected by a resource have a say in how the resource is managed and how the benefits are distributed. They also have a means within the group of making final decisions.
- *Conflict resolution* which is closely related to decision making. People have a means for settling disputes, both internally and externally to the group.
- *Monitoring*. Information about the quality of the resource is available to the group.
- *Group size and organisation*. Groups are sufficiently small to enable regular contact and communication. Where larger numbers of people are involved, groups are nested to enhance organisational efficiency.
- *Incentives/benefits*. The net benefits to people are positive and may include economic as well as cultural or intangible benefits. Incentives may be positive or negative (e.g., sanctions). Forest management options should be considered in comparison with benefits resulting from other activities (opportunity cost).
- *Inputs*. People have adequate labour, technology, information, capital and other inputs necessary for sustainable management.
- *Conservation value or commitment to sustainability*. People using the forest place value on forest conservation and seek to maintain the quality of the resource.

Although not all forests are managed as common pool resources, many of the forest management situations we have encountered have a strong common pool management component.[17] Thus, this list of 'social conditions'

17 For example, forests are often officially under the management of a forest industry concession, but local people continue to harvest forest products and undertake forest management practices of their own.

can be very useful in the assessment of sustainability for most forests. In fact, by implication, if these conditions are satisfied, then commonly perceived negative aspects of people's use of forests can be minimised.

5.1.3 CONTINUITY AND TEMPORAL ASPECTS

Continuity and temporal aspects affect both biophysical and social elements of sustainable forest management. From the biophysical standpoint, it is important to understand that continuity is not taken to mean a constant flow of goods and services. As with any dynamic natural system, outputs from sustainably managed forests will fluctuate. Nevertheless, the amplitude of these fluctuations must be controlled to ensure that the system remains stable. These fluctuations should fall into a relatively predictable range over long periods of time.

Social systems also require a balance between stability and change. While there should be room within a given social system for fluctuation over time, there are limits beyond which a healthy system will break down. Because such a breakdown could seriously disrupt forest management systems, one important task in developing and assessing social C&I is to find indicators that tell us when the limits of stable social systems are being approached or have been exceeded.

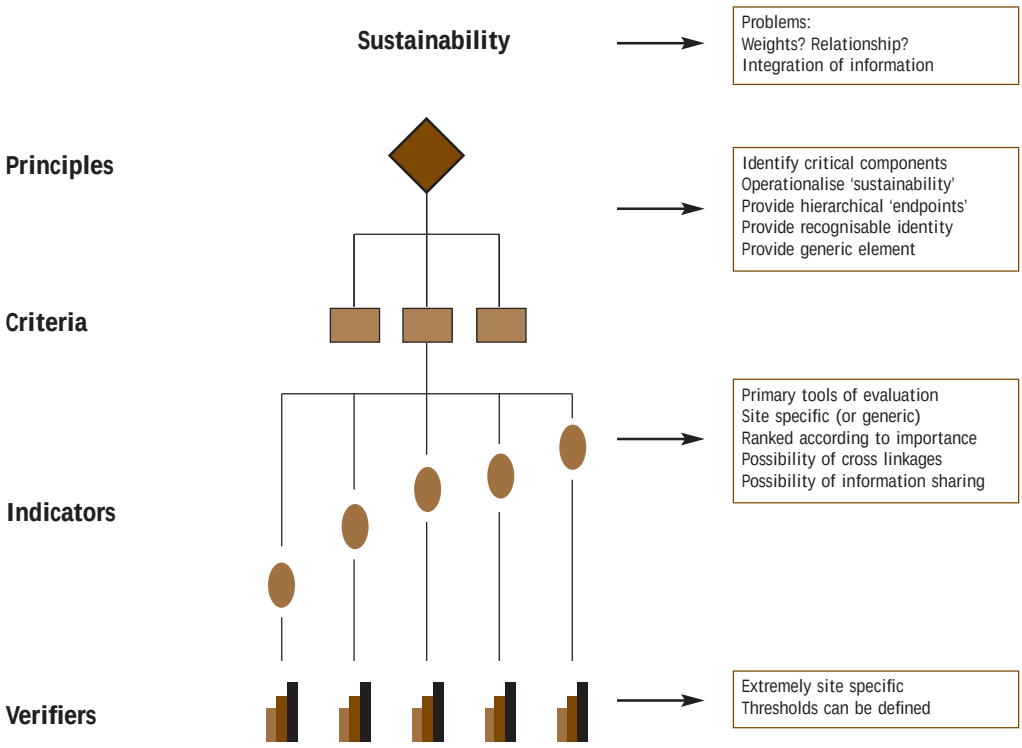
The essence of sustainability is the maintenance of desirable conditions over time. How these conditions are sustained is determined by various factors which the C&I attempt to measure. For example, intergenerational equity is one of the principles which should reflect the long-term stability of the system. However, the reliability of the C&I which evaluate such principles is also important to consider. Such reliability is expected to decrease rather rapidly over time due to inherent uncertainties involved in making predictions about complex social and ecosystem interactions. We, therefore, rec-

ommend five years as the maximum period of validity of any sustainability assessment.

5.2 – UNDERSTANDING PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS

In this section, we define the three main conceptual tools for guiding assessments: principles, criteria and indicators. We also define and discuss verifiers and verification procedures. The relationships among these elements is presented in Figure 4.

Figure 4. **Conceptual Framework**



The following definitions were used by the test teams in assessing C&I.

Principle

A fundamental truth or law as the basis of reasoning or action. Principles in the context of sustainable forest management are seen as providing the primary framework for managing forests in a sustainable fashion. They provide the justification for criteria, indicators and verifiers. Consider that principles embody human *wisdom*. Wisdom is defined as: *a small increment in knowledge created by a person's (group's) deductive ability after attaining a sufficient level of understanding of a knowledge area.* Wisdom, therefore, depends on knowledge.

Examples of principles:[18]

- for sustainable forest management to take place 'ecosystem integrity is maintained or enhanced'; or
- for sustainable forest management to take place 'human well-being is assured'.

Criterion

A principle or standard that a thing is judged by. A criterion can, therefore, be seen as a 'second order' principle, one that adds meaning and operationality to a principle without itself being a direct measure of performance. Criteria are the intermediate points to which the information provided by indicators can be integrated and where an interpretable assessment crystallises. Principles form the final point of integration. In addition to considering criteria to be second-order principles, treat them also as reflections of *knowledge*. Knowledge is the accumulation of related information over a long period of time. It can be viewed as a large-scale selective combination or union of related pieces of information.

Examples of criteria (applied to the first principle given above):

- for ecosystem integrity to be maintained or enhanced 'principal functions and processes of the forest ecosystem are also maintained'; or
- for ecosystem integrity to be maintained or enhanced 'processes that sustain or enhance genetic variation are perpetuated'

18 The phrase 'for sustainable forest management to take place' is included here for clarification.

Indicator

An indicator is any variable or component of the forest ecosystem or management system used to infer the status of a particular criterion. Indicators should convey a 'single meaningful message'. This 'single message' is termed *information*. It represents an aggregate of one or more data elements with certain established relationships.

An example of an indicator applied to the above criterion:

- to ensure that processes that sustain or enhance genetic variation are perpetuated we can examine the 'directional change in allele or genotype frequencies'.

Verifier

Data or information that enhances the specificity or the ease of assessment of an indicator. The fourth level of specificity, verifiers provide specific details that would indicate or reflect a desired condition of an indicator. They add meaning, precision and usually also site-specificity to an indicator. They may define the limits of a hypothetical zone from which recovery can still safely take place *(performance threshold/target)*. On the other hand, they may also be defined as procedures needed to determine satisfaction of the conditions postulated in the indicator concerned *(means of verification)*.

An example of a verifier applied to the above indicator:

- the directional change in allele or genotype frequencies can be determined via periodic measures of the 'number of alleles in the population'.

Verification procedures are *procedures that will actually be used in the field*, focusing on the verifiers, to determine satisfaction of the conditions proposed in the evaluation system. For example, if the verifier is 'housing for the staff is appropriate and at least meets the legal minimum', then the means of verification might be 'interviews with workers and examination of contract conditions'.

Verification procedures must be:

- *cost-effective* — once the C&I have been identified, the cost of the evaluation depends to a large extent on what procedures are adopted for the means of verification;
- *quick*, *simple and understandable* — this is important if they are to be effectively followed by different evaluation teams and produce consistent results; and
- *transparent and plausible*, in order to be acceptable.

5.3 – DETERMINING THE SUITABILITY OF C&I

5.3.1 NINE KEY ATTRIBUTES

Nine attributes were selected to judge the overall suitability of various proposed C&I for a given situation. Over the course of our tests, team members varied considerably in their perceptions of the utility of these nine attributes. Some of the variation can be attributed to differences in disciplinary perspectives. Other modes of evaluation are discussed at the end of this section.

The key attributes below were selected by the project team for use by team members to judge the usefulness of C&I.

- *Relevance*. All C&I should be relevant to the issues that define sustainable forest management.

- *Closely and unambiguously related logically to the assessment goal*. Each indicator must be directly related to a criterion and each criterion to a principle. All principles have sustainable forest management as their ultimate end-point.

  Although similar to the previous attribute relevance, this attribute emphasises the position of the criterion or indicator within a given logical association.

  This attribute is necessary because, in the process of defining or developing C&I, a seemingly logical association can sometimes hide the fact that a particular indicator has little direct relevance to sustainability.[19]

- *Precisely defined*. The wording for the definition of criteria should be simple and unambiguous.

19 For example, the horsepower of a bulldozer is often linked to the extent of damage it creates, this in turn is linked to the condition of a forest, which is linked to ecosystem integrity. A seemingly logical sequence, it has resulted in the inclusion of bulldozer horsepower in some sets of C&I. This is misleading as it is not only the horsepower of the bulldozer that is relevant to sustainability, but the skill (i.e., training) and commitment of the bulldozer driver. A combination of attributes would, we believe, help reveal such logical inconsistencies.

- *Diagnostically specific*. As far as possible, indicators should provide information that allows a direct interpretation of the fulfilment of a criterion. For instance, the indicator 'A permanent forest estate (PFE) comprising both protection and production forest has been constituted…' is diagnostically specific to the criterion 'Legal and policy framework recognise the benefits occurring from forests and seeks to optimise and maintain them'. This will, however, not always be possible due to a lack of information, or the cost of such a direct assessment, among other factors (see also comments in Section 5.3.3)

  In such cases, proxy indicators will need to be defined. The indicator 'Chemicals banned in Europe, America or target country are not used' is a proxy indicator that seeks to establish '… no chemical contamination to… food chains and ecosystem'. Both indicators are assessing fulfilment of the criterion 'Ecosystem function is maintained'. However, even such an indirect assessment should strive to fulfil the attribute of diagnostic specificity as far as possible.

- *Easy to detect, record and interpret*. In most cases, the cost of assessing sustainability has to be funded, directly or indirectly, from sales of products of the forest management unit. Thus, it is important that indicators are selected in such a way that they result in minimal additional costs. Indicators that are easy to detect, record and interpret contribute significantly towards the goal of cost-effectiveness.

- *Reliable*. The techniques or methods necessary to ascertain the information specified by the criterion or indicator must be sufficiently reliable, as indicated, for example, by replicability. In other words, do we get the same answer when we reapply the same assessment procedure to the same conditions?

- *Adequate response range to changes in levels of stress on the forest management, ecological or social systems*. C&I should be defined so that they provide meaningful gradual change in response to a system changes. Although in some cases a simple yes/no answer may be advantageous, in most cases management impacts will result in varying responses from the underlying systems. A useful indicator will provide meaningful information over a wide range of changes in the system.

- *Provide a summary or integrative measure over space and/or time*. This attribute is related the quantity of system information contained in a single indicator. Some indicators will contain information related to a number of factors.

  For example, the indicator 'Potentially dominating secondary successional vegetation is not abundant in logged-over stands' integrates information on the disturbance suffered by a forest during harvesting operations. This includes the amount of canopy opening, disturbance to the soil, tending operations, etc. Such indicators, often defined in relation to 'choke-points' in the system, will tend to be more informative and cost-effective than others (see also 'cost-effectiveness' below).[20]

- *Appeal to users*. This attribute recognises the fact that those persons who will apply the C&I need to accept them as important, practical and legitimate measures. The user of the C&I should be able to answer 'yes' to the question: Does this principle, criterion, indicator, verifier sequence make logical, practical and financial sense to you? For example, our expert teams were frequently asked to assess cost-effectiveness in considering various C&I indicating that cost effectiveness was a major factor affecting acceptability. A related issue is whether the C&I are acceptable to consumers who might

20 However, is also important to retain the logical sequence specified in the attribute 'Closely and unambiguously related logically to the assessment goal'.

accept or reject a certification scheme based on the 'appeal' of the C&I.[21]

5.3.2 OTHER PERSPECTIVES TO HELP IDENTIFY AND DEVELOP BETTER C&I

In this section, we discuss judging C&I from four perspectives: causal association with sustainable forest management; information content; temporal classification; and classification according to geopolitical level. Each criterion or indicator can be defined in different ways depending on which one of these perspectives is chosen. Some of the resulting definitions will differ only superficially, due simply to a different choice of language. In other cases, however, differences in perspective will significantly affect the formulation of the C&I and this can result in different *types* of indicators, with consequences for what is assessed, where, when and how. This difference in perspective will affect indicators and performance thresholds more than it does criteria.

We suggest that these different perspectives can be used as *aids* to identifying and developing better C&I, not as ends in themselves.

Causal Association with Sustainable Forest Management

Two types of causal association are identified. The first differentiates physical *human inputs*, or *human processes* and the *outcomes* of these on the forest ecosystem or the social system. A second, different, causal association is in use when C&I are identified as *stresses* (or *pressures*), affecting the *states* of the system or *responses* from the system. The two types of classification are not mutually exclusive. Our experience has shown that the input-process-outcome classification was more readily accepted by the expert teams when dealing with human activities.

21 For example, C&I referring to protection of particular wildlife species may have more appeal than others.

Stork *et. al.* (1997) visualised a stress/response system: a sequence starting with human *interventions* such as logging which cause *effects*,[22] such as habitat fragmentation, which in turn affect processes, such as reproduction which affect *biodiversity*. From this perspective, they felt that pressure indicators were applicable at the beginning of this sequence whereas state or response indicators were more appropriate at the end.

Some working definitions of these terms are:

- *Human input*. What is put in, taken in or operated on by any process or system. Example: Percentage of revenue reinvested in the forest.
- *Human process*. A course of human action or proceeding. Examples: 'Logging is rationally planned'; 'Large canopy gaps are avoided'.
- *Outcome*. The result or effect of inputs and processes on the three systems concerned. Example: 'Residual stands satisfactorily regenerated'.
- *Stress (or pressure)*. An external factor, force or stimulus applied to a system. This is used to classify the causes of change in the status of a system component. Examples: 'Maximum five trees to be harvested per hectare'; 'Logging prohibited on slopes of over 25°'.[23]

  For instance, Brown *et. al.* (1997) tend to view genetic indicators of the state of the environment as measures of responses of the ecosystem to external *pressures* such as habitat fragmentation. They consider indicators of responses to these pressures as they affect population characteristics, micro-evolutionary processes and genetic diversity.

22 They termed these intermediate effects 'mediators'.

23 Note that 'logging prohibited' would be a stress on the production of goods and services whereas 'logging allowed' would be a stress on the ecosystem.

- *State*. The condition or quality of the system component concerned. This classification is to be used when the purpose is to describe a desired condition of a system component, independent of what forces of change are acting on it. Example: 'Forest-dependent people are aware of their rights to resources'.

- *Response*. The reaction of the system to stress. In other contexts response has been interpreted narrowly to mean human (especially policy) responses to changes in state (e.g., Anon. 1993). In the present context, the term is used to classify both human- and ecosystem-related reactions to pressure or changes in the state of the system. Some examples of responses might be: 'Creepers such as *Merremia* spp. and *Mesoneuron* spp. are generally not present within stands' and 'Economic alternatives are increasing because of forestry activities'.

Temporal Classification

Temporal classification seeks to allocate a criterion or indicator to a particular time period, e.g., an average growth rate is largely a historical *(past)* indicator, total standing volume is a current *(present)* indicator and a projection of growth rate would be predictive and, therefore, attributable to the *future*.

Classification According to Geopolitical Scale

This classification seeks to order a criterion or indicator according to the level of its primary influence on forest management. For example, the CITES convention is *international* in its geopolitical influence; definitions of 'production' or 'conversion' forests in the Indonesian context are of *national* significance; local taxes, reporting and control instruments are seen to be *regional* instruments; and decisions taken within the forest management unit or the surrounding population will have a *local* influence.

The test in Germany contributed to the identification of these methods for evaluation of C&I (Palmer 1995, Annex 5).

Assessment, Monitoring and Guidelines: A Clarification of Terms

As they apply to sustainable forest management, the terms *assessment*, *monitoring* and *guidelines* are often confused. These concepts are related inasmuch as they all deal with sustainable forest management and so share many ideas.

An *assessment* of the sustainability of forest management primarily aims at providing answers to the following three questions.

- Is forest management committed to sustainability?
- Is the condition of forests and its users acceptable?
- Is the response to management interventions positive?

To use the doctor-patient analogy, an *assessment* should try and reach a diagnosis on whether:

- there is an impairment of health, i.e., sustainability;
- which parts of the body have been affected, as in the criterion 'Structure and diversity aspects of ecosystem-integrity have been affected'; and, if possible,
- the extent of damage.

The *assessment* may also give indications of the nature of the illness ('Pollination chains have broken down'), however, we have not considered this to be a necessary attribute. We do not see it as incumbent upon an assessment system to suggest remedies or monitor recovery.[24] These functions, if desired, will call for additional diagnosis modules and would lead to guidelines for management. In a typical certi-

fication process, sustainability *assessment* is only one of several steps, as can be seen in Figure 5.

We can view assessment in the context of sustainable forest management as *the process by which information about forest management is collected with a view to establishing, within a defined framework of expectations, the current status and probable future direction of the interactions between human beings and forests, using certain criteria and indicators*.

In concrete terms, the difference between *assessment* of sustainability and *monitoring* is that the former attempts to facilitate a spot judgement of management by defining the indicators to compare existing states against predefined targets as in the verifier 'Not more than X per cent of canopy is opened'. In contrast, indicators in a *monitoring* process are usually more neutral and procedural in character, and are defined to enable the interpretation of trends over time, based on repeated data collection (e.g., percentage change in forest area).

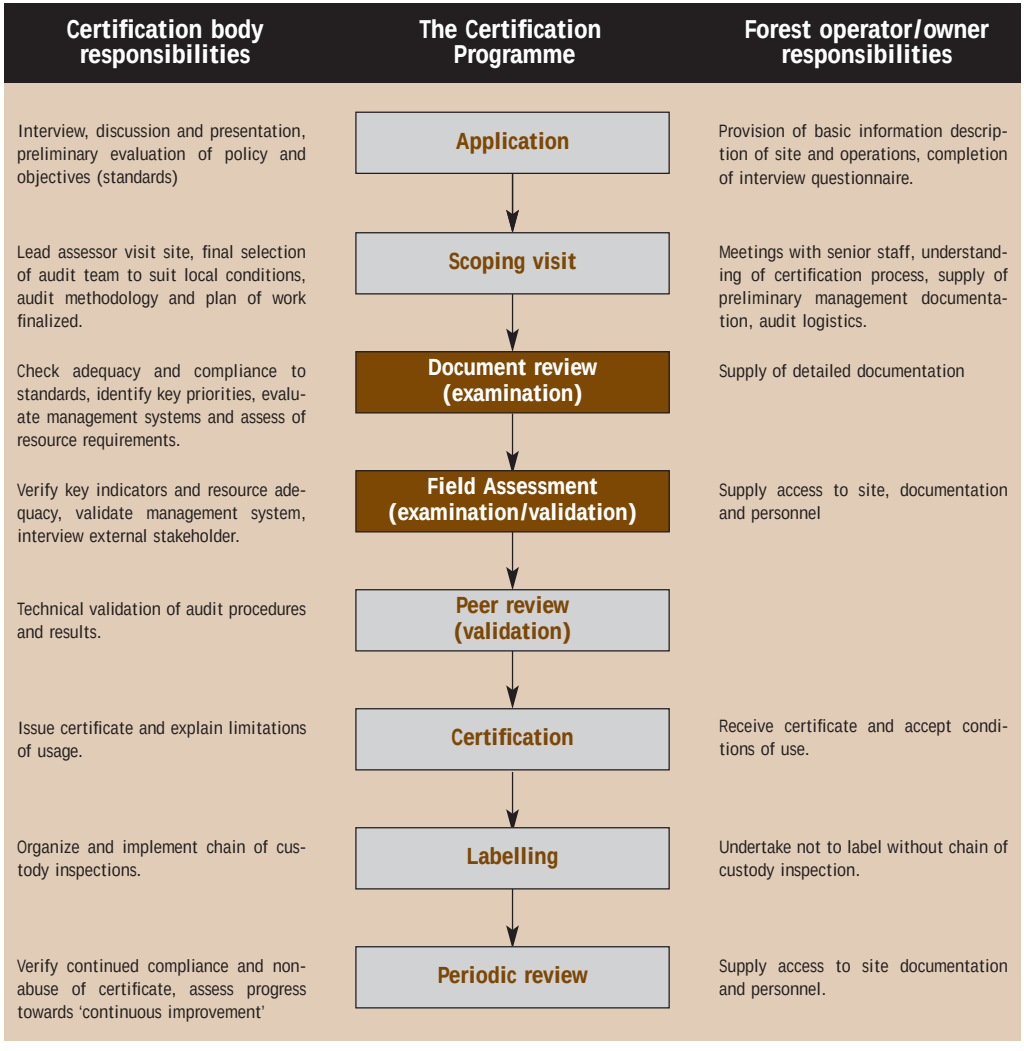
Guidelines, in contrast, are usually prescriptions for actions needed to achieve a certain goal. They are implicit in indicators for assessment especially when the latter are prescriptive in nature, such as 'No tractor logging on slopes steeper than 25°'. However, a guideline will not be implicit in a descriptive or evaluative indicator (e.g., 'Secondary succession species account for less than 10 per cent of basal area'). In such a case, to arrive at relevant *guidelines*, the underlying assumptions of indicators will require translation into management prescriptions. Such interpretation will be particularly necessary if the assessment indicators are response or outcome oriented.

24 This is not to be confused with a certification process, where it is legitimate to expect management to respond to corrective action requests (CAR) and provide proof of this during surveillance visits.

We suggest it is not productive for an assessment or monitoring system to provide a complete description of the present condition. Rather emphasis should be placed on measurement of trends or changes in the system. In fact, attempts to describe the whole system will incur significant extra costs which are not really necessary.

Figure 5. **The Certification Process (from Upton and Bass 1995)**

The use of C&I takes place only in the highlighted stage.
The C&I testing and selection process described in this manual would take place outside this process, or perhaps as a part of the scoping visit.



Management Systems vs. Performance Standards

The conceptual framework presented in the previous sections would apply equally well to the development of a sustainability assessment system based on either:

- C&I to evaluate the presence of process or 'systems' (such as those contained in an environmental management system[25]); or
- C&I to assess compliance with performance standards.

The former stresses the procedural nature of management systems and seeks to establish the presence and quality of these systems. The latter approach assesses sustainability against a set of performance standards or targets. However, we believe both approaches have validity and should be reconciled with each other in order to achieve maximum efficiency. This is possible within the conceptual framework described, as both procedural and outcome- or target-oriented indicators are permissible. This is borne out by the results of CIFOR tests; the sets of C&I proposed by the teams in Indonesia, Côte d'Ivoire and Brazil contained C&I based on performance as well as process. These results suggest that a combination of both process and performance standards are necessary.

The nine attributes described in Section 5.3.1 and the different perspectives described in Section 5.3.2 provide ideas for improving the cost-effectiveness of an assessment system. Cost-effectiveness will depend on two overall qualities: information content of the C&I element and methods used to collect information about the C&I element.

25 According to Upton and Bass (1995), an environmental management system is defined as 'the organisational structure, responsibilities, practices, processes and resources for implementing environmental management'.

Information Content and Cost Effectiveness

To be cost-effective, indicators need to be selected in such a way that they provide information on changes at critical points in the system. Selection of such indicators will ensure that information on system interactions affecting this critical point will be reflected by changes at the point itself. Having first selected the 'critical areas', the second consideration is then to actually define the indicator. This can be descriptive, qualitative or quantitative. In either of these cases, it will be important to know what to observe or measure and, in the latter case, what measurement to use. Finally, some thought must be given to the interval of time over which information is integrated.

In order to achieve information efficiency several conditions need to be met. Some of these have been articulated in the nine attributes described in Section 5.3.1. In particular, cost effectiveness can be enhanced by building in mechanisms for effective *information sharing* or multiple linking of C&I, even across disciplinary boundaries, wherever possible. Thus, a biophysical indicator might also be used to indicate fulfilment of a criterion related to ecosystem integrity and also to a social criterion. For example, fish yields from streams in logging areas might be used as an indicator of sound logging practice (maintenance of buffer zones near streams, therefore preventing water temperatures and sediment loads to rise unduly, etc.) but can also be used as one indicator of economic and social impact of forest management (income or income-substitution, source of animal protein, water quality). Similarly, population characteristics of certain keystone animal species may be important indicators both for ecological criteria as well as social criteria (e.g., as a source of food for local people).

5.3.3 INTEGRATION OF INFORMATION AND COST-EFFECTIVE C&I

It is also conceivable that information can be integrated without attempting to move up to a higher level of hierarchy. This takes place for instance when the information contained in several indicators is combined to form a new composite indicator or index value.

To improve cost-effectiveness through improved information content, one might ask the following questions.

- Have the C&I successfully been limited to the key areas of sustainability?
- How much information does each item potentially hold?
- How carefully have the C&I been defined?
- Can we better define the indicator so that information is integrated more meaningfully?
- Where, within a system, should we place an indicator in order to summarise a satisfactory amount of information on interactions?

Note that here is an inherent conceptual conflict between the desire to have efficient, and thus interlinked, C&I and the need that C&I be diagnostically specific. It seems to us that that this seeming conflict is not critical. In some cases, the links may take precedence, and in other cases the diagnostically specific characteristic may be more important. (See comments in Section 5.3.1 concerning diagnostically specific C&I, as well as those under the discussion of 'linkages' on Part M of Form 2 in Annex 8.2).

Only after the C&I are precisely defined according to the above should the issue of cost effectiveness of data collection be considered. That is, cost efficiency

should not take precedence over the logic of the C&I system design.

(*Note:* The task of defining the actual field procedures is left for a later phase.)

6 Three Case Studies

Synthesised by Phil Macoun based on project reports

The methods described in this manual are intended to provide a rigorous yet flexible guide to developing, testing and selecting C&I. In applying these methods, we expect modifications will be needed to reflect the conditions at individual sites, and the specific objectives of different tests. In this section, three examples of how these methods have been adapted to specific circumstances are provided. The case studies reviewed are:

1. Initiative of the African Timber Organization (ATO) on Principles, Criterion and Indicators for Sustainable Forest Management in Africa: Gabon Test.
2. The North American Test of Criteria and Indicators in the Boise National Forest, Boise, Idaho.
3. Developing Criteria and Indicators for Community Managed Forests in Cameroon, West Kalimantan and Brazil.

In all these tests, the general structure outlined in this manual was followed, however each test has adapted and applied these methods in different ways. Unless stated otherwise, it can be assumed that 3 Filters and 2 Forms (Section 3.1) were used, with some modifications.

6.1 – INITIATIVE OF THE AFRICAN TIMBER ORGANIZATION (ATO) ON PRINCIPLES, CRITERIA AND INDICATORS FOR SUSTAINABLE FOREST MANAGEMENT IN AFRICA: GABON TEST.

The Gabon test of principles, criteria and indicators for sustainable forest management was conducted from April 1 to April 30, 1998. The field work phase of the test (two weeks) was conducted in a forest concession of more than 500 000 hectares granted to the Compagnie Equatoriale des Bois (CEB) and situated in the east of Gabon.

Of the three case studies presented in this section, the Gabon test followed the CIFOR methods manual the most closely. As a result it is a useful illustration of some of the pros and cons of the specific methods outlined in this manual.

In the test site, approximately 16 170 inhabitants were divided into 43 villages and 4 towns and lived either immediately surrounding or within the site. As the previously prosperous craft industry had totally disappeared, the current 'economic' activities were subsistence focussed; for example, traditional agriculture, hunting and gathering. The logging company, CEB, had been operating in the area since 1987 and employed about 250 people on the site.

The expert team consisted of 5 members, a forester/ecologist (also team leader), an economist, an ecologist, an anthropologist and a sociologist. The team was assisted by a coordinator from ATO and received occasional 'external' contributions from other experts. Following the testing, the team felt that an ideal number of members would be three or four and that there should not be two experts from the same discipline.[26] Moreover, they felt the team would benefit

26 This makes it compulsory to split up a principle in to component criteria so as to give a portion to each expert, thus requiring additional work later on to 'reassemble' the components and resolve contradictions.

from support by short-period external expertise in the second week of the field phase.

During this test the expert team followed CIFOR's methods quite closely with positive results. Some of the aspects of these methods that contributed to this positive outcome are:

- At the beginning of the test, two days were devoted to a presentation of the methodology by CIFOR experts. This Briefing Workshop[27] was deemed essential to the proper development of the test. In fact, more time could have been devoted to the preparation of the team as even during the middle of the test some basic points of methodology were still unclear or confused to the team members.
- The team of experts received two base sets, representing 230 items, that fulfilled the conditions required for initial sets of C&I[28]. The sets used were: the *ATO set*, which was considered relatively well organised from a hierarchical point of view; the *Kribi set*, which resulted from a compilation of six sets, including the ATO set.
- A mode of operation for the field visits (Filter No. 2) was adopted that made room for Team Discussions and followed guidelines suggested for Structuring Team Interactions.[29] For example:
  - Tours or field visits were as far as possible made by multidisciplinary teams.
  - Every evening the team and coordinator held a meeting to talk about the problems faced and the progress made dur-

27 See Section 2.5.3.

28 See Section 2.3.

29 See Section 3.3.5.

ing the day, and to prepare the work program for the next day.

- Every 3 or 4 days one full or half day was devoted to a team meeting in which participants shared information regarding the progress of their work and the difficulties encountered.

The team also encountered difficulties with some of the CIFOR methods, and suggested alternative approaches that might be useful. They felt that:

- Form 2 was better used as a dynamic iteration tool rather than a 'static' tool in which the forms are filled once before the test and once after.
- Some frameworks in the form (K, L and M) had no real importance to the team of experts, created confusion and made the form a bit more daunting.
- While Form 2 appeared to be a very useful tool for jotting down and organising the data collected on one item, it did not suggest any real means for the organisation and hierarchical structuring of items. During the test, problems of hierarchical structuring were the most difficult to overcome by team members. Roughly nine to ten hours of discussions over nearly three days were necessary to structure the set of C&I at the outcome of Filter No. 2, despite many intermediate meetings.

The test ended with a workshop which brought together roughly 50 people from various scientific specialties and many countries. The workshop was organised in accordance with CIFOR recommendations[30] and resulted in a number of refinements to the final C&I set proposed. In the workshop, there were four working groups, one on General

30 See Section 3.4.2 and 3.4.4.

Policy, one on Management, one on ecology and one on Social Aspects. Each group consisted of about twelve people, which enabled a fairly open discussion while remaining manageable to group leaders. Each group was conducted by a chairman and a rapporteur. The results of the groups were then debated in plenary session and the final hierarchy was adopted during the workshop.

6.2 – NORTH AMERICAN TEST OF CRITERIA AND INDICATORS OF SUSTAINABLE FORESTRY

The North American Test of Criteria and Indicators was conducted from June 8 to July 10, 1998, in the area of the Boise National Forest, Idaho, U.S.A. The Boise Test Site encompassed an area of about 4.3 million acres (1.7 million hectares) and was located in the United States Department of Agriculture (USDA) Forest Service's southwestern section of the State.

The Boise Test Site makes an interesting case study because the area represents a Forest Management Unit (FMU) with a sophisticated level of forest management. Some of the characteristics of the area are:

- Most landholders maintain comprehensive resource management plans generally aimed towards long-term productivity and ecological health of the forest.
- The area has a comprehensive database and high level of stakeholder involvement.
- The forest represents a valued resource for wide range of users, supplying local peoples with revenue from timber products, outdoor recreation opportunities, fuelwood and other forest products.
- The area also serves as a refuge for many animals and plants, and protects ecosystems and natural processes which may be declining on adjacent lands.

Project Team members were selected from a wide range of disciplines and originated from throughout the United States, Canada and Mexico. The core test team consisted of two ecologists, one social scientist, one economist, three forest managers, and one forest geneticist. Additional specialists included one carbon biochemist, one anthropologist, one systems ecologist and a forest ecologist.

Compared to previous tests of CIFOR's methods for developing, testing and selecting C&I the Boise tests were quite ambitious in scope. The 'expert teams' were larger and included more disciplines and they spent a comparatively longer time in the field. They also took the tests one step further by trying to apply the indicators selected and commenting on their practicality.

The sets of C&I selected for evaluation included: 1) those that emerged from the CIFOR Phase I synthesis; 2) CIFOR's basic assessment guide (BAG) for human well-being; 3) Canadian Council of Forest Ministers (CCFM) C&I for Sustainable Forest management in Canada; 4) Local/regional indicators; including the Idaho Forest Practices Act; and, 5) The Greater Fundy Ecosystem Guidelines, developed for the Fundy Model Forest.

Prior to the initiation of the North American field test, several meetings were held to inform and seek participation in the test. In March, 1998 a series of presentations were made to potential cooperators and interested participants. These participants included agencies, corporations and others who might provide data, present research papers or observe the test. In addition, a meeting was held for groups that could have an interest in knowing what the test would be about but who would not be expected to participate. Finally, a briefing was held for both State of Idaho and U.S. congressional staff to provide information about what the North American test was

and would expect to accomplish. In addition, the CIFOR test leaders met with the Boise National Forest and Boise State University personnel to make all the logistical arrangements for the period when the entire team would be in Boise.

The methods generally followed those described in this handbook, but with some modifications to fit the North American context. The methods involved three phases conceived as four separate filters or stages. At each stage, a particular C&I could be rejected, merged, or passed to more detailed evaluation in the next filter. The use of four filters, rather than three, diverges slightly from the format suggested in Section 3.1, but is really a slightly more involved version of the same progression.

Stage 1 was done in accordance with the methods prescribed for Filter 1 (see Section 3.2). Each team member was asked to read a comprehensive set of information on the study site, as well as local planning and evaluation documents. They were then given a modified version of Form 1 to fill out. Like the Form 1 in Annex 8.1 this form asked the experts to numerically rank (on a scale of 1–5), each criterion and indicator against a set of parameters. The results of Form 1 were tabulated and averaged on a spreadsheet and made available to the team at the start of the fieldwork stage.

Form 1 was modified in the following ways:

- A column was added to indicate whether each element of the base set being evaluated was a Principle, Criteria or Indicator.
- The categories used to classify the C&I were changed. The revised categories used in the Boise Test were: Biophysical; Social; Planning & Policy; Damage control management; Yield control management.

- A column was added asking the experts to rank each C&I on the basis of how well it fit into a theoretical framework.
- A comments box was added.

Stage 2, the Initial Fieldwork, was a detailed three-day orientation workshop on the local social, economic and ecological conditions, as well as a summary of data available for the test. The third day of the workshop was devoted to a field trip, which looked at forest conditions and harvest practices on all land ownership's. Then the team worked in sub-groups and discussed the tabulated results from Form 1. After debate, individual criteria and indicators were rejected, merged or allowed to go on to the next, more detailed evaluation. This stage of the process represents a more in depth version of the 'Initial Team Discussion', described as the first step in Filter 2.

Terminology was not consistent between the sets of criteria and indicators tested. To test the same elements between the indicator sets (i.e. CIFOR Phase I and CCFM), members used the definitions of Principles, Criteria, and Indicators provided by Tropenbos (1997). The criteria and indicators were regrouped under three main principles, following the Tropenbos definitions. The principles were (1) maintenance of ecological integrity, (2) yield and quality of forest goods are sustainable, and (3) society accepts responsibilities for resource management.

In *Stage 3*, the Field Evaluation, members worked with reference material, other experts and in discussion groups to critique or refine the theoretical basis for each criterion or indicator. In some cases this meant directly contacting experts in the local area or reaching others by telephone or e-mail. For each indicator, they also attempted to use data from

the Boise Study Area to assess it's practicality. Wherever possible, team members talked to local resource people to get their views on value of the indicator. This stage can be thought of as the Field exercises that are recommended as the second part of Filter 2.

For each indicator tested, team members filled out a modified assessment Form 2 (Annex 8.2). These modifications did not change the nature of the information being gathered about each criterion and indicator, rather they helped focus the information to make it as useful as possible to the examination team.

In *Stage 4*, a post-fieldwork workshop was held. This was a two-day workshop which included 60 new participants from different institutional and disciplinary backgrounds. During this two-day workshop, working groups discussed the proposals made by the team concerned. This provided peer review to the team members' work and also a first view of the wider applicability of the proposed C&I.

Some of the problems the team faced trying to create a set of C&I relevant to the local context in Boise, Idaho, might be instructive to other teams working to adapt sets of C&I. To this end, a number of the issues that came up regarding the different C&I in the different disciplines are outlined below.

Ecological C&I:

- To practically measure ecological variables can be costly and time consuming.
- Many of the indicator sets often had no supporting or explanatory material to support the concept. The theoretical rationale for indicator selection was often very brief or absent.

- The measurement side of the CCFM and CIFOR sets relied too heavily on available data, which meant that data had to be stretched to fit, thus undermining the indicator's usefulness.
- The CIFOR ecological indicators tended to be geared to tropical forests and therefore were less applicable to the temperate Boise Site.

Economic C&I:

- The CIFOR and CIFOR-BAG C&I (earlier version of Toolbox Series No. 5) included no overt economic indicators other than some equity considerations in the CIFOR-BAG group. A CIFOR working paper by Ruitenbeek and Carter (1998) that addresses C&I from an economic perspective was used as a source document.
- Nearly all the CCFM C&I were focussed on national economic parameters and were difficult to apply at the FMU level.
- The team felt that the set tested was quite limited in that it was primarily diagnostic and focussed on economic structure with few dynamic aspects. The relationships to sustainability were mostly second-order.

Management C&I:

- The management indicators were only aimed at areas included in the forest management program, and tended to be focused on the balanced management of trees. In the context of the North American test, this meant the concepts of forest management theory were only applied to approximately 25% of the total area because 25% of the test area was available for harvest. The team identified the need for indicators that can be appropriately applied to an entire study area or ecosystem. This would require loosening of the definition of manage-

ment to include activities such as no management, terrestrial and aquatic restoration, non-traditional forest removals, planning for ecological functions and others.

Social C&I:

- The developed nation/developing nation contrast between the North American test and previous tests of the CIFOR-BAG C&I resulted in significant incompatibility in applying the indicators. This contrast might be described as the difference between forest-dwelling or forest dependent people and people who live in a forested area.
- In the North American context an extensive legal and constitutional structure protects many of the property and treaty rights that are more variable in developing countries. The result is that these indicators are relatively easy to assess, but not useful to measure people's satisfaction with these legal/constitutional structures.
- The CIFOR-BAG methods were mostly anthropological in origin and not designed to take advantage of existing data sources in North America. Thus they were only useful in relatively small test areas or as initial means of scoping or refining methods.

In general, the major problems found with the sets of C&I tested were:

- The tested indicator sets were developed at the national level, and did not translate well to the forest management level;
- Neither the CCFM nor the CIFOR Phase 1 sets provided useful target-values ('norms' or threshold values) for any of the indicators. In order to be useful the indicators needed to be referenced against a target;

- There was often confusion, or overlap between the indicator sets concerning the definition of Principle, Criterion and Indicator;
- The indicator sets tested were generally poorly documented and referenced.
- The indicator sets did not address operational issues surrounding their use. For example, issues of cost, replicability, data management and quality control; and
- Finally, they found it difficult to work in an interdisciplinary manner as there is still no accepted theoretical basis for the integration of ecological, social and economic indicators. A paper by Hoekstra *et al*. (1998), was suggested as a possible theoretical basis for integration.

6.3 – TESTING AND DEVELOPING CRITERIA AND INDICATORS FOR COMMUNITY MANAGED FORESTS.

The C&I for community managed forests (CMF) tests were conducted between March 1997 and February 1998 in three separate test areas: Central Province, Cameroon; West Kalimantan, Indonesia; Para, Brazil. Previous CIFOR research focussed on developing C&I for the sustainability of *timber production* at the Forest Management Unit Level in natural forest areas. In the C&I for CMF tests, the focus was extended to testing and developing C&I for the sustainability of other forest management types including *plantations* and *community forest management*.

Each test lasted one month and was undertaken by an interdisciplinary team consisting of a social scientist, an ecologist and a forest management specialist, in consultation with the local forest community. In keeping with these disciplines, the C&I sets produced were divided into three areas: socio-economic, forest management and ecology. Interactive community participation was encouraged throughout these tests using the techniques of Participatory Rural appraisal (PRA).

The tests aimed to:

- Identify C&I that could be used by various forest-interest groups to assess the sustainability of forest resources at the test sites;
- Derive the extent to which the C&I generated were relevant to geographical locations other than the test sites; and
- Assess the resources different potential users would need to apply the C&I generated. For example, funds, knowledge, skills and technology.

During testing a number of different aspects of the methods suggested by CIFOR for the development, testing and selection of C&I were highlighted. Some general *strengths* and *limitations* of the CIFOR methods were discovered. As well the tests helped reveal the suitability of these methods for encouraging *community participation* and extracting information that can be *generalised across sites*.

General Strengths and Limitations

Some of the points discussed below are strengths and weaknesses of the CIFOR methods outlined in this manual, and some are related to the particular way these methods were implemented in the C&I for CMF tests.

Some of the *strengths* of these methods are:

- *The focus on field visits*. Nearly all the testers had extensive experience in community forestry or integrated rural development in forested zones. Nonetheless, they all found it necessary to alter their original ideas of what constituted the most relevant, applicable C&I for CMF after having consulted forest inhabitants and visited their homes, farms and forests. This reconfirms the importance of the field visits that are a central feature of the recommended methods.
- *Community Participation*. The productive participation of the forest community helped different forest stakeholder groups better understand how their respective ideas and interests interrelate.

Some of the *limitations* of these methods are:

- The ability of the *Tropenbos Hierarchy* of Principles, Criteria, Indicators and Verifiers to represent reality was found to be limited by its inflexible approach to allocating issues to a sin-

gle hierarchical level, whereas it was felt that an issue could appear in different forms at different hierarchical levels. The segregation of issues among ecological, forest management and social science disciplines made it difficult to identify relationships between these categories.

In the context of Community Managed Forestry, the ramifications of some issues might have been better presented, by inter-disciplinary C&I complexes, rather than dispersal across 3 discipline specific sets. For instance, to monitor how a change in a forest's economic value affects people's behaviour and attitudes to conservation, we need to monitor socio-economic, ecological and managerial variables. But, what needs to be monitored most of all, are the relationships between these types of variables and their outcomes.

- During these tests, a number of issues emerged that reinforce the importance of *careful 'expert' team selection* when engaging in an inter-disciplinary process.[31] For example, in the Brazilian and Cameroonian tests, some of the team members opted to work alone over substantial periods, which hampered integration of the sub-sets created in these tests. They suggested that the requirement of segregating issues according to discipline was a barrier to effective integration of the different disciplinary efforts.

  Possibly, the relatively small size of the selection teams also contributed to their difficulties in integrating the disciplines. In Section 2.5, we suggest that 'a five or six-member team has a much better 'critical mass' for discussions', and more discussion between testers could have further clarified ways the different disciplines could inter-relate. As well, in these cases, the team leader should have been working to encourage the participation and cooperation of all the team members in

31 For a review of the important aspects of team selection and composition, see Section 2.5.1.

conducting an inter-disciplinary approach to the testing.

Another factor mentioned by the team members was the relatively short time period in which the testing took place. A longer time period might have accommodated more time for discussion between the testers, leading to more effective inter-disciplinary integration.

- During testing, the teams were exposed to C&I *base sets* containing many C&I originally proposed for industrial timber management, and then asked to select C&I from these for CMF. In many cases, this introduced biases into the final sets compiled. The team suspected that less C&I of commercial timber management might have been included in the C&I sets formulated during the tests, had different or no base sets been tested as part of the exercise. These tests, then, illustrate the importance of selecting appropriate starting sets of C&I.

- While the peer review role played by the *final workshop* is important, the CMF tests showed that the recommendations need to be viewed with caution as many of the participants are unfamiliar with the context of the site. During the tests, the final workshops allowed new untested hypotheses to be introduced into C&I sets that had been field tested with the explicit aim of eliminating invalid hypotheses. This made the workshops inconsistent in some respects with the objective of making the proposed C&I sets more relevant and cost effective. These untested hypotheses could have the counter-productive result of making the sets either largely irrelevant or cost-ineffective assessment tools for many places.

- One of the original objectives of the C&I for CMF test was to evaluate the indicators and verifiers developed according to the attributes 'ease of use' and 'cost of application'. This objective could not be satisfactorily achieved within the time

frame of the testing process because the attributes would have had to be evaluated separately for each potential user group. Thus, the time frame of one month was too short to properly field test indicators and verifiers for CMF.

Community Participation

During the field-testing iteration, community members were actively encouraged to contribute ideas. However, subsequent iterations culminating with the final workshop iteration led to increasing exclusion of community members in the testing process. As a result, the contents of the C&I sets developed was ultimately determined by expert teams despite endeavours to enhance inter-active community participation. Thus, the final sets were unlikely to fully equate with community definitions of what are or should be common-ground indicators.

In general, the villagers participated as providers of information. The most active and vocal participants tended to be the wealthier, politically influential community members. Some of the barriers to more effective community participation were:

- clear differences between testers in their approach to eliciting and applying local knowledge.
- language barriers at the Cameroonian and Indonesian test sites where the local majority only spoke their tribal language.

There was a tendency for the non-community members involved to evaluate the community members' contributions according to their own standards. The tendency was particularly notable in some of the professionals reviewing C&I with community members at the workshops. These workshop participants tended to: pursue arguments, the academic complexity of which outstripped the community par-

ticipant's comprehension; substantially doubt the validity and utility of local knowledge; be wary of letting local people take the lead for fear of important questions being under-addressed.

Furthermore, in the concluding workshops people had different knowledge and communication abilities. As their mother tongues and worldviews differed, not all participants could easily understand each other. In general, the more assertive, vocal participants tended to overly influence debates.

Generalisation across Sites

Trying to identify general principles that could apply across sites proved to be difficult. The three C&I sets that emerged from the different tests clearly differed in the issues they addressed and the distribution of emphasis among them. Some plausible explanations for this are:

- The expert's different specialist fields of interest;
- Different local priority concerns;
- Variation in the accessibility of relevant information; and
- The sophistication of practice. For example, none of the experts was specialised in rubber tapping techniques, therefore their understanding of what indicates good rubber tapping was confined to within the precincts of local knowledge. At different sites the sophistication of this knowledge varied greatly.

Another factor that made it difficult to compare the results of the three tests was variation in the definition and use of different words. For example, the inconsistency in defining Principles, Criteria, Indicators and Verifiers made it difficult to identify common C&I. Also, to identify C&I

common to more than one site, the C&I were screened for key words and conceptual resemblance; the extent to which different words in similar contexts, or the same words in different contexts, have been ascribed with the same meaning remains an outstanding question. For example, Indicators containing words like 'banned', 'prohibited', 'outlawed', 'authorised', 'forbidden', are weakly indicative of the distribution of authority unless their positioning within a complex of C&I makes clear upon whose command inquiries are focussed.

In general, the results of the C&I tests for CMF and commercial timber management suggest that Principles and Criteria, as large, fundamental truths come closest to being of universal relevance. The more detailed Indicators and Verifiers, that constitute more practical assessment tools for evaluating how well processes and methods are adapted to local constraints and possibilities, are much more prone to variability across sites. These findings are consistent with the findings of Prabhu *et al*. (1996).

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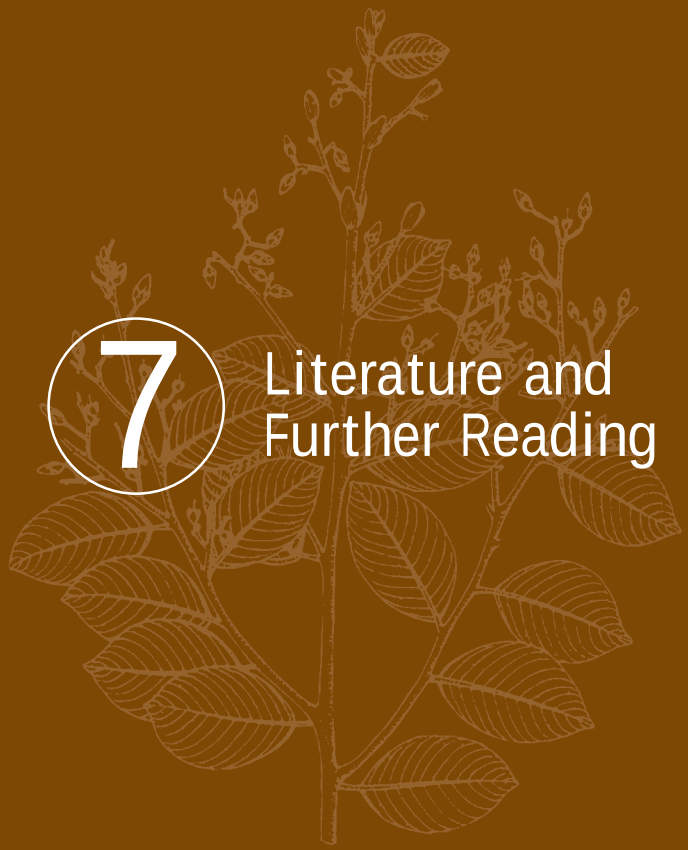

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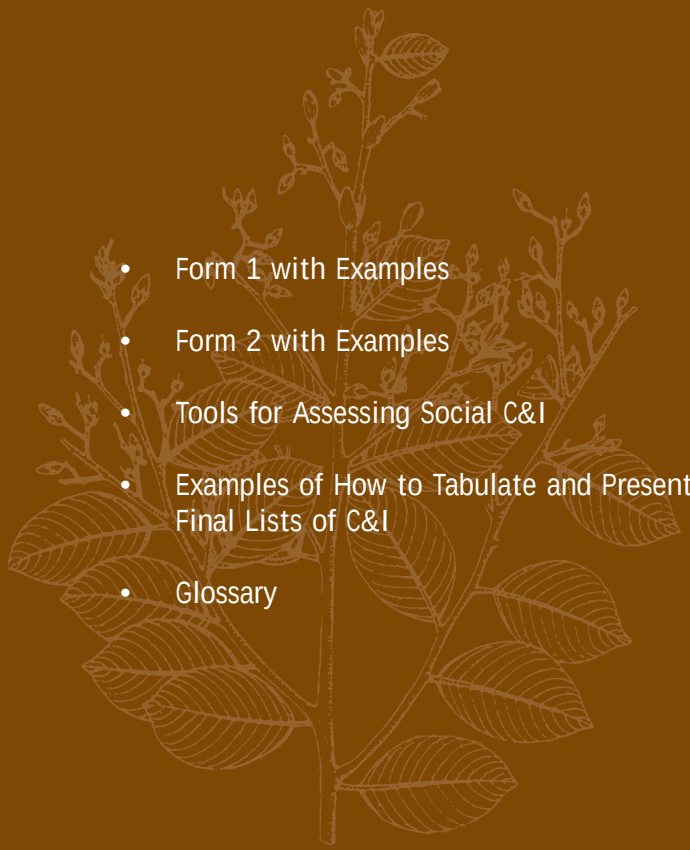
8 Annexes



- Form 1 with Examples
- Form 2 with Examples
- Tools for Assessing Social C&I
- Examples of How to Tabulate and Present Final Lists of C&I
- Glossary

8.1 – FORM 1 WITH EXAMPLE

Form 1:

Source	No. of C/I as printed in source document	Class (P, M, E, S, F)	Closely and unambiguously related to the assessment goal? (1–5)	Easy to detect, record and interpret? (1–5)	Provides a summary or integrative measure? (1–5)	Adequate response range to changes in level of stress? (1–5)	Important and therefore selected as 'priority'? Yes = 1 No = 0
1	2	3	4	5	6	7	8

EXAMPLE FORM 1

Form 1: For Cameroon Test. Please fill in this form before October 28.

Source	No. of C/I as printed in source document	Class (P, M, E, S, F)	Closely and unambiguously related to the assessment goal? (1–5)	Easy to detect, record and interpret? (1–5)	Provides a summary or integrative measure? (1–5)	Adequate response range to changes in level of stress? (1–5)	Important and therefore selected as 'priority'? Yes = 1 No = 0
1	2	3	4	5	6	7	8
1 = (ATO)	B.2.3	P	4	1	4	2	1
1	B.3	P	5	2	2	4	1
1	B.3.1	P	5	4	3	4	1
1	B.3.2	S	3	3	1	2	1
1	C.1	P	5	3	5	2	1
1	C.1.1	M	5	4	4	5	1
1	C.1.2	P	5	5	1	4	1
1	C.1.3	M	3	3	2	1	1
1	C.1.4	M	4	4	2	1	1
1	C.2	M	5	2	3	1	1
1	C.I	M					
1	C.I.1	M	4	2	4	3	0
1	C.I.2	M	5	4	2	2	0
1	C.I.2*	M	5	4	4	4	1
1	C.I.2.1	E	4	2	4	2	1
1	C.1.2.2	E	5	4	3	1	1
1	C.1.2.3	M	5	5	2	4	1
1	C.1.2.4	M	4	4	3	2	1
1	C.1.2.5	M	5	5	2	1	1

8.2 – FORM 2 WITH EXAMPLE

Testing Criteria and Indicators: CIFOR Method
Form 2: Field Responses

Team No. 1

Expert's Initials ✓ JMS
A = ……, B = ……,
C = ……,

Source ATD
State source document

Identification No. E.1
in source

Final Identification No. (as reported in final list) 1.1

Class S
Policy = P, Social = S, Production of Goods & Services = M,
Ecology = E, Financial & Economic Aspects = F

Recommendation (After field testing) Yes ✓ No

Enter the selected criterion or indicator as stated in the source document in this space (use Box F for final version)

All stakeholders have their user or property rights well defined and secure.

A

Justify your selection of this criterion or indicator:

Land tenure issues are very important for any sustainable forest management process to succeed in time and space.

B

Attributes Please use a scale of 1–5 when answering, where 1 = no/bad/unimportant and 5 = yes/good/important

C

	(d)	(o)		(d)	(o)
Provides a summary or integrative measure	5	5	Easy to detect, record and interpret? Feasible?	5	5
Closely and unambiguously related to the assessment goal?	5	5	Precisely defined? (clear)	3	5
Adequate response range to stresses? (Sensitive)	3	5	Will it produce replicable results? (reliable)	3	5
Diagnostically specific?	3	5	How relevant is this criterion or indicator?	5	5
Appealing to users?	5	5	Other:		

Provide bibliographic references (if any):

D

Give the ref. of C&I in the Base Set (e.g. ATO) that overlap (come closest) to the criterion or indicator recommended above:

		1–5		1–5		1–5		1–5		1–5
ATO	E 1.1	4	E 1.2							
DDB	6A	2								
Compiled Set	S 16	4			S 21	5				

E

Final version of criterion/indicator, *state only if different from definition in Box A:*

The social dimension of sustainable forest management depends on the security and acceptability of tenure, use rights, local laws and other values of rural men and women.

F

Notes: Please record your notes on evaluating the criterion/indicator (box A) here: G

This criterion tends to summarise what one would expect to observe in the field. After all, without secured and accepted rights to land by all stakeholders in a given context, then the goods and services it provides cannot be sustainably managed.

Would this C&I need to be evaluated H

In the field?	✓
In the office?	
Both?	

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. I

Diary of Important Actions to Evaluate C&I

J

Date	Action	Remarks
27.10.96	Interview with village chief	
28.10.96	Gender analysis, discussions with several	
	members of the community	
30.10.96	Interview with local officials in Kribi	

Function 1 K

		(d)	(o)		(d)	(o)		(d)	(o)
Justify:	Human input			Human Process	4		Outcome		

Task Leader: ……

Function 2 L

		(d)	(o)		(d)	(o)		(d)	(o)
Justify:	Stress	5		State			Response		

Task Leader: ……

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

Bio-physical:
Social: ✓
Management:
Other

Task Leader: ……

AUTHOR'S NOTE: The box below was not used by the expert team members

Workshop Notes (for office use only) N

Did the workshop accept this criterion indicator unchanged? Yes / No

Why?

Were revisions called for? Yes / No
State revisions:

State justification for revision:

OR was this criterion or indicator rejected as being unsuitable? Yes / No
State reasons:

8.3 – TOOLS FOR ASSESSING SOCIAL C&I

Several prototype tools have been created and are described in CIFOR Working Papers. These include:

- a simple technique to help forest managers and others determine the most relevant stakeholders to involve in decision making (Colfer 1995);
- a method for partially assessing the degree to which local people are involved in co-management of forest resources (Colfer and Wadley 1996);
- a group of three qualitative methods designed to assess security of intergenerational access to resources (Colfer *et al.* 1997);
- a method for assessing people's perceptions of their relationship to the forest (Colfer *et al.* 1996); and
- a group of methods designed to assess the well being of women as well as men (including discussion of related problems) (Colfer *et al.* 1997).

We remain dissatisfied with these methods, and have been conducting additional tests of 12 methods for assessing human well-being.[32] These methods are divided into three main topics:

32 These methods are described in more detail in the third iteration (January 1997) of the 'social science packet' (a test of social science assessment methods on defining forest actors, security of intergenerational access to resources, co-management of forests) which is under development at CIFOR.

Assessment of 'who counts' in sustainable forest management

- Focus Group Analysis
- CatPac Analysis of Recorded, Open-ended Interviews on forest related topics
- Galileo Questionnaire to Produce Cognitive Maps on People and Natural Resources

Assessment of security of intergenerational access to resources

- Historical Trends Analysis [also relevant for co-management issues]
- Historical Transects of Landscape: Past, Present and Projected
- Iterative Continuum Method [also relevant for assessment of people's rights intergenerational… as below]
- Participatory Mapping
- Benefit Sharing among Stakeholders: Pebble Distribution Method 1
- Access to Resources by Generation: Pebble Distribution Method 2

Assessment of people's rights and obligations to manage forests cooperatively (or to participate in forest management)

- Participatory Card Sorting on Co-Management Issues
- Rights and Means to Manage: Pebble Distribution Method 3
- Iterative Continuum Method (ICM) [also relevant for intergenerational access to resources]
- Researcher Guide Pertaining to the Four Proposed Functions of Participation

8.4 – EXAMPLES OF HOW TO TABULATE AND PRESENT FINAL LISTS OF C&I

					Source Sets of C&I				
P	C	I	V	Description	DDB	ITW	LEI	SA	SW
1				The forest ecosystem's integrity is maintained					
	1			Maintenance of critical ecosystem functions and processes is secure at all stages of forest management					
		1		Areas of ecological importance (watershed and soil protection, areas with high biodiversity, high degree of endemism, occurence of rare/endangered species, sensitive habitats) are identified, reported and adequately managed or protected.		C.1.5.3			5.5
		2		Corridors of uncut forest based on streamsides with link up slopes and across ridges to connect adjoining catchments, connecting any large patches of forest which will not be harvested are retained.		C.1.5.2		5.108b	5.6
			1	Percolation index (measures the connectedness of a landscape from one edge to the other).					

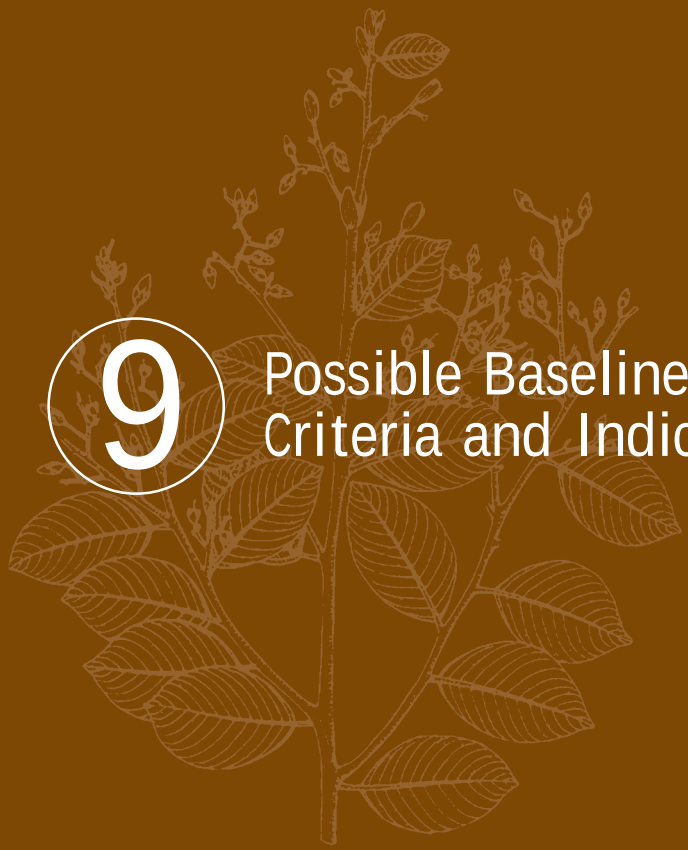
8.5 – GLOSSARY

ATO	Africa Timber Organization. The ATO comprises 13 African timber-producing countries including Angola, Cameroon, Central African Republic, Congo, Côte d'lvoire, Equatorial Guinea, Gabon, Ghana, Liberia, Nigeria, Sao Tome and Principe and Zaire. The ATO has been working on the development of a certification system for its member states since 1993.
CCFM	Canadian Council of Forest Ministers.
C&I	Criteria and indicators (see definition and discussion in Section 5.2).
Continuous forest inventory (CFI)	A timber sampling system that provides for periodic re-measurement of specific stands or plots to reveal the forest status and change over time.
CSA	Canadian Standards Association. CSA is an independent, non-governmental, not-for-profit association which develops standards and certification programmes in a number of areas. These include developing standards related to sustainable forest management.
DDB	Deskundigenwerkgroep Duurzaam Bosbeheer. A Dutch working group on criteria and indicators.
FAO	Food and Agriculture Organization of the United Nations

FMU	Forest management unit. A clearly demarcated area of land covered predominantly by forests, managed to a set of explicit objectives and according to a long-term management plan.
FSC	Forest Stewardship Council. An international NGO composed of representatives from the scientific community, indigenous peoples, business and other NGOs. The FSC promotes good forest management and operates a voluntary accreditation programme for organisations and companies which provide certification in the forestry sector, but the FSC does not undertake certification itself.
Greenpeace	Greenpeace describes itself as 'an independent, campaigning organization which uses non-violent, creative confrontation to expose global environmental problems, and to force the solutions which are essential to a green and peaceful future'.
Helsinki & Montreal Processes	Working groups established with the specific purpose of developing and implementing internationally agreed C&I for sustainable forest management.
Indonesia's TPTI system	Tebang Pilih Tanam Indonesia/TPTI (the Indonesian Selective Cutting and Planting system). A commonly used Indonesian wood harvesting system.
ITTO	The International Tropical Timber Organization. An intergovernmental organisation working to provide an effective framework for consultation among producer and consumer member countries on various aspects of the world timber economy.

ITW	The Initiative Tropenwald. ITW, founded by German timber trade unions, importers and processors in 1992, works to develop a process of certification using nationally-accredited bodies within timber exporting nations who would certify that producers have met high standards of forest management.
LEI	Lembaga Ekolabel Indonesia (The Indonesian Ecolabeling Institute). An independent organisation working toward ecolabelling in Indonesia.
NGO	Non-governmental organisation.
NTFPs	Non-timber forest products such as honey, rattan, wildlife and medicinal plants.
Permanent forest estate (PFE)	Various categories of land, both public or private, which are kept under permanent forest cover. This might include land to be protected; land for nature conservation; land for production of timber and other forest products. Includes land where logging is allowed as well as those land categories where logging is not allowed.
SCS Inc.	Scientific Certification Services. A USA-based organisation which develops environmental labelling programmes. The SCS has applied their Forest Conservation Program (FCP) in the USA and elsewhere.
SGS-Forestry/Qualifor	SGS-Forestry is a private forest services company which has developed a certification programme, called Qualifor, which has been accredited by the Forest Stewardship Council.

Smart Wood	A forest certification programme. Initiated by the Rainforest Alliance in 1989, the programme is now the oldest and largest forestry certification programme in existence.
TCA	(or ACT) The Amazon Cooperation Treaty. The TCA was signed in 1978 by Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela to promote harmonious development in the Amazon Basin.
UNEP	the United Nations Environment Programme.
Woodmark	Woodmark is a certification scheme aimed at promoting good forest management worldwide. It was developed by the Soil Association, an environmental NGO.
WWF	World Wide Fund for Nature. WWF is the world's largest independent conservation organisation.



9 Possible Baseline Sets of Criteria and Indicators

9.1 – THE CIFOR GENERIC TEMPLATE OF CRITERIA AND INDICATORS*
(WITHOUT VERIFIERS)

P	C	I	Description
1			**Policy, planning and institutional framework are conducive to sustainable forest management**
	1.1		**There is sustained and adequate funding for the management of forests**
		1.1.1	Policy and planning are based on recent and accurate information
		1.1.2	Effective instruments for inter-sectoral coordination on land-use and land management exist
		1.1.3	A Permanent Forest Estate (PFE), which includes both protection and production forests and is the basis for sustainable management, exists and is protected by law
		1.1.4	There is a regional land use plan (or PFE) which reflects the different forested land uses, and give attention to such factors as population, agriculture, conservation, environmental, economic and cultural values
		1.1.5	Institutions responsible for forest management and research are adequately funded and staffed
	1.2		**Precautionary economic policies exist**
		1.2.1	Reserve funds for potential damages are available (performance bond)
		1.2.2	Anti-corruption provisions have been implemented
	1.3		**Non forestry policies do not distort forest management**
		1.3.1	Absence of agricultural sector incentives for production expansion
		1.3.2	Absence of price controls on domestic food production
		1.3.3	Absence of price controls on fuel oils
		1.3.4	Absence of distorting resettlement policies
		1.3.5	Absence of distorting exchange rate over or under-valuation
	1.4		**A functioning buffer zone exists**
		1.4.1	Low level of conflict at forest management unit (FMU) boundary
		1.4.2	Local respect for FMU boundary
		1.4.3	Forest management (e.g., company, concession) has demonstrated attempts to protect FMU boundaries
	1.5		**Legal framework protects access to forest and forest resources**
		1.5.1	Security of tenure is clear and documented
		1.5.2	Existence of non-confiscatory land use policy
		1.5.3	Existence of property rights for exploited non-timber forest products (NTFPs) (e.g. fuel wood)
		1.5.4	Land tenurial prerequisite policy does not discriminate against forestry
		1.5.5	Efficient equivalence log price/export log price
		1.5.6	Transparent system of concession allocation
	1.6		**Demonstrated reinvestment in forest-use options**
		1.6.1	Absence of excessive capital mobility (promoting 'cut and run')
2			**Maintenance of ecosystem integrity**
	2.1		**The processes that maintain biodiversity in managed forests (FMUs) are conserved**
		2.1.1	Landscape pattern is maintained
		2.1.2	Change in diversity of habitat as a result of human interventions are maintained within critical limits as defined by natural variation and/or regional conservation objectives
		2.1.3	Community guild structures do not show significant changes in the representation of especially sensitive guilds, pollinator and disperser guilds

* Excerpted from Criteria & Indicators Toolbox Series No. 2.

P	C	I	Description
		2.1.4	The richness/diversity of selected groups show no significant change
		2.1.5	Population sizes and demographic structures of selected species do not show significant change, and demographically and ecologically critical life-cycle stages continue to be presented.
		2.1.6	The status of decomposition and nutrient cycling shows no significant change
		2.1.7	There is no significant change in the quality and quantity of water from the catchment
	2.2		**Ecosystem function is maintained**
		2.2.1	No chemical contamination to food chains and ecosystem
		2.2.2	Ecologically sensitive areas, especially buffer zones along watercourses, are protected
		2.2.3	Representative areas, especially sites of ecological importance, are protected and appropriately managed
		2.2.4	Rare or endangered species are protected
		2.2.5	Erosion and other forms of soil degradation are minimised
	2.3		**Conservation of the processes that maintain genetic variation**
		2.3.1	Level of genetic diversity are maintained within critical limits
		2.3.2	There is no directional change in genotypic frequencies
		2.3.3	There are no changes in gene flow/migration
		2.3.4	There are no changes in the mating system
3			**Forest management maintains or enhances fair intergenerational access to resources and economic benefits**
	3.1		**Local management is effective in controlling maintenance of, and access to, the resource**
		3.1.1	Ownership and use rights to resources (inter- and intragenerational) are clear and respect preexisting claims
		3.1.2	Rules and norms of resource use are monitored and successfully enforced
		3.1.3	Means of conflict resolution function without violence
		3.1.4	Access to forest resources is perceived locally to be fair
		3.1.5	Local people feel secure about access to resources
	3.2		**Forest actors have a reasonable share in the economic benefits derived from forest use**
		3.2.1	Mechanisms for sharing benefits are seen as fair by local communities
		3.2.2	Opportunities exist for local and forest-dependent people to receive employment and training from forest companies
		3.2.3	Wages and other benefits conform to national and/or International Labour Organisation (ILO) standards
		3.2.4	Damages are compensated in a fair manner
		3.2.5	The various forest products are used in an optimal and equitable way
	3.3		**People link their and their children's future with management of forest resources**
		3.3.1	People invest in their surroundings (i.e., time, effort, and money)
		3.3.2	Out-migration levels are low
		3.3.3	People recognise the need to balance number of people with natural resource use
		3.3.4	Children are educated (formally and informally) about natural resource management
		3.3.5	Destruction of natural resources by local communities is rare
		3.3.6	People maintain spiritual or emotional links to the land

P	C	I	Description
4			**Concerned stakeholders have acknowledged rights and means to manage forests cooperatively and equitably**
	4.1		**Effective mechanisms exist for two-way communication related to forest management among stakeholders**
		4.1.1	> 50% of timber company personnel and forestry officials speak one or more local language, or > 50% local women speak the national language used by the timber company in local interactions
		4.1.2	Local stakeholders meet with satisfactory frequency, representation of local diversity, and quality of interaction
		4.1.3	Contributions made by all stakeholders are mutually respected and valued at a generally satisfactory level
	4.2		**Local stakeholders have detailed, reciprocal knowledge pertaining to forest resource use (including user groups and gender roles), as well as forest management plans prior to implementation**
		4.2.1	Plans/maps showing integration of uses by different stakeholders exist
		4.2.2	Updated plans, baseline studies and maps are widely available, outlining logging details such as cutting areas and road construction, and include temporal aspects
		4.2.3	Baseline studies of local human systems are available and consulted
		4.2.4	Management staff recognises the legitimate interests and rights of other stakeholders
		4.2.5	Management of NTFP reflects the interests and rights of local stakeholders
	4.3		**Agreement exists on rights and responsibilities of relevant stakeholders**
		4.3.1	Level of conflict is acceptable to stakeholders
5			**The health of the forest actors, cultures and the forest is acceptable to all stakeholders**
	5.1		**There is a recognisable balance between human activities and environmental conditions**
		5.1.1	Environmental conditions effected by human uses are stable or improving
		5.1.2	In-migration and/or natural population increases are in harmony with maintaining the forest
	5.2		**The relationship between forest management and human health is recognised**
		5.2.1	Forest managers cooperate with public health authorities regarding illnesses related to forest management
		5.2.2	Nutritional status is adequate among local populations
		5.2.3	Forest employers follow ILO work and safety regulations and take responsibility for the forest-related health risks of workers
	5.3		**The relationship between forest maintenance and human culture is acknowledged as important**
		5.3.1	Forest managers can explain links between relevant human cultures and the local forest
		5.3.2	Forest management plans reflect care in handling human cultural issues
		5.3.3	There is no significant increase in signs of cultural disintegration
6			**Yield and quality of forest goods and services are sustainable**
	6.1		**Forest management unit is implemented on the basis of legal title on the land, recognised customary rights, or clear lease agreements**
		6.1.1	Documentary evidence of the agreements with local communities under which management is entitled to manage the forest exists
		6.1.2	Information on the identity, location and population of all indigenous and traditional peoples living in the vicinity of the management area or claiming customary rights to the management area exists

P	C	I	Description
		6.1.3	Evidence or statements from the representative organisations of local indigenous or traditional communities defining the extend of their territories exist, and include maps
	6.2		**Management objectives are clearly and precisely described and documented**
		6.2.1	Objectives are clearly stated in terms of the major functions of the forests, with due respect to their spatial distribution
	6.3		**Forest management plan is comprehensive**
		6.3.1	A comprehensive forest management plan exists
		6.3.2	Management take place with appropriate involvement of the stakeholders and takes into account all the components and functions of the forest, such as timber production, NTFP, ecology and well-being of local populations
		6.3.3	Yield regulation by area and/or volume prescribed
		6.3.4	Silvicultural systems prescribed and appropriate to forest type and produce grown
		6.3.5	Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact
		6.3.6	Management plan is periodically submitted to revision
	6.4		**Implementation of the management plan is effective**
		6.4.1	The forest unit is zoned into areas to be managed for various objectives
		6.4.2	Boundaries are marked in the field
		6.4.3	Inventory of all forest uses and products are available
		6.4.4	Workers and staff have adequate training to implement management
		6.4.5	Infrastructure is laid out prior to harvesting and in accordance with prescriptions
		6.4.6	Low residual stand damage
		6.4.7	Rehabilitation of degraded and impacted forest is undertaken in accordance with a code of practice
		6.4.8	Absence of significant off-site impacts such as on down stream water quality/quantity, infrastructure etc.
		6.4.9	Systems for production and transformation of forest products are efficient
	6.5		**An effective monitoring and control system audit's management's conformity with planning**
		6.5.1	Continuous Forest Inventory (CFI) plots are established and measured regularly
		6.5.2	Documentation and record of all forest management and forest activities are kept in forms that enable monitoring
		6.5.3	Worked coupes are protected (e.g. from fire, encroachment and premature re-entry)
		6.5.4	Tree marking of seed stock and potential crop trees is practised
		6.5.5	Results derived from monitoring and research, as well as any additional scientific and technical information, are incorporated into the implementation and revision of the management plan
	6.6		**Equitable distribution and presence of economic rent**
		6.6.1	Estimated government rent capture
		6.6.2	Estimated operator (manager) rent capture
		6.6.3	Estimated forest local dwellers rent capture

FURTHER READING

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9.2 – ANOTHER EXAMPLE OF A FOREST MANAGEMENT UNIT-LEVEL SET OF C&I (EXTERNAL TO CIFOR)

9.2.1 LEMBAGA EKOLABEL INDONESIA

The Indonesia Ecolabeling Institute (LEI) describes itself as follows.[33]

> The Indonesia Ecolabeling Institute is a non-profit organization whose duties are: (1) to increase Indonesia's commitment in implementing sustainable development, (2) to act in a proactive way in selecting a system of sustainable forest management, and (3) to create an ecolabel certification process which will earn recognition from other countries. It is hoped that with the formation of one certification body in Indonesia, a shared vision and ideas of assessing the performance of a forest management unit will become a reality. This is a necessary condition if the objective is an efficient certification process, for only one set of agreed criteria and indicators of sustainable forest management.

One aspect of LEI's efforts is the development of the following set of principles criteria and indicators.[34]

33 From the web-page of LEI at http://www.iscom.com/~ekolabel/buku0.html (6 October 1997)

34 Excerpted from http://www.iscom.com/~ekolabel/buku1.html (2 October 1997)

Principles Related to Sustaining the Yield of Forest Products

Principle #1 **Certainty of Land Tenure**	**Criterion 1** **Clear Boundaries** The boundary around the forest area must be clear and understood by all relevant parties. The forest area consists of both the outer concession area and the inner area, comprising of (1) the annual and five year activities' block, (2) the conservation area and (3) the area allocated to the local community. **Criterion 2** **A Conflict-free Area** The process of setting boundaries must include the participation of the local community to reach a jurisdictional consensus, to overcome the possibility of conflicts arising out of the process. **Criterion 3** **The Concessionaires must ensure forest resource security** The huge resources in the forest must be protected. The responsibility to do this is the concessionaire's.
Principle #2 **Sustaining the Products of the Forest** A silvicultural system is to be applied in managing the forest. This system will enable the management unit to sustain the yield of forest products. This must be a system whereby a product harvesting system is applied to achieve efficiency in forest exploitation.	**Criterion 1** **Exploitation of the Products of the Forest must take into account the Forest's Capacity** The production and annual harvesting cycle must enable the forest to produce again at either the same level or greater than the previous period. **Criterion 2** **Efficiency in Harvesting the Products of The Forest** Harvesting activities must be supported by the level of forest clearing activities that will minimize impact and ensure orderliness throughout the year. Logging waste must be kept at the lowest level possible.
Principle #3 **Sustaining the Economic Value for Stakeholders** Management of the forest must also create economical value, both for the management unit, the local community and also for development of the area. To turn this idea into a reality, forest management has to be left to professional managers and run professionally.	**Criterion 1** **Increase in Positive Economic Impact in Stakeholders** Exploitation of the resources of the forest must benefit the entrepreneurs, while at the same time creating added value to the community and regional development. **Criterion 2** **Forest Management Must be Supported by Professionals** The number and qualifications of forest management professionals must be sufficient to achieve the objectives of SFM.

Principles Related to Sustaining the Forest Ecosystem

Principle #1
Regeneration, Ecology and the Stability of the Ecosystem

Regenerative capacity is the ability of an ecosystem to recover after a disturbance. Stability of the ecosystem is defined as a dynamic balance of the size and structure of the ecosystem. A disturbance in the regenerative capacity and stability of the ecosystem signals a large deviation in the ecosystem. The deviation may be permanent or, at best, hard to recover from.

Criterion 1

Maintaining the Forest as a Means to Support Life

One function of the forest is to support life. This function may be maintained if a part of the ecosystem of the original forest and its germplasm is conserved. There must also be a means whereby this ecosystem is connected to other ecosystems, possibly through of a buffer zone and a wildlife corridor. The better the original ecosystem is maintained, the better will be the ecosystem's life-supporting function.

Criterion 2

Maintaining the Forest as a Center of Biodiversity

The forest also functions as a center of biological diversity and this function must be maintained. The actual and potential value of the forest is priceless. This function may be prolonged if logging impacts are kept at a minimum and most of the original species are conserved.

Principle #2
Keystone Species Survival

Keystone species are those species that have a large influence on the existence of other species in the ecosystem. If the keystone species become extinct, other species in the same food chain will become extinct as well. Usually, keystone species are easily identifiable as species that are forest-dependent. The higher the abundance of the keystone species in an ecosystem of an exploited forest, the lower is the level of negative impacts from logging activities.

Criterion 1

Abundance of Keystone Species

Abundance of keystone species determines the quality of the forest ecosystem. Success in preserving the existence of keystone species at a viable population level will indicate the efforts to preserve the forest's ecosystem from destruction due to logging activities.

Principles Related to Sustaining the Socio-Cultural Function of the Forest

Principle #1
Equity

Equity refers to the distributional concept of the ideology of the state and the development. What this means is that resources of the forest are viewed as a concern related to the livelihood of the nation. Therefore, equity management must aim at an improvement in the welfare of the nation.

The framework is actually identical to the one used in the Bina Desa program (Decree of the Minister of Forestry no. 691/Kpts II/1991) SUDAH DIHAPUSKAN; DIGANTI DENGAN SK 69, 1995 TENTANG KEWAJIBAN HPH that clearly states the responsibility of the concessionaires to try to improve the welfare of the local communities. On the other hand, there is inter-generation equity, specifically for those whose livelihoods depend on the products of the forest, and face being excluded from the forest, thus bearing the cost of forest extraction. The condition whereby people have to sacrifice their livelihood dependence on the forest is not in line with the framework of sustainable development. The right to live off the forest must be enjoyed by generations to come, not only ours. In forest management, the right to choose to live off the forest for generations to come must be taken into account.

Criterion 1

Certainty of the Traditional Rights and Interests of the Local Communities

Usually, there are already people in the concession location before forest exploitation activities began. Their lives have certain patterns and depend on the products of the forest. A social infrastructure is also in place and carries with it certain forest-related norms and values. The infrastructure plays an important part, both in defending the existence of the community as an entity, and as an identity for its members. The forest management unit must be able to maintain the existence of the essential social infrastructure for the continued existence of the community. This may be done through making the infrastructure an integral part of both the management and the selection of the activities of the management unit. This will reduce the possibility of disruptive conflicts.

Criterion 2

Continued Access to, and Control of, the Products of the Forest

The local community depends upon the forest for part of their livelihood. This dependence is determined by the level of access and control to the forest. Without access to the forest, the community will not be able to continue with their lives. They will also lose this feeling of ownership and also their pride and honor. It is, therefore, imperative that the community continues to have access to and control of the products of the forest that are an integral part of their lives and have been theirs traditionally. Without the access and control, it is impossible to maintain security and order in the area.

Criterion 3

The Presence of the Concessionaires Must Give the Community a Chance to Improve Their Quality of Life

The objective of the development of the forest industry is ultimately to increase the economical well-being of the Indonesian people. People who live inside and around the concession area are a part of the Indonesian people who have lived there for years. It follows, therefore, that they should benefit directly from the results of the development of the forest. Without an increase in the well-being of the local community, any effort to manage the exploitation of the forest's products will be highly problematic.

Criterion 4

The Local Community Must be Able to Increase its Economical and Social Independence through the Facilities and Infrastructure Support of the Management Unit

Development is directed towards making it possible both for the individual and group to improve life as a citizen of a free country. The life of the population of a free country experiences full of freedom and independence. If an independent economic and social life does not exist, then there is a possibility of dependency between the people and the management unit. On the other hand, without any assistance, the level of conflict will increase.

Principle #2
Community Participation

The management unit is generally a newcomer to the area, while the local community has been there since long before. It is, therefore, right that the management unit should include the community in its activities. A 1993 decree by the Minister of Forestry has stated that the management unit must honor and respect the traditional rights of the community.

Criterion 1

The Knowledge of the Community in Forest Management-related Matters Must be Integrated into the SFM

The community, with their forest-dependent traditional and integrated life has an excellent understanding and knowledge of the forest. The management unit must view this knowledge as an asset to be used in the SFM. Without making use of this rich resource, valuable knowledge will be underutilized. Time lag in understanding may also cause the extinction of important species.

Criterion 2

Participation of the Community in the Decision Making

Just like any other free citizen of Indonesia, the community has an equal right to determine its future. Therefore, the community must have a say in any matters that will change their lives. If the management unit has a policy or program that will influence the way the community lives, then they must provide the community with a chance to choose how they want to live their life. Without any compromise between what the management unit wants and what the community wants, it is very likely that conflicts will arise and the management unit will face some hard times ahead.

9.3 – EXAMPLES OF FRAMEWORK C&I FOR FMU

9.3.1 THE INTERNATIONAL TROPICAL TIMBER ORGANIZATION (ITTO)

The International Tropical Timber Organization (ITTO) was created by treaty in 1983. The primary goal is to provide an effective framework for consultation among producer and consumer member countries on all aspects of the world timber economy within its mandate. Among its multiple objectives is a commitment to assist Members to meet ITTO's unique Year 2000 Objective, which states that by the year 2000 all tropical timber products traded internationally by Member States shall originate from sustainably managed forests. The governing body is the International Tropical Timber Council, composed of all 53 Members and meeting twice a year. On 1 January, 1997, the International Tropical Timber Agreement 1994, entered into force.[35]

As a part of its efforts to encourage the sustainable management of forests, the ITTO developed the following criteria and indicators. The following text is taken from ITTO sources.[36]

Criterion 1: Enabling Conditions for Sustainable Forest Management

This criterion covers the general institutional factors that are necessary for actions included under the other criteria to succeed, addressing institutional capacity in policy, legislation, financial resources, research, trained personnel, education and training, mechanisms for consultation and participation etc. Many of the indicators are necessarily descriptive. Taken together, they demonstrate a political commitment at the highest level. It would be useful if countries could supplement the indicators by providing relevant documentation.

35 This paragraph was adapted from the ITTO web-page http://www.itto.or.jp (6 October 1997).

36 The following were taken from the Report of the ITTO expert panel on criteria and indicators. Yokohama, September, 1997. Appendix 4: Criteria and indicators for the measurement of sustainable management of natural tropical forests. Part III. Criteria and indicators.

Indicators		National	FMU
Legal Framework			
1.1	Existence of a forest policy ensuring a balanced use of the forest resources of the country.	+	-
1.2	Existence of legal framework (laws, regulations, etc.) to govern:		
	the establishment and security of the permanent forest estate,	+	-
	the control of forest management,	+	-
	the control of forest harvesting, and	+	-
	health and safety.	+	-
Economic Framework			
1.3	Availability of financial resources (budget) for necessary expenditure, and for investment and reinvestment in forest management, administration, research and human resource developed from:		
	national resources,	+	+
	Bali Partnership Fund, and	+	+
	other international contributions.	+	+
1.4	Adequate institutional structure to support sustainable forest management.	+	+
1.5	Number and adequacy of trained professional and technical personnel at all levels to perform the necessary tasks to ensure sustainable forest management.	+	+
1.6	Number of professional personnel to support the various aspects of sustainable forest management:		
	research, and	+	-
	extension.	+	+
1.7	Existence of adequate technology to practise sustainable forest management and the efficient conversion of forest produce.	+	+
1.8	Existence of internal checking mechanisms and capacity for periodical monitoring, evaluation and feedback on progress towards sustainable forest management.	+	+
1.9	Degree of public participation at various levels of forest management, such as planning, decision making and monitoring of progress towards sustainable forest management.	+	+
1.10	Adequate and timely information to increase public awareness about forest policies, legislation and sustainable forest management practices.	+	+

Criterion 2: Forest Resource Security

This criterion on Forest Resource Security is concerned with the areal extent of forests, one of the basic foundations for sustainable forest practices. Sustainable forest management is a long-term endeavour and depends, among other things, upon the stability and security of a country's forest estate. This criterion, therefore, considers comprehensively the extent to which there is a secure and permanent forest estate, consisting of both natural and plantation forests, sufficient to fulfil production, protection, biological diversity conservation, and social, cultural and economic functions. It should, also, be adequate to meet the aspirations of present and future generations for forest goods and services in the overall context of national economic planning, and in the quest to achieve sustainable development. Related legal and institutional aspects are included under Criterion 1.

Indicators		National	FMU
Description of Resource Base			
2.1	Extent and percentage of total area, and expressed in a time series:		
	under natural forest,	+	+
	under plantation forest,	+	+
	under permanent forest estate secured by legislation, and	+	+
	under comprehensive integrated land-use plans.	+	-
2.2	Extent and percentage of external boundaries of the permanent forest estate demarcated or clearly defined.	+	+
2.3	The extent and nature of:		
	illegal exploitation,	+	+
	encroachment,	+	+
	re-entry,	+	+
	slash and burn,	+	+
	illegal hunting, and	+	+
	mining.	+	+
2.4	Area of the permanent forest estate converted to permanent non-forest use, and expressed in a time series.	+	-
2.5	Increase in area of legally established permanent forest estate, and expressed in a time series.	+	-
Protection Procedures			
2.6	Existence of policies, strategies and procedures to control encroachment into forest.	+	-

Criterion 3: Forest Ecosystem Condition

This criterion is concerned with quality of the forest and lays the foundation for the efficient biological functioning of the forest ecosystem, considered independently of its species composition. The condition of any forest ecosystem can be changed by both human actions and natural events. Examples of the former are pollution, the excessive and persistent removal of biomass, changes in tree cover and the compaction of soil by machinery; of the latter, wildfires, flooding or cyclones. Not all of these factors may apply in a particular country or forest type; and each country should select those that have a significant effect on the sustainable management of its forests.

Accurate quantitative measurements of soil and productivity variables can only be obtained by the periodic recording of permanent sample plots; but a qualitative assessment can be made of some indicators by careful observation, for example, by a comparison of harvested areas with a representative area of undisturbed forest in the same forest type. Others, such as fire damage may be detectable by remote sensing techniques. Quantitative changes at the national level can only be assessed by examining a stratified sample of measurements made in the forest at the forest management unit level.

In many countries, suitable data may not be readily available. In such cases, each country should judge for itself whether the issues are of sufficient importance for the future of its forests to warrant the expenditure of time and money required to obtain adequate data.

Indicators		National	FMU
Disturbance and Stress			
3.1	Area and degree of damage, and expressed in a time series, caused by:		
	(a) fire,	+	+
	(b) drought,	+	+
	(c) storms or natural catastrophes, and	+	+
	(d) other causes such as change in hydrological regime, pollution, browsing and grazing.	+	+
Conservation and Protection Procedures			
3.2	Availability of prescriptions for forest road layout, including drainage requirements and conservation of buffer strips along streams and rivers.	+	+
3.3	Presence of procedures:		
	(a) to protect the soil from compaction by harvesting machinery during periods of high soil moisture,	+	+
	(b) to protect the soil from erosion during harvesting operations, and for low impact logging to reduce damage to the residual stand.	+	+
3.4	Existence of quarantine and phytosanitary procedures to prevent the introduction of pests and diseases.	+	-
3.5	Existence of procedures to prevent the introduction of potentially harmful exotic species.	+	-
Climatic Effects			
3.6	Temperature sums, as a means of assessing climate change, and moisture indices.	+	-
3.7	Total carbon storage in forest stands and change in the storage.	+	-

Criterion 4: Flow of Forest Produce

This criterion is concerned with forest management for the production of wood and of non-wood forest products. Such production can only be sustained in the long-term if it is economically and financially viable. Returns on this produce should reflect, among others, full replacement costs, including environmental and social costs.

Forests earmarked for production are able to fulfil a number of other important forest functions, such as environmental protection and, to a varying degree, the conservation of biological diversity. These multiple roles of for-

est should be safeguarded by the application of sound management practices that maintain the potential of the forest resource to yield the full range of benefits to society.

Indicators		National	FMU
Resource Assessment			
4.1	Area and percentage of forest for which inventory and survey procedures have been used to define:		
	(a) major forest products	+	+
	(b) resource rights and ownership, and	+	+
	(c) quantity of each product.	+	+
4.2	Estimate of sustainable harvest (cut) for each major wood and non-wood forest product.	+	+
4.3	Statistics for wood and important non-wood forest products, expressed in a time series, by:		
	(a) area,	+	+
	(b) forest type, and	+	+
	(c) quantity of harvest.	+	+
Planning Procedures			
4.4	Extent and percentage of production forest covered by integrated management plans which include all the elements identified in indicators 4.3–4.9, and which take into account the environmental effects identified in Criteria 5 and 6.	+	+
4.5	Extent of compartments/coupes harvested that have detailed harvesting (operation) plans prepared before harvesting (including areas to be harvested, area to be protected, location of roading and tracking systems, etc.) (See also Criterion 3.2).	+	+
4.6	Existence of long-term projections, strategies and plans for production, including the use of tree plantations.	+	-
4.7	Availability of records covering the extent and nature of forest management across the permanent forest estate.	+	-
Management Prescriptions			
4.8	Availability of management prescriptions for each of the major wood and non-wood forest products to be harvested.	+	+
4.9	Availability of procedures to monitor and review the basis of prescriptions	+	+
4.10	Existence of procedures to supplement natural regeneration where this is not effective.	+	+
Monitoring and Evaluation Procedures			
4.11	Percentage of area harvested, for which comprehensive (written) evaluation of the completeness of prescription implementation is available.	+	+
4.12	Percentage of area harvested for which post-harvest surveys are conducted, and percentage of those areas which have effective regeneration in all size classes, including seedlings.	+	+

Criterion 5: Biological Diversity

The ITTO guidelines on the Conservation of Biological Diversity in Tropical Production Forests (ITTO Policy Development Series No. 5) spell out the general principles to govern the conservation of biological diversity in tropical forests.

National measures should include the following:

- The establishment and management of a system of protected areas (combinations of IUCN Categories I to VI) containing representative samples of all forest types in the country. The system should, as far as possible, include samples of forests in their original or near-original condition. Historical records should be used where these exist. If forest types are known to have disappeared, efforts should be made to rehabilitate them. The effectiveness of such a system depends upon the total area protected, the percentage of each forest type covered, their representativeness, their size relative to the area of forest type and landscape, their setting (comprising the other ecosystems that surround them), and the existence of biological corridors linking them or 'stepping stones' between them. This can be ensured by effective policies for national land use, forest land use and for protected areas, supported by appropriate legislation and effective mechanism for implementation and enforcement.

- The effective protection of important species, especially those that are endangered, rare or threatened should be undertaken at national level, by effective wildlife legislation; and, at the level of the forest management unit, by management prescriptions.

- The conservation, at an appropriate level, of the biological diversity in those forests managed primarily for production,

both to contribute to forest quality (see Criterion 3 – Forest Ecosystem Condition) and to provide a setting for the protected areas which enables them to be most effective. Such conservation is ensured by management prescriptions for the forests in question. Efforts should be made to conduct harvesting in such a way that the original forest structure is maintained as far as possible. Detailed guidelines are given in the ITTO publication cited above (Recommended Actions 8–17).

Indicators		National	FMU
Ecosystem Diversity			
5.1	Statistics, for each forest type in the country, of protected areas of forest in each of the IUCN protected area categories I to VI. These statistics should cover:		
	(a) number of protected areas in each forest type,	+	-
	(b) total area covered by in each forest type,	+	-
	(c) range of sizes and average size of protected area in each forest type,	+	-
	(d) percentage of forest type covered,	+	-
	(e) percentage of boundaries demarcated or clearly defined, and	+	-
	(f) presence of biological corridors or 'stepping stones' between protected areas.		
Species Diversity			
5.2	Existence of procedures to identify the endangered, rare and threatened species of forest flora and fauna.	+	+
5.3	Number of endangered, rare or threatened species and the percentage of these in relation to the total number of species of the forest. Lists should be appended if available.	+	+
Genetic Diversity			
5.4	Presence of a strategy to implement *in situ* and/or *ex situ* genetic conservation of any commercial, endangered, rare and threatened species of forest flora and fauna.	+	+
5.5	Presence and implementation of management prescriptions to:		
	(a) keep undisturbed a part of each production forest,	+	+
	(b) protect endangered, rare and threatened species of forest flora and fauna, and	+	+
	(c) protect features of special biological interest, such as seed trees, nesting sites, niches and keystone species.	+	+
Monitoring and Evaluation Procedures			
5.6	A measure of the biological diversity preserved in the production forests, and of forest structure, derived from repeated standard sample surveys of selected groups of species conducted both in harvested areas and in areas kept free of human intervention.	+	+

Criterion 6: Soil and Water Protection

This criterion deals with the regularly function of the forest, especially in relation to off-site values. Soil and water protection is important for maintaining the productivity and quality of the forest ecosystem (see Criterion 3 — Forest Ecosystem Condition); but a well-managed forest also plays a very significant role in maintaining the stability of flow and the quality of water in the streams that emerge from it and in protecting areas downstream from the effects of periodic flooding and accelerated soil loss. The environmental and social effects of mismanagement can be very serious and very costly to restore.

Each forest management unit has its own characteristics in this respect (slope, geological structure and the inherent erodibility of the soil type). The protection of soil and water is therefore best ensured by specific guidelines for different situations which can only be based on experience and research. Valid national indicators can only be derived from the aggregation of indicators at the level of the forest management unit, or from the fact that adequate guidelines exist and are properly enforced.

Indicators		National	FMU
Extent of Protection			
6.1	Percentage of total forest area managed primarily for the protection of soil and water	+	+
6.2	Percentage of area to be harvested for which off-site catchment values have been defined and documented before planning of harvesting.	+	+
6.3	Percentage of area to be harvested which has been defined as environmentally sensitive (e.g., very steep or erodible) before planning of harvesting.	+	+
6.4	Percentage of area to be harvested for which drainage systems have been demarcated or clearly defined before harvesting.	+	+
6.5	Percentage of total area occupied by buffer zones along water courses, waterbodies and other areas, as appropriate, such as mangroves and other wetlands.	+	+
6.6	Percentage of total area of buffer zones along streams protected during forest harvesting.	+	+
Protection Procedures			
6.7	Availability of procedures covering:		
	(a) use of chemicals in the forest, and	+	+
	(b) fire management.	+	+

Criteria 7: Social, Cultural and Economic Effects

This criterion deals with the social, cultural and economic effects of sustainably managed forests, besides those mentioned under Criterion 4 — Flow of Forest Produce, Criterion 5 — Biological Diversity and Criterion 6 — Soil and Water Protection/Maintenance.

A well-managed forest is a constantly self-renewing resource which, if economically viable, will produce a range of social, cultural and economic effects, making an important contribution to the sustainable development of the country.

Indicators		National	FMU
Economic Effects			
7.1	Total investment in the forestry and related sectors, and expressed in a time series.	+	+
7.2	Amount of direct and indirect employment in the forestry and related sectors as percentages of total employment, and expressed in a time series.	+	+
7.3	Volume and value of wood and non-wood forest products traded in:		
	(a) the domestic market, and	+	+
	(b) international market,	+	+
	and expressed in a time series.		
7.4	Volume and value of wood and non-wood forest products, including fuelwood for subsistence use.	+	+
7.5	Existence of mechanism for the efficient distribution of incentive and the fair and equitable sharing of costs and benefits by the parties involved.	+	+
7.6	Ration of domestic log production to the processing capacity of wood-based industries, and expressed in a time series.	+	-
7.7	Efficiency of utilization:		
	(a) percentage of utilisable volume left in the forest harvesting, and	+	+
	(b) recovery rates of wood processing mills.	+	+
7.8	Value and percentage contribution of the forestry sector to Gross National Product, and expressed in a time series.	+	-
7.9	Number of people dependent on forests for traditional and customary lifestyles.	+	+
7.10	Number of forest recreational sites established and available for use by the general public and the number of visitors to these sites.	+	+
7.11	Numbers of forest sites available for:		
	(a) research, and	+	-
	(b) education.	+	-
7.12	Areas of forest fruit trees and other tree species managed for the direct use and benefit of local communities, and expressed in a time series.	+	+
Cultural Effects			
7.13	Number of important archaeological and cultural sites identified, mapped and protected.	+	+
Community Participation			
7.14	Extent to which tenure and user rights over the forests are documented.	+	-
7.15	Existence of procedures whereby forest planning and management practices and processes consider and meet legal or customary rights with respect to indigenous people and local communities, forest dwellers and other forest-dependent communities.	+	+
7.16	Extent of participation by indigenous people and local communities, forest dwellers and other forest-dependent communities in forest-based economic activities.	+	+
7.17	Number of agreements involving local communities in co-management responsibilities in the field of sustainable forest management.	+	-

9.3.2 FOREST STEWARDSHIP COUNCIL (FSC)

The FSC, is an international NGO composed of representatives from the scientific community, indigenous peoples, business and other NGOs. It strives to be an international institution for accrediting national and local certification systems. Principles and criteria established by the FSC in early 1994 cover not only forest-management practices, but also the social and legal aspects of forest use, compliance with national laws and international agreements, legal land tenure, indigenous peoples' rights to the forest resources on their lands, the well-being of workers, and the social impact of forestry activities in the community. The FSC secretariat has released guidelines for certifiers and a description of the process that it will adopt to accredit them. Independence from interest groups and open, accountable process are among the prerequisites for accreditation.[37]

Following are the principles and criteria developed by the FSC. Principles 1–9 were ratified by the Council's Founding Members and Board of Directors in September 1994. Principle 10 was ratified by the FSC Members and Board of Directors in February 1996.

Principle #1

Compliance with Laws and FSC Principles

Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.

- 1.1 Forest management shall respect all national and local laws and administrative requirements.
- 1.2 All applicable and legally prescribed fees, royalties, taxes and other charges shall be paid.
- 1.3 In signatory countries, the provisions of all binding international agreements such as CITES, ILO Conventions, ITTA, and Convention on Biological Diversity, shall be respected.
- 1.4 Conflicts between laws, regulations and the FSC Principles and Criteria shall be evaluated for the purposes of certification, on a case by case basis, by the certifiers and the involved or affected parties.
- 1.5 Forest management areas should be protected from illegal harvesting, settlement and other unauthorized activities.
- 1.6 Forest managers shall demonstrate a long-term commitment to adhere to the FSC Principles and Criteria.

37 This paragraph adapted from a summary provided by the World Resources Institute at http://www.igc.apc.org/wri/biodiv/oppbx2.html#FSC (6 October 1997).

Principle #2 **Tenure and Use Rights and Responsibilities** Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.	2.1 Clear evidence of long-term forest use rights to the land (e.g. land title, customary rights, or lease agreements) shall be demonstrated. 2.2 Local communities with legal or customary tenure or use rights shall maintain control, to the extent necessary to protect their rights or resources, over forest 2.3 Appropriate mechanisms shall be employed to resolve disputes over tenure claims and use rights. The circumstances and status of any outstanding disputes will be explicitly considered in the certification evaluation. Disputes of substantial magnitude involving a significant number of interests will normally disqualify an operation from being certified.
Principle #3 **Indigenous People's Rights** The legal and customary rights of indigenous people to own, use and manage their lands, territories, and resources shall be recognised and respected.	3.1 Indigenous peoples shall control forest management on their lands and territories unless they delegate control with free and informed consent to other agencies. 3.2 Forest management shall not threaten or diminish, either directly or indirectly, the resources or tenure rights of indigenous peoples. 3.3 Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers. 3.4 Indigenous peoples shall be compensated for the application of their traditional knowledge regarding the use of forest species or management systems in forest operations. This compensation shall be formally agreed upon with their free and informed consent before forest operations commence.
Principle #4 **Community Relations and Workers' Rights** Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.	4.1 The communities within, or adjacent to, the forest management area should be given opportunities for employment, training and other services. 4.2 Forest management should meet or exceed all applicable laws and/or regulations covering health and safety of employees and their families. 4.3 The rights of workers to organize and voluntarily negotiate with their employers shall be guaranteed as outlined in Conventions 87 and 98 of the International Labour Organisation (ILO). 4.4 Management planning and operations shall incorporate the results of evaluations of social impact. Consultations shall be maintained with people and groups directly affected by management operations. 4.5 Appropriate mechanisms shall be employed for resolving grievances and for providing fair compensation in the case of loss or damage affecting the legal or customary rights, property, resources, or livelihoods of local peoples. Measures shall be taken to avoid such loss or damage.

Principle #5
Benefits from the Forest

Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

5.1 Forest management should strive toward economic viability, while taking into account the full environmental, social and operational costs of production, and ensuring the investments necessary to maintain the ecological productivity of the forest.

5.2 Forest management and marketing operations should encourage the optimal use and local processing of the forest's diversity of products.

5.3 Forest management should minimize waste associated with harvesting and on-site processing operations and avoid damage to other forest resources.

5.4 Forest management should strive to strengthen and diversify the local economy, avoiding dependence on a single forest product.

5.5 Forest management operations shall recognize, maintain and, where appropriate, enhance the value of forest services and resources such as watersheds and fisheries.

5.6 The rate of harvest of forest products shall not exceed levels which can be permanently sustained.and Criteria.

Principle #6
Environmental Impact

Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes and, by so doing, maintain the ecological functions and the integrity of the forest.

6.1 Assessment of environmental impacts shall be completed — appropriate to the scale, intensity of forest management and the uniqueness of the affected resources — and adequately integrated into management systems. Assessments shall include landscape level considerations as well as the impacts of on-site processing facilities. Environmental impacts shall be assessed prior to commencement of site-disturbing operations.

6.2 Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g., nesting and feeding areas). Conservation zones and protection areas shall be established, appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collecting shall be controlled.

6.3 Ecological functions and values shall be maintained intact, enhanced or restored, including:

1. Forest regeneration and succession
2. Genetic, species, and ecosystem diversity
3. Natural cycles that affect the productivity of the forest ecosystem

6.4 Representative samples of existing ecosystems within the landscape shall be protected in their natural state and recorded on maps, appropriate to the scale and intensity of operations and the uniqueness of the affected resources.

6.5 Written guidelines shall be prepared and implemented to: control erosion; minimize forest damage during harvesting, road construction, and all other mechanical disturbances; and protect water resources.

6.6 Management systems shall promote the development and adoption of environmentally friendly non-chemical methods of pest management and strive to avoid the use of chemical pesticides. World Health Organization Type 1A and 1B and chlorinated hydrocarbon pesticides; pesticides that are persistent, toxic or whose derivatives remain biologically active and accumulate in the food chain beyond their intended use; as well as any pesticides banned by international agreement, shall be prohibited. If chemicals are used, proper equipment and training shall be provided to minimize health and environmental risks.

6.7 Chemicals, containers, liquid and solid non-organic wastes including fuel and oil shall be disposed of in an environmentally appropriate manner at off-site locations.

6.8 Use of biological control agents shall be documented, minimized, monitored and strictly controlled in accordance with national laws and internationally accepted scientific protocols. Use of genetically modified organisms shall be prohibited.

6.9 The use of exotic species shall be carefully controlled and actively monitored to avoid adverse ecological impacts.

Principle #7
Management Plan

A management—appropriate to the scale and intensity of the operations—shall be written, implemented, and kept up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.

7.1 The management plan and supporting documents shall provide:

1. Management objectives.
2. Description of the forest resources to be managed, environmental limitations, land use and ownership status, socioeconomic conditions, and a profile of adjacent lands.
3. Description of silvicultural and/or other management system, based on the ecology of the forest in question and information gathered through resource inventories.
4. Rationale for rate of annual harvest and species selection.
5. Provisions for monitoring of forest growth and dynamics.
6. Environmental safeguards based on environmental assessments.
7. Plans for the identification and protection of rare, threatened and endangered species.
8. Maps describing the forest resource base including protected areas, planned management activities and land ownership.
9. Description and justification of harvesting techniques and equipment to be used.

7.2 The management plan shall be periodically revised to incorporate the results of monitoring or new scientific and technical information, as well as to respond to changing environmental, social and economic circumstances.

7.3 Forest workers shall receive adequate training and supervision to ensure proper implementation of the management plan.

7.4 While respecting the confidentiality of information, forest managers shall make publicly available a summary of the primary elements of the management plan, including those listed in Criterion 7.1.

Principle #8 **Monitoring and Assessment** Monitoring shall be conducted—appropriate to the scale and intensity of forest management—to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.	8.1 The frequency and intensity of monitoring should be determined by the scale and intensity of forest management operations as well as the relative complexity and fragility of the affected environment. Monitoring procedures should be consistent and replicable over time to allow comparison of results and assessment of change. 8.2 Forest management should include the research and data collection needed to monitor, at a minimum, the following indicators: 1. Yield of all forest products harvested 2. Growth rates, regeneration and condition of the forest 3. Composition and observed changes in the flora and fauna 4. Environmental and social impacts of harvesting and other operations 5. Costs, productivity and efficiency of forest management 8.3 Documentation shall be provided by the forest manager to enable monitoring and certifying organizations to trace each forest product from its origin, a process known as the 'chain of custody'. 8.4 The results of monitoring shall be incorporated into the implementation and revision of the management plan. 8.5 While respecting the confidentiality of information, forest managers shall make publicly available a summary of the results of monitoring indicators, including those listed in Criterion 8.2.
Principle #9 **Maintenance of Natural Forest** Primary forests, well-developed secondary forests and sites of major environmental, social or cultural significance shall be conserved. Such areas shall not be replaced by tree plantations or other land uses.	9.1 Trees planted in natural forests may supplement natural regeneration, fill gaps or contribute to the conservation of genetic resources. Such plantings shall not replace or significantly alter the natural ecosystem. 9.2 The use of replanting as a technique for regenerating stands of certain natural forest types may be appropriate under certain circumstances. Guidelines on the acceptable intensity and spatial extent of tree planting will be addressed in national and regional forest management standards to be approved by the FSC. In the absence of such national or regional standards, guidelines developed by the certifier and approved by the FSC will prevail.

Principle #10
Plantations

Plantations shall be planned and managed in accordance with Principles and Criteria 1–9, and Principle 10 and its Criteria. While plantations can provide an array of social and economic benefits, and contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests.

10.1 The management objectives of the plantation, including natural forest conservation and restoration objectives, shall be explicitly stated in the management plan, and clearly demonstrated in the implementation of the plan.

10.2 The design and layout of plantations should promote the protection, restoration and conservation of natural forests, and not increase pressures on natural forests. Wildlife corridors, streamside zones and a mosaic of stands of different ages and rotation periods, shall be used in the layout of the plantation, consistent with the scale of the operation. The scale and layout of plantation blocks shall be consistent with the patterns of forest stands found within the natural landscape.

10.3 Diversity in the composition of plantations is preferred, so as to enhance economic, ecological and social stability. Such diversity may include the size and spatial distribution of management units within the landscape, number and genetic composition of species, age classes and structures.

10.4 The selection of species for planting shall be based on their overall suitability for the site and their appropriateness to the management objectives. In order to enhance the conservation of biological diversity, native species are preferred over exotic species in the establishment of plantations and the restoration of degraded ecosystems. Exotic species, which shall be used only when their performance is greater than that of native species, shall be carefully monitored to detect unusual mortality, disease, or insect outbreaks and adverse ecological impacts.

10.5 A proportion of the overall forest management area, appropriate to the scale of the plantation and to be determined in regional standards, shall be managed so as to restore the site to a natural forest cover.

10.6 Measures shall be taken to maintain or improve soil structure, fertility, and biological activity. The techniques and rate of harvesting, road and trail construction and maintenance, and the choice of species shall not result in long term soil degradation or adverse impacts on water quality, quantity or substantial deviation from stream course drainage patterns.

10.7 Measures shall be taken to prevent and minimize outbreaks of pests, diseases, fire and invasive plant introductions. Integrated pest management shall form an essential part of the management plan, with primary reliance on prevention and biological control methods rather than chemical pesticides and fertilizers. Plantation management should make every effort to move away from chemical pesticides and fertilizers, including their use in nurseries. The use of chemicals is also covered in Criteria 6.6 and 6.7.

10.8 Appropriate to the scale and diversity of the operation, monitoring of plantations shall include regular assessment of potential on-site and off-site ecological and social impacts, (e.g. natural regeneration, effects on water resources and soil fertility, and impacts on local welfare and social well-being), in addition to those elements addressed in principles 8, 6 and 4. No species should be planted on a large scale until local trials and/or experience have shown that they are ecologically well-adapted to the site, are not invasive, and do not have significant negative ecological impacts on other ecosystems. Special attention will be paid to social issues of land acquisition for plantations, especially the protection of local rights of ownership, use or access.

9.4 – REGIONAL FRAMEWORK SETS OF C&I

9.4.1 MONTREAL PROCESS

The Montreal process has been summarised as follows:[38]

> The Montreal Process Working Group was established with the specific purpose of developing and implementing internationally agreed C&I for sustainable forest management. The group has developed a comprehensive set of 7 criteria and 67 indicators for the conservation and sustainable management of temperate and boreal forests.
>
> The history of the Montreal Process began when Canada convened an International Seminar of Experts on Sustainable Development of Boreal and Temperate Forests, following the UN Conference on Environment and Development (UNCED), held in Rio de Janiero in June 1992. The seminar, held in Montreal, Canada, in September 1993 focussed specifically on the development of criteria and indicators for the sustainable management of temperate and boreal forests and provided the conceptual basis for subsequent regional and international work on criteria and indicators (C&I).
>
> This initiative led to the formation in June 1994 of the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests, now known as the 'Montreal Process' Working Group.

38 The following three paragraphs were taken from the following web page of the Australian Department of Primary Industries and Energy http://www.dpie.gov.agfor/forests/montreal/international.html. The Montreal process C&I can be obtained at http://www.dpie.gov.agfor/forests/montreal/c-i.html.

Criterion 1 **Conservation of Biological Diversity** Biological diversity includes the elements of the diversity of ecosystems, the diversity between species, and genetic diversity in species.	**Indicators:** **Ecosystem diversity** a. Extent of area by forest type relative to total forest area-(a);[39] b. Extent of area by forest type and by age class or successional stage-(b); c. Extent of area by forest type in protected area categories as defined by IUCN[40] or other classification systems-(a); d. Extent of areas by forest type in protected areas defined by age class or successional stage-(b); and e. Fragmentation of forest types-(b). **Species diversity** a. The number of forest-dependent species-(b); and b. The status (threatened, rare, vulnerable, endangered or extinct) of forest dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment-(a) . **Genetic diversity** a. Number of forest dependent species that occupy a small portion of their former range-(b); and b. Population levels of representative species from diverse habitats monitored across their range-(b).
Criterion 2 **Maintenance of Productive Capacity of Forest Ecosystems**	**Indicators:** a. Area of forest land and net area of forest land available for timber production-(a); b. Total growing stock of both merchantable and nonmerchantable tree species on forest land available for timber production-(a); c. The area and growing stock of plantations of native and exotic species-(a); d. Annual removal of wood products compared to the volume determined to be sustainable-(a); and e. Annual removal of non-timber forest products (e.g., fur bearers, berries, mushrooms, game), compared to the level determined to be sustainable-(b).

39 Indicators followed by an 'a' are those for which most data are available. Indicators followed by a 'b' are those which may require the gathering of new or additional data and/or a new programme of systematic sampling or basic research.

40 IUCN categories include: I. Strict protection; II. Ecosystem conservation and tourism; III. Conservation of natural features; IV Conservation through active management; V. Landscape/seascape conservation and recreation; VI. Sustainable use of natural ecosystems.

Criterion 3 **Maintenance of Forest Ecosystem Health and Vitality**	**Indicators:** a. Area and percent of forest affected by processes or agents beyond the range of historic variation, e.g., by insects, disease, competition from exotic species, fire, storm, land clearance, permanent flooding, salinisation, and domestic animals-(b); b. Area and percent of forest land subjected to levels of specific air pollutants (e.g., sulfates, nitrate, ozone) or ultraviolet B that may cause negative impacts on the forest ecosystem-(b); and c. Area and percent 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, wasps, etc.) -(b).
Criterion 4 **Conservation and Maintenance of Soil and Water Resources** This criterion encompasses the conservation of soil and water resources and the protective and productive functions of forests.	**Indicators:** a. Area and percent of forest land with significant soil erosion-(b); b. Area and percent of forest land managed primarily for protective functions, e.g., watersheds, flood protection, avalanche protection, riparian zones-(a); c. Percent of stream kilometers in forested catchments in which stream flow and timing has significantly deviated from the historic range of variation-(b); d. Area and percent of forest land with significantly diminished soil organic matter and/or changes in other soil chemical properties-(b); e. Area and percent of forest land with significant compaction or change in soil physical properties resulting from human activities-(b); f. Percent of water bodies in forest areas (e.g., stream kilometers, lake hectares) with significant variance of biological diversity from the historic range of variability(b); g. Percent of water bodies in forest areas (e.g., stream kilometers, lake hectares) with significant variation from the historic range of variability in pH, dissolved oxygen, levels of chemicals (electrical conductivity), sedimentation or temperature change-(b); and h. Area and percent of forest land experiencing an accumulation of persistent toxic substances-(b).

Criterion 5 **Maintenance of Forest Contribution to Global Carbon Cycles**	**Indicators:** a. Total forest ecosystem biomass and carbon pool, and if appropriate, by forest type, age-class, and successional stages-(b); b. Contribution of forest ecosystems to the total global carbon budget, including absorption and release of carbon (standing biomass, coarse woody debris, peat and soil carbon)-(a or b); c. Contribution of forest products to the global carbon budget-(b) .

Criterion 6

Maintenance and Enhancement of Long-Term Multiple Socioeconomic Benefits to Meet the Needs of Societies

Indicators:

Production and consumption

a. Value and volume of wood and wood products production, including value added through downstream processing-(a);
b. Value and quantities of production of non-wood forest products-(b);
c. Supply and consumption of wood and wood products, including consumption per capita-(a);
d. Value of wood and non-wood products production as percentage of GDP-(a or b);
e. Degree of recycling of forest products-(a or b); and
f. Supply and consumption/use of non-wood products-(a or b).

Recreation and tourism

a. Area and percent of forest land managed for general recreation and tourism, in relation to the total area of forest land-(a or b);
b. Number and type of facilities available for general recreation and tourism, in relation to population and forest area-(a or b); and
c. Number of visitor days attributed to recreation and tourism, in relation to population and forest area-(b).

Investment in the forest sector

a. Value of investment, including investment in forest growing, forest health and management, planted forests, wood processing, recreation and tourism-(a);
b. Level of expenditure on research and development, and education- (b);
c. Extension and use of new and improved technologies-(b); and
d. Rates of return on investment- (b).

Cultural, social and spiritual needs and values

a. Area and percent of forest land managed in relation to the total area of forest land to protect the range of cultural, social and spiritual needs and values-(a or b); and
b. Non-consumptive use forest values-(b).

Employment and community needs

a. Direct and indirect employment in the forest sector and forest sector employment as a proportion of total employment-(a or b);
b. Average wage rates and injury rates in major employment categories within the forest sector-(a);
c. Viability and adaptability to changing economic conditions, of forest dependent communities, including indigenous communities-(b); and
d. Area and percent of forest land used for subsistence purposes-(b).

Criterion 7

Legal, Institutional and Economic Framework for Forest Conservation and Sustainable Management

Note: Criterion 7 and associated indicators relate to the overall policy framework of a country that can facilitate the conservation and sustainable management of forests. Included are the broader societal conditions and processes often external to the forest itself but which may support efforts to conserve, maintain or enhance one or more of the conditions, attributes, functions and benefits captured in Criteria 1–6. No priority or order is implied in the listing of the indicators.

Indicators:

Extent to which the *legal framework* (laws, regulations, guidelines) supports the conservation and sustainable management of forests, including the extent to which it:

a. Clarifies property rights, provides for appropriate land tenure arrangements, recognizes customary and traditional rights of indigenous people, and provides means of resolving property disputes by due process;
b. Provides for periodic forest-related planning, assessment and policy review that recognizes the range of forest values, including coordination with relevant sectors;
c. Provides opportunities for public participation in public policy and decision-making related to forests and public access to information;
d. Encourages best practice codes for forest management; and
e. Provides for the management of forests to conserve special environmental, cultural, social and/or scientific values.

Extent to which the *institutional framework* supports the conservation and sustainable management of forests, including the capacity to:

a. Provide for public involvement activities and public education, awareness and extension of programs, and make available forest-related information;
b. Undertake and implement periodic forest-related planning, assessment, and policy review including cross-sectoral planning and coordination;
c. Develop and maintain human resource skills across relevant disciplines;
d. Develop and maintain efficient physical infrastructure to facilitate the supply of forest products and services and support forest management; and
e. Enforce laws, regulations and guidelines.

Extent to which the *economic framework* (economic policies and measures) supports the conservation and sustainable management of forests through:

a. Investment and taxation policies and a regulatory environment which recognize the long-term nature of investments and permit the flow of capital in and out of the forest sector in response to market signals, nonmarket economic valuations, and public policy decisions in order to meet long-term demands for forest products and services; and
b. Non-discriminatory trade policies for forest products.

Capacity to measure and monitor changes in the conservation and sustainable management of forests, including

a. Availability and extent of up-to-date data, statistics and other information important to measuring or describing indicators associated with Criteria 1–7;

...

...

b. Scope, frequency and statistical reliability of forest inventories, assessments, monitoring and other relevant information; and
c. Compatibility with other countries in measuring, monitoring and reporting on indicators.

Capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services, including:

a. Development of scientific understanding of forest ecosystem characteristics and functions;
b. Development of methodologies to measure and integrate environmental and social costs and benefits into markets and public policies, and to reflect forest-related resource depletion or replenishment in national accounting systems;
c. New technologies and the capacity to assess the socioeconomic consequences associated with the introduction of new technologies;
d. Enhancement of ability to predict impacts of human intervention on forests; and
e. Ability to predict impacts on forests of possible climate change.

9.4.2 TARAPOTO (MANAGEMENT UNIT LEVEL CRITERIA)[41]

In 1995, Bolivia, Brazil, Colombia, Peru, Suriname and Venezuela (Amazon Cooperation Treaty countries) agreed to seven criteria and 51 indicators at the national level, four criteria and 23 indicators at the management unit level and one criterion and seven indicators at the global level. Only the management unit level criteria and indicators are presented here.

Criterion 8 **Legal and Institutional Framework**	**Indicators:** a. Forest management plan approved by the competent authorities; b. Periodicity of evaluation of management plan implementation and average percentage of implementation; and c. Legal framework that guarantees the stability of long-term investments in the forest sector.

41 The Tarapoto set includes C&I at higher levels than the management unit level, but those are not included here.

Criterion 9 **Sustainable Forest Production**	**Indicators:** a. Annual extraction of timber and non-timber forest products compatible with the sustainability capacity of the resource base; b. Area and percentage of forest soils affected by significant alterations in physical/chemical properties and erosion; c. Effectiveness of systems of administration and control; d. Degree of diversification of production; and e. Degree of utilization of environmentally friendly technologies.
Criterion 10 **Conservation of Forest Ecosystems**	**Indicators:** a. Proportion of area of permanent production in areas of environmental protection. b. Measures to protect, recuperate and sustainable use wild populations of species in danger of extinction; c. Area and percentage of forest affected by processes or other natural agents (insect attack, disease, fire, etc.) and by human actions; d. Rates of regeneration and forest ecosystem structure; e. Soil conservation measures; and f. Measures for protection of water courses from forest activities.
Criterion 11 **Local Socioeconomic Benefits**	**Indicators:** a. Quality of life of local populations; b. Profitability and rate of return of forest management; c. Efficiency of systems of production and transformation of forest products; d. Impact of the economic use of the forest on the availability of forest resources of importance to local populations. Amount of direct and indirect employment, and income level; f. Nature and quantity of benefits deriving from forest management; g. Annual quantity of products extracted per hectare; h. Aggregate value of production; and i. Mechanisms for consultation and the effective participation of local communities in the management of forest resources, depending upon the scale of management.

Guidelines for Developing, Testing and Selecting Criteria and Indicators for Sustainable Forest Management. This manual provides methods for the development and evaluation of criteria and indicators (C&I) which can then be used to assess the sustainability of forest management. The manual is written primarily for researchers, people or groups interested in evaluating C&I for assessments of forests in new areas, or as a reference for readers wanting to know how CIFOR's Generic Template was produced. The methods presented are aimed at the development of sets of C&I for natural forest at the forest management unit (FMU) level, especially in the tropics. Following an introductory chapter focusing on the overall purpose, specific objectives, and the C&I development process, three chapters (2–4) explain how to prepare for C&I testing, how to conduct a test, and how to analyse the results. Subsequent chapters (5–7) explain the conceptual basis of C&I development, with three case studies offered as examples, and suggested additional reading materials. Specific forms and tools that have been used in the course of CIFOR's testing are also presented (Chapter 8), with examples of ways to present the results. The final chapter (9) provides possible baseline sets of C&I, available to users for evaluation and testing in their own contexts.

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